

**East WRF Influent Pump Station
Rehabilitation Project (13-0016-UT)**

**CONTRACT DOCUMENTS &
SPECIFICATIONS**

Prepared for



Bid Documents

September 2023

City of Clearwater, Florida
East WRF Influent Pump Station
Rehabilitation Project (13-0016-UT)

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**INVITATION TO BID
NOTICE TO CONTRACTORS**

**East WRF Influent Pump Station
Rehabilitation Project**

Documents and plans for Project #13-0016-UT are available at www.myclearwater.com/bid.

The work includes: demolition and disposal of the odor control scrubber system; replacement of the influent pumps, pipe assembly, and the new influent flow meter assembly; installation of a bypass manhole; rehabilitate existing wet well with new coating and installation of new bubble mixing system and spray cleaning system; installation of electrical improvements, and the operation of temporary bypass pumping during construction.

Pre-Bid Conference:

Oct. 31,2023 at 10:00am

Zoom Meeting:

Meeting ID 823 6229 0433

Passcode 638182

Pre-qualification DEADLINE: Nov. 22, 2023

Category: Sanitary & Storm Sewers

Pre-qualification Amount: \$2 Million

Bids DUE: Dec. 6, 2023 at 2:00pm

City of Clearwater, Project # 13-0016-UT

Procurement Office, 3rd Floor

100 S. Myrtle Ave, Clearwater, FL 33756-5520

Bid Opening: Dec. 6, 2023 at 2:00pm

Zoom Meeting:

Meeting ID 880 1841 8733

Passcode 637762

Issued by Lori Vogel, CPPB, Procurement Manager

For additional information contact Public Works Dept.:
727-562-4750

SECTION II

INSTRUCTIONS TO BIDDERS

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1. COPIES OF BIDDING DOCUMENTS

- 1.1. Complete sets of the Bidding Documents are accessible through the City of Clearwater website at address: www.myclearwater.com/bid. Bidding Documents may include, but are not limited to, plans, specifications, bond forms, contract form, affidavits, bid/proposal form, and addendums.
- 1.2. Complete sets of Bidding Documents must be used in preparing bids. Neither the City nor the Engineer shall be liable for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents, by Bidders, sub-bidders, or others.

2. QUALIFICATION OF BIDDERS

- 2.1. Each prospective Bidder must pre-qualify to demonstrate, to the complete satisfaction of the City of Clearwater, that the Bidder has the necessary facilities, equipment, ability, financial resources and experience to perform the work in a satisfactory manner. An application package for pre-qualification may be obtained by contacting the City of Clearwater, Engineering Department, P.O. Box 4748, Clearwater, Florida 33758-4748 (mailing address); 100 South Myrtle Avenue, Clearwater, Florida 33756-5520 (street address) or by phone at (727) 562-4750. Pre-qualification requirement information is also available on the City of Clearwater Website at address:

www.myclearwater.com/government/city-departments/engineering/construction-management.

Contractors wanting to pre-qualify to bid on a project as a General Contractor must do so two weeks (ten workdays) prior to the bid opening date. Bidders currently pre-qualified by the City do not have to make reapplication. It is the Contractor's responsibility to confirm pre-qualification status before a Bid Opening.

The Contractor shall provide copies of the current Contractor License/Registration with the State of Florida and Pinellas County in the bid response.

3. EXAMINATION OF CONTRACT DOCUMENTS AND SITE

- 3.1. It is the responsibility of each Bidder, before submitting a Bid, to (a) examine the Contract Documents thoroughly; (b) visit the site to become familiar with local conditions that may in any manner affect cost, progress, performance or furnishing of the work; (c) consider and abide by all applicable federal, state and local laws, ordinances, rules and regulations; and (d) study and carefully correlate Bidder's observations with the Contract Documents, and notify Engineer in writing of all conflicts, errors or discrepancies in the Contract Documents.
- 3.2. For the purposes of bidding or construction, bidder may rely upon the accuracy of the technical data contained in reports of explorations and tests of subsurface conditions at the site which have been utilized by the Engineer in the preparation of the Contract Documents, but not upon non-technical data, interpretations or opinions contained therein or for the completeness thereof. Drawings relating to physical conditions of existing surface and subsurface conditions (except Underground Facilities) which are at or contiguous to the site and which have been utilized by the Engineer in preparation of the Contract Documents, may be relied upon by Bidder for accuracy of the technical data contained in such drawings but not upon the completeness thereof for the purposes of bidding or construction.

- 3.3. Information and data reflected in the Contract Documents with respect to Underground Facilities at or contiguous to the site are based upon information and data furnished to the City and Engineer by owners of such Underground Facilities or others, and the City does not assume responsibility for the accuracy or completeness thereof unless expressly provided in the Contract Documents.
- 3.4. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders on subsurface conditions, Underground Facilities, other physical conditions, possible conditions, and possible changes in the Contract Documents due to differing conditions appear in the General Conditions.
- 3.5. Before submitting a Bid, each Bidder shall, at Bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests and studies and obtain any additional information and data which pertain to the physical conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing the work in accordance with the time, price and other terms and conditions of the Contract Documents.
- 3.6. On request in advance, City will provide each Bidder access to the site to conduct such explorations and tests at Bidder's own expense as each Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the site to its former condition upon completion of such explorations and tests.
- 3.7. The lands upon which the Work is to be performed, rights-of-way and easements for access thereto and other lands designated for use by the Contractor in performing the Work are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by the Contractor. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by the City unless otherwise provided in the Contract Documents.
- 3.8. The submission of a Bid will constitute an unequivocal representation by the Bidder that the Bidder has complied with every requirement of these Instructions to Bidders and that, without exception, the Bid is premised upon performing and furnishing the Work required by the Contract Documents by such means, methods, techniques, sequences or procedures of construction as may be indicated in or required by the Contract Documents, and that the Contract Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions of performance and furnishing of the work.

4. INTERPRETATIONS AND ADDENDA

- 4.1. All questions as to the meaning or intent of the Contract Documents are to be directed in writing to the Engineer. Interpretations or clarifications considered necessary by the Engineer in response to such questions will be issued by Addenda, via the Jiffy Reprographics Plan Room to all parties recorded by the Plan Room as plan holders having received the Bidding Documents. Questions received after the time frame specified on the pre-bid meeting agenda, prior to the date for opening of Bids, may not be answered. Only information provided by formal written Addenda will be binding. Oral and other interpretations of clarifications will be without legal effect.
- 4.2. Addenda may also be issued to modify the Bidding Documents as deemed advisable by the City or Engineer.

5. BID SECURITY OR BID BOND

- 5.1. Each Bid must be accompanied by Bid Security made payable to the City of Clearwater in an amount equal to ten percent (10%) of the Bidder's maximum Bid price and in the form of a certified or cashier's check or a Proposal/Bid Bond (on form provided in Section V) issued by a surety meeting the requirements of the General Conditions.
- 5.2. The Bid Security of the Successful Bidder will be retained until such Bidder has executed the Agreement and furnished the required Payment and Performance bonds, whereupon the Bid Security will be returned. If the Successful Bidder fails to execute, deliver the Agreement and furnish the required Bonds within ten (10) days after the award of contract by the City Council, the City may annul the bid and the Bid Security of the Bidder will be forfeited. The Bid Security of any Bidder whom the City believes to have a reasonable chance of receiving the award may be retained by the City until the successful execution of the agreement with the successful Bidder or for a period up to ninety (90) days following bid opening. Security of other Bidders will be returned approximately fourteen (14) days after the Bid Opening.
- 5.3. The Bid Bond shall be issued in the favor of the City of Clearwater by a surety company qualified to do business in, and having a registered agent in, the State of Florida.

6. CONTRACT TIME

- 6.1. The number of consecutive calendar days within which the work is to be completed is set forth in the Technical Specifications.

7. LIQUIDATED DAMAGES

- 7.1. Provisions for liquidated damages are set forth in the Contract Agreement, Section V.

8. SUBSTITUTE MATERIAL AND EQUIPMENT

- 8.1. The contract, if awarded, will be on the basis of material and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute or "or equal" items. Whenever it is indicated in the Drawings or specified in the Specifications that a substitute or "or equal" item may be furnished or used, application for its acceptance will not be considered by the Engineer until after the effective date of the Contract Agreement. The procedure for submittal of any such application is described in the General Conditions and as supplemented in the Technical Specifications.

9. SUBCONTRACTORS

- 9.1. If requested by the City or Engineer, the Successful Bidder, and any other Bidder so requested, shall, within seven (7) days after the date of the request, submit to the Engineer an experience statement with pertinent information as to similar projects and other evidence of qualification for each Subcontractor, supplier, person and organization to be used by the Contractor in the completion of the Work. The amount of subcontract work shall not exceed fifty percent (50%) of the Work except as may be specifically approved by the Engineer. If the Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, supplier, other person or organization, he may, before recommending award of the Contract to the City Council, request the Successful Bidder to submit an acceptable substitute without an increase in Contract Price or Contract Time. If the Successful Bidder declines to make any such substitution, the City may award the contract to the next lowest and most responsive Bidder

that proposes to use acceptable Subcontractors, Suppliers, and other persons and organizations. Declining to make requested substitutions will not constitute grounds for sacrificing the Bid Security to the City of any Bidder. Any Subcontractor, supplier, other person or organization listed by the Contractor and to whom the Engineer does not make written objection prior to the recommendation of award to the City Council will be deemed acceptable to the City subject to revocation of such acceptance after the Effective Date of the Contract Agreement as provided in the General Conditions.

- 9.2. No Contractor shall be required to employ any Subcontractor, supplier, person, or organization against whom he has reasonable objection.

10. BID/PROPOSAL FORM

- 10.1. The Bid/Proposal Form is included with the Contract Documents and shall be printed in ink or typewritten. All blanks on the Bid/Proposal Forms must be completed. Unit Prices shall be to no more than two decimal points in dollars and cents. The Bidder must state in the Bid/Proposal Form in words and numerals without delineation's, alterations or erasures, the price for which they will perform the work as required by the Contract Documents. Bidders are required to bid on all items in the Bid/Proposal form. The lump sum for each section or item shall be for furnishing all equipment, materials, and labor for completing the section or item as per the plans and contract specifications. Should it be found that quantities or amounts shown on the plans or in the proposal, for any part of the work, are exceeded or should they be found to be less after the actual construction of the work, the amount bid for each section or item will be increased or decreased in direct proportion to the unit prices bid for the listed individual items.
- 10.2. Bids by corporations shall be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal shall be affixed. The corporate address and state of incorporation shall be shown below the Signature. If requested, the person signing a Bid for a corporation or partnership shall produce evidence satisfactory to the City of the person's authority to bind the corporation or partnership.
- 10.3. Bids by partnerships shall be executed in the partnership name and signed by a general partner, whose title shall appear under the signature and the official address of the partnership shall be shown below the signature.
- 10.4. All names shall be typed or printed below the signature.

11. SUBMISSION OF BIDS

- 11.1. Sealed Bids shall be submitted at or before the time and at the place indicated in the Advertisement for Bids and shall be submitted in a sealed envelope with the project name and number on the bottom left hand corner. If forwarded by mail, the Bid shall be enclosed in another envelope with the notation "Bid Enclosed" on the face thereof and addressed to the City of Clearwater, attention Purchasing Manager. Bids will be received at the office indicated in the Advertisement until the time and date specified. Bids in any other form will not be accepted.
- 11.2. The sealed bid envelope shall contain, but not be limited to, the Proposal/Bid Bond and corresponding Power of Attorney, Affidavit, Non-Collusion Affidavit, Proposal (pages one

and two), Addendum Sheet, Bidder's Proposal, ~~and~~ Scrutinized Companies and Business Operations with Cuba and Syria Certification Form, and E-Verify form.

12. MODIFICATION AND WITHDRAWAL OF BIDS

- 12.1. Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered as described in the Advertisement of Bids. A request for withdrawal or a modification shall be in writing and signed by a person duly authorized to do so. Withdrawal of a Bid will not prejudice the rights of a Bidder to submit a new Bid prior to the Bid Date and Time. After expiration of the period for receiving Bids, no Bid may be withdrawn or modified.
- 12.2. After a bid is received by the City, the bidder may request to modify the bid for typographical or scrivener's errors only. The bidder must state in writing to the City that a typographical or scrivener's error has been made by the bidder, the nature of the error, the requested correction of the error, and what the adjusted bid amount will be if the correction is accepted by the City. The City reserves the right at its sole discretion to accept, reject, or modify any bid.

13. REJECTION OF BIDS

- 13.1. To the extent permitted by applicable State and Federal laws and regulations, the City reserves the right to reject any, and all Bids, and to waive any, and all informalities. Grounds for the rejection of a bid include but are not limited to a material omission, unauthorized alteration of form, unauthorized alternate bids, incomplete or unbalanced unit prices, or irregularities of any kind. Also, the City reserves the right to reject any Bid if the City believes that it would not be in the best interest of the public to make an award to that Bidder, whether because the Bid is not responsive or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by the City. The City reserves the right to decide which bid is deemed to be the lowest and best in the interest of the public.

14. DISQUALIFICATION OF BIDDER

- 14.1. Any or all bids will be rejected if there is any reason for believing that collusion exists among the bidders, the participants in such collusion will not be considered in future proposals for the same work. Each bidder shall execute the Non-Collusion Affidavit contained in the Contract Documents.

15. OPENING OF BIDS

- 15.1. Bids will be opened and read publicly at the location and time stated in the Advertisement for Bids. Bidders are invited to be present at the opening of bids.

16. LICENSES, PERMITS, ROYALTY FEES AND TAXES

- 16.1. The Contractor shall secure all licenses and permits (and shall pay all permit fees) except as specifically stated otherwise in the Technical Specifications. The Contractor shall comply with all Federal and State Laws, County and Municipal Ordinances and regulations, which in any manner effect the prosecution of the work. City of Clearwater building permit fees and impact fees will be waived except as specifically stated otherwise in the Technical Specifications.

- 16.2. The Contractor shall assume all liability for the payment of royalty fees due to the use of any construction or operation process, which is protected by patent rights except as specifically stated otherwise in the Technical Specifications. The amount of royalty fee, if any, shall be stated by the Contractor.
- 16.3. The Contractor shall pay all applicable sales, consumer, use, and other taxes required by law. The Contractor is responsible for reviewing the pertinent State Statutes involving the sales tax and sales tax exemptions and complying with all requirements.
- 16.4. The City of Clearwater is exempt from state sales tax on materials purchased by the City and incorporated into the WORK. The City of Clearwater reserves the right to implement the Owner Direct Purchase (ODP) Option, as may be indicated in the Scope of Work Description in Section IV – Technical Specifications and as defined in Section III – General Conditions.

17. IDENTICAL TIE BIDS/VENDOR DRUG FREE WORKPLACE

- 17.1. In accordance with the requirements of Section 287.087 Florida Statutes regarding a Vendor Drug Free Workplace, in the event of identical tie bids, preference shall be given to bidders with drug-free workplace programs. Whenever two or more bids which are equal with respect to price, quality, and service are received by the City for the procurement of commodities or contractual services, a bid received from a business that certifies that it has implemented a drug-free workplace program shall be given preference in the award process. Established procedures for processing tie bids will be followed if none or all of the tied bidders have a drug-free workplace program. In order to have a drug-free workplace program, a contractor shall supply the City with a certificate containing the following six statements and the accompanying certification statement:
- (1) Publish a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the workplace and specifying the actions that will be taken against employees for violations of such prohibition.
 - (2) Inform employees as to the dangers of drug abuse in the workplace, the business's policy of maintaining a drug-free workplace, any available drug counseling, rehabilitation, and employee assistance programs, and the penalties that may be imposed upon employees for drug abuse violations.
 - (3) Give each employee engaged in providing the commodities or contractual services that are under bid a copy of the statement specified in subsection (1).
 - (4) In the statement specified in subsection (1), notify the employees that, as a condition of working on the commodities or contractual services that are under bid, the employee will abide by the terms of the statement and will notify the employer of any conviction of, or plea of guilty or nolo contendere to, any violation of chapter 893, or of any controlled substance law, of the United States, or of any state, for a violation occurring in the workplace no later than five (5) days after such conviction.
 - (5) Impose a sanction on or require the satisfactory participation in a drug abuse assistance or rehabilitation program if such is available in the employee's community, by any employee who is so convicted.
 - (6) Make a good faith effort to continue to maintain a drug-free workplace through implementation of this section.

I certify that this firm does/does not (select only one) fully comply with the above requirements.

18. AWARD OF CONTRACT

- 18.1. Discrepancies between words and figures will be resolved in favor of words. Discrepancies in the multiplication of units of work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.
- 18.2. In evaluating the Bids, the City will consider the qualifications of the Bidders, whether the Bids comply or not with the prescribed requirements, unit prices, and other data as may be requested in the Bid/Proposal form. The City may consider the qualifications and experience of Subcontractors, suppliers and other persons and organizations proposed by the Contractor for the Work. The City may conduct such investigations as the City deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of Bidders, proposed Subcontractors, Suppliers and other persons, and organizations to perform and furnish the Work in accordance with the Contract Documents to the City's satisfaction within the prescribed time.
- 18.3. If the Contract is to be awarded, it will be awarded to the lowest responsible, responsive Bidder whose evaluation by the City indicates to the City that the award will be in the best interest of the City.
- 18.4. Award of contract will be made for that combination of base bid and alternate bid items in the best interest of the City, however, unless otherwise specified all work awarded will be awarded to only one Contractor.
- 18.5. The successful bidder/contractor will be required to comply with Section 119.0701, Florida Statutes, specifically to:
 - (a) Keep and maintain public records that ordinarily and necessarily would be required by the City of Clearwater in order to perform the service;
 - (b) Provide the public with access to public records on the same terms and conditions that the City of Clearwater would provide the records and at a cost that does not exceed the cost provided in this chapter or as otherwise provided by law;
 - (c) Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law; and
 - (d) Meet all requirements for retaining public records and transfer, at no cost, to the City of Clearwater all public records in possession of the contractor upon termination of the contract and destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. All records stored electronically must be provided to the public agency in a format that is compatible with the information technology systems of the City of Clearwater.

19. BID PROTEST

19.1. RIGHT TO PROTEST:

Pursuant to Section 2.562(3), Clearwater Code of Ordinances, a bidder who submitted a response to a competitive solicitation and was not selected may appeal the decision through the bid protest procedures, a copy of which shall be available in the Procurement Division. A protesting bidder must include a fee of one percent of the amount of the bid or proposed contract to offset the City's additional expenses related to the protest. This fee shall not exceed

\$5,000.00 nor be less than \$50.00. Full refund will be provided should the protest be upheld. No partial refunds will be made.

20. TRENCH SAFETY ACT

- 20.1. The Bidder shall comply with the provisions of the City of Clearwater’s Ordinance related to trench digging (Ordinance No. 7918-08) along with the Florida Trench Safety Act (Sections 553.60-553.64, Florida Statutes) and the provisions of the Occupational Safety and Health Administration's (OSHA) excavation safety standards, 29 C.F.R.s 1926.650 Subparagraph P, or current revisions of these laws.

21. CONSTRUCTION SITE EROSION AND SEDIMENT CONTROL MANAGEMENT MEASURES

- 21.1. The Bidder shall comply with the provisions of the Environmental Protection Agency (EPA) National Pollution Discharge Elimination System (NPDES) stormwater permit and implement stormwater pollution prevention plans (SWPPP’s) or stormwater management programs (both using best management practices (BMPs) that effectively reduce or prevent the discharge of pollutants into receiving waters.
- A. The control of construction-related sediment loadings is critical to maintaining water quality. The implementation of proper erosion and sediment control practices during the construction stage can significantly reduce sediment loadings to surface waters.
- B. Prior to land disturbance, prepare and implement an approved erosion and sediment control plan or similar administrative document that contains erosion and sediment control provisions.

NPDES Management Measures available at [City of Clearwater Engineering Environmental Division](#) and [EPA](#) websites to help address construction-related Best Management Practices.

SECTION III

GENERAL CONDITIONS

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1. DEFINITIONS

Addenda

Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the contract documents.

Agent

Architect, engineer or other outside agency, consultant or person acting on behalf of the City.

Agreement

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

Application for Payment

The form accepted by Engineer which is to be used by Contractor in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

Approve

The word approve is defined to mean satisfactory review of the material, equipment, or methods for general compliance with the design concepts and with the information given in the Contract Documents. It does not imply a responsibility on the part of the Engineer to verify in every detail conformance with the Drawings and Specifications.

Bid

The offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the work to be performed.

Bidding Documents

The advertisement or invitation to Bid, instructions to bidders, the Bid form, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

Bonds

Performance and payment bonds and other instruments of security.

Change Order

A written order to Contractor signed by Owner and Contractor authorizing an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Time issued on or after the effective date of the Agreement.

City

The City of Clearwater, Pinellas County, Florida.

Construction Inspector

A person who is the authorized representative of the Construction Manager and inspects City construction projects in order to ensure the Contractor's work complies with the intent of the Contract Documents.

Construction Manager

The person who is typically in responsible charge of City construction projects. The Construction Manager assumes responsibility for the management of construction contracts at the Preconstruction Conference. The Construction Manager chairs the Preconstruction Conference and is the authority on any disputes or decisions regarding

contract administration and performance. The Construction Manager typically acts as the Owner's Representative during construction.

Contract Documents

The Agreement, Addenda (which pertain to the Contract Documents), Contractor's Bid (including documentation accompanying the bid and any post-Bid documentation submitted prior to the execution of the Agreement) when attached as an exhibit to the Agreement, the Bonds, Instructions to Bidders, these General Conditions, any Supplementary Conditions, the Specifications and the Drawings, any other exhibits identified in the Agreement, together with all Modifications issued after the execution of the Agreement.

Contract Price

The Contract price constitutes the total compensation (subject to authorized adjustments) payable by Owner to Contractor for performing the Work.

Contract Time

The number of days or the date stated in the Agreement for the completion of the Work.

Contractor

The Person with whom the Owner has entered into the Agreement. For the purposes of this contract, the person, firm, or corporation with whom this contract or agreement has been made by the City of Clearwater or its duly authorized representative.

Critical Path Method Construction Schedule (CPM)

A graphic format construction schedule that displays construction activities as they relate to one another for the purpose of identifying the most efficient way to perform the work in a timely manner. The critical path identifies which activity is critical to the execution of the schedule.

Day

A calendar day of twenty-four (24) hours measured from midnight to the next midnight.

Defective

An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to Engineers recommendation of final payment.

Drawings

The drawings, which will be identified in Technical Specifications or the Agreement, which show the character and scope of the Work to be performed and which have been prepared or approved by Engineer and are referred to in the contract documents. Shop drawings are not Drawings as so defined.

Engineer

The duly appointed representative of the City Manager of the City of Clearwater. For the purposes of this contract, the City Engineer of the City of Clearwater, Pinellas County, Florida, or his authorized representative. For certain projects, the Engineer may serve as the Owner's Representative during construction.

Engineer's Consultant

A Person having a contract with Engineer to furnish services as Engineer's independent

professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.

F.D.O.T. Specifications

The Standard Specifications for Road and Bridge Construction as issued by the Florida Department of Transportation (latest English edition).

Furnish

The words "furnish", "furnish and install", "install", and "provide" or words of similar meaning shall be interpreted, unless otherwise specifically stated, to mean "furnish and install complete in place and ready for service".

Inspection

The term "inspection" and the act of inspecting means examination of construction to ensure that it conforms to the design concept expressed in the Drawings and Specifications. These terms shall not be construed to mean supervision, superintending, or overseeing.

Laws and Regulations

Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any kind of governmental bodies, agencies, authorities, and courts having jurisdiction.

Liens

Liens, charges, security interests or encumbrances upon real property or personal property.

Milestone

A principal event specified in the contract Documents relating to an intermediate completion date or time prior to the final completion date.

Notice to Proceed (NTP)

A written notice given by the Owner to the Contractor fixing the date on which the Contract Time will commence to run and on which Contractor shall start to perform his obligations under the Contract Documents.

Owner

The City of Clearwater, Florida. For the purposes of this contract, the person who is the City's authorized representative from the City's Department with whom will be responsible for the maintenance and operation of the Work once the Work is completed. For certain projects, a designee of the Owner may serve as the Owner's Representative during construction.

Owner's Representative

Designee of the Owner with authority to act on behalf of the Owner during construction.

Person

A natural person, or a corporation, partnership, firm, organization, or other artificial entity.

Project

The total construction of which the Work to be provided under the Contract Documents may be the whole or a part as indicated elsewhere in the Contract Documents.

Partial Utilization

Use by Owner of a substantially completed part of the Work for the purpose for which is intended (or a related purpose) prior to Final Completion of all the Work.

Representative of Contractor

The Contractor shall assign a responsible person or persons, one of whom shall be at the construction site at all times, that work is progressing. The names and positions of these persons shall be submitted to the City Engineer at the time of the pre-construction conference. This person or persons shall not be changed without written approval of City Engineer.

Request for Information (RFI)

An official written request for clarification of the intent of the contract documents from the Contractor to the Engineer.

Shop Drawing

All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for Contractor to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a supplier and submitted by Contractor to illustrate material or equipment for some portion of the Work.

Specifications

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

Subcontractor

A person having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the site.

Substantial Completion

The Work (or a specified part thereof) which has progressed to the point where, in the opinion of Engineer, as evidenced by Engineer's definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if no such certificate is issued, when the Work is complete and ready for final payment as evidenced by the Engineer's recommendation of final payment. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

Supplementary Conditions

The part of the Contract which amends or supplements these General Conditions.

Supplier

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

Surety

Any person, firm or corporation which is bound with Contractor and which engages to be responsible for Contractor and his acceptable performance of the Work by a Bid, Performance or Payment Bond.

Underground Facilities

All pipelines, conduits, ducts, cables, wires manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity,

gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal or treatment, traffic or other control systems or water.

Unit Price Work

Work to be paid for on the basis of unit prices.

Work

The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing or furnishing labor and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents.

Work Change Directive

A written directive to Contractor, issued on or after the Effective Date of the Agreement and signed by the Engineer, ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed or emergencies. Work Change Directive will not change the Contract Price or Contract Time but is evidence that the parties expect that the change directed or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

2. PRELIMINARY MATTERS

2.1. DELIVERY OF BONDS AND CERTIFICATES OF INSURANCE

When Contractor delivers the executed Agreements to the Owner, Contractor shall also deliver to the Owner such Bonds and Certificates of Insurance as Contractor may be required to furnish by this contract.

2.2. COPIES OF DOCUMENTS

Engineer shall furnish to Contractor one (1) copy of Contract Documents for execution. Additional copies will be furnished, upon request, at the cost of reproduction.

2.3. COMMENCEMENT OF CONTRACT TIME/NOTICE TO PROCEED, STARTING THE PROJECT

The Contract Time will commence on the day indicated in the Notice to Proceed. Contractor shall start to perform the work on the date the Contract Time commences to run. No work shall be done at the site prior to the date that the Contract Time commences to run. Pursuant to Section 255.05(1)(b), Florida Statutes, the Notice to Proceed cannot be issued until Contractor provides City with a certified copy of the recorded bond issued by the Pinellas County Clerk of Court.

2.4. BEFORE STARTING CONSTRUCTION

Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error or

discrepancy which Contractor may discover; and shall obtain a written interpretation or clarification from Engineer before proceeding with any work effected thereby; however, Contractor shall not be liable to the Owner for failure to report any conflict, error or discrepancy in the Drawings or Specifications, unless Contractor had actual knowledge thereof or should reasonably have known thereof.

No verbal agreement or conversation with any officer, Agent or employee of the Owner or Engineer's Consultant, either before or after the execution of this Contract, shall affect or modify any of the terms or obligations herein contained. Contractor shall not commence any work at any time without approved insurance required by these General Conditions. Failure to obtain this insurance will be the sole responsibility of the Contractor.

2.5. PRECONSTRUCTION CONFERENCE

After Contract has been fully executed and before the start of the Work, the Owner's Representative shall schedule a preconstruction conference to be attended by Contractor, Engineer, Owner and others as appropriate to establish a working understanding among the parties as to the Work and to discuss the schedule of the Work and general Contract procedures.

The Contractor shall submit to the Owner's Representative prior to the Notice to Proceed, a color Critical Path Method (CPM) Construction Schedule. This is to be a sequence of events including submittal review and procurement. Notice to Proceed is usually established at the preconstruction conference and such date can be inserted into the schedule at that time. The Contractor shall also submit a Submittal Schedule for review by the Engineer. This is to make sure that the list is complete, and this schedule shall be the basis of a Submittal Log.

The Contractor shall submit to the Owner's Representative prior to the Notice to Proceed, a completed Emergency Call List, a completed Authorized Signature List, and Verification of Illegal Discharge Construction Site Training.

2.6. PROGRESS MEETINGS

The Contractor is required to attend Progress Meetings. These meetings will be scheduled on a weekly, bi-weekly, or monthly basis depending on the needs of the project. The Contractor shall bring to each meeting an updated submittal log, an updated request for information (RFI) log, a look-ahead schedule to cover the project activity from the current meeting to the next meeting, and all material test reports generated in the same time period.

3. CONTRACT DOCUMENTS, INTENT

3.1. INTENT

The Contract Documents comprise the entire Agreement between Owner and the Contractor concerning the Work. They may be altered only by written agreement. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials or equipment which may reasonably be inferred from the Contract Documents or from prevailing custom or from trade usage as being required to produce the intended result will be furnished and performed whether or not specifically called for. When words or phrases, which have a well-known technical or construction industry or trade meaning, are used to describe Work, materials or equipment, such words or phrases shall be interpreted in accordance with that meaning. Clarifications and

interpretations of the Contract Documents shall be issued by the Owner's Representative. Reference to standards, specifications, manuals or codes of any technical society, organization or association, or to the code, Laws or Regulation of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual or code, or Laws or Regulations in effect at the time of opening of Bids except as may be otherwise specifically stated in the Contract Documents. However, no provision of any referenced standard specification, manual or code, whether or not specially incorporated by reference in the responsibilities of Owner or Contractor as set forth in the Contract Documents, shall change the duties and responsibilities of Owner, Contractor, Engineer or Owner's Representative, or any of their Agents or employees from those set forth in the Contract Documents. Clarifications and interpretations of the Contract shall be issued by the Owner's Representative. Each and every provision of law and clause required by law to be inserted in these Contract documents shall be deemed to be inserted herein, and they shall be read and enforced as through it were included herein, and if through mistake or otherwise, any such provision is not inserted, or if not correctly inserted, then upon the application of either party, the Contract Documents shall forthwith be physically amended to make such insertion.

3.2. REPORTING AND RESOLVING DISCREPANCIES

If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such Law or Regulation applicable to the performance of the Work or of any such standard, specification, manual or code or of any instruction of any Supplier, Contractor shall report it to the Owner's Representative in writing at once, and Contractor shall not proceed with the Work affected thereby (except in an emergency) until an amendment or supplement to Contract Documents has been issued by one of the methods provided in these General Specifications, provided however, that Contractor shall not be liable to Owner, or Owner's Representative for failure to report any such conflict, error, ambiguity or discrepancy unless Contractor knew or reasonably should have known thereof.

4. AVAILABILITY OF LANDS, SUBSURFACE AND PHYSICAL CONDITIONS, REFERENCE POINTS

4.1. AVAILABILITY OF LANDS

The Owner shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be Performed, rights-of-way, easements, rights of entry for access thereto, and such other lands which are designated for the use of Contractor. The Owner shall identify any encumbrances or restrictions not of general application but specifically related to use of lands so furnished with which Contractor will have to comply in performing the Work. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by the Owner, unless otherwise provided in the Contract Documents.

4.2. INVESTIGATIONS AND REPORTS

Reference is made to the Supplementary Conditions and Technical Specifications for identification of those reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress or performance of the Work which have been relied upon by Engineer in preparation of the Drawings and Specifications. Such reports are not guaranteed as to accuracy or completeness and are not part of the Contract Documents. Contractor shall promptly

notify the Owner's Representative in writing of any subsurface or latent physical conditions at the site, or in an existing structure, differing materially from those indicated or referred to in the Contract Documents. Engineer will promptly review those conditions and advise if further investigation or tests are necessary. Owner or Engineer shall obtain the necessary additional investigations and tests and furnish copies to the Engineer and Contractor. If Engineer finds that the results of such investigations or tests indicate that there are subsurface or latent physical conditions, which differ materially from those, indicated in the contract Documents, and which could not reasonably have been anticipated by Contractor, a work change, or Change Order will be issued incorporating the necessary revisions.

4.3. PHYSICAL CONDITIONS, UNDERGROUND FACILITIES

The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities or by others. Unless otherwise expressly provided in the Contract Documents, Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data; and the cost of all the following will be included in the Contract Price and Contractor shall have full responsibility for: (i) reviewing and checking all such information and data, (ii) locating all Underground Facilities shown or indicated in the Contract Documents, (iii) coordination of the Work with the owners of such Underground Facilities during construction, and (iv) the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work. The Contractor is required to call the Sunshine State One Call of Florida prior to any excavation per State regulations and to notify any utility owners who are not a member of the Sunshine State One Call of Florida prior to any excavation. The Sunshine State One Call of Florida is an agency for the protection and location of utilities prior to any excavation and contact number is available in local telephone directory.

4.4. REFERENCE POINTS

Engineer shall provide engineering surveys to establish reference points for construction, which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, unless otherwise noted in the Contract, shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of the Owner and Engineer. Contractor shall report to Engineer whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations and shall be responsible for the accurate replacement or relocation of such reference points by a surveyor licensed in the State of Florida. The Contractor is referred to the Technical Specifications for more specific information regarding the provision of construction surveys. If a City survey crew is assigned to the project and there is excessive stake replacement caused by negligence of Contractor's forces after initial line and grade have been set, as determined by the Engineer, the Contractor will be charged at the rate of \$200.00 per hour. Time shall be computed for actual time on the project. All time shall be computed in one-hour increments with a minimum charge of one hour.

5. BONDS AND INSURANCE

5.1. PERFORMANCE AND PAYMENT BOND/CONTRACT BOND

Contractor shall furnish a Performance and Payment Bond pursuant to Section 255.05, Florida Statutes in an amount equal to the Contract Price as security for the faithful performance and payment of all Contractor's obligations under the Contract Documents. This bond shall remain in effect at least one year after the date when final payment becomes due unless a longer period of time is prescribed by laws and regulations or by the Contract Documents. Contractor shall also furnish such other Bonds as are required by the Supplementary Conditions. All Bonds shall be in the form prescribed by the Contract Documents in Section V and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff, Bureau of Government Financial Operations, U.S. Treasury Department. All bonds signed by an agent must be accompanied by a certified copy of such agents' authority to act. All bonds shall be deemed to contain all of the Conditions of Section 255.05, Florida Statutes, even if such language is not directly contained within the bond and the Surety shall be licensed and qualified to do business in the State of Florida. Owner reserves the right to reject any surety. If the Surety on any Bond furnished by the Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of these Contract Documents, the Contractor shall within five days after notice thereof substitute another Bond and surety, both of which must be acceptable to Owner.

5.2. INSURANCE REQUIREMENTS

The Contractor shall, at its own cost and expense, acquire and maintain (and cause any Subcontractors, representatives or agents to acquire and maintain) during the term with the City, sufficient insurance to adequately protect the respective interest of the parties. Coverage shall be obtained with a carrier having an AM Best Rating of A-VII or better. In addition, the City has the right to review the Contractor's deductible or self-insured retention and to require that it be reduced or eliminated.

Specifically, the Contractor must carry the following minimum types and amounts of insurance on an occurrence basis or in the case of coverage that cannot be obtained on an occurrence basis, then coverage can be obtained on a claims-made basis with a minimum four (4) year tail following the termination or expiration of this Agreement:

The following insurance limits may be achieved by a combination of primary and umbrella/excess liability policies.

5.2.1. COMMERCIAL GENERAL LIABILITY INSURANCE

Commercial General Liability Insurance coverage, including but not limited to, premises operations, products/completed operations, products liability, contractual liability, advertising injury, personal injury, death, and property damage in the minimum amount of \$1,000,000 (one million dollars) per occurrence and \$2,000,000 (two million dollars) general aggregate.

5.2.2. COMMERCIAL AUTOMOBILE LIABILITY INSURANCE

Commercial Automobile Liability Insurance coverage for any owned, non-owned, hired or borrowed automobile is required in the minimum amount of \$1,000,000 (one million dollars) combined single limit.

5.2.3. WORKERS' COMPENSATION AND EMPLOYER'S LIABILITY INSURANCE

Statutory Workers' Compensation Insurance coverage in accordance with the laws of the State of Florida, and Employer's Liability Insurance in the minimum amount of \$100,000 (one hundred thousand dollars) each employee each accident, \$100,000 (one hundred thousand dollars) each employee by disease and \$500,000 (five hundred thousand dollars) aggregate by disease with benefits afforded under the laws of the State of Florida. Coverage should include Voluntary Compensation, Jones Act, and U.S. Longshoremen's and Harbor Worker's Act coverage where applicable. Coverage must be applicable to Employees, Contractors, Subcontractors, and Volunteers, if any.

5.2.4. PROFESSIONAL LIABILITY/MALPRACTICE/ERRORS OR OMISSIONS INSURANCE

Professional Liability/Malpractice/Errors or Omissions Insurance coverage appropriate for the type of business engaged in by the Contractor with minimum limits of \$1,000,000 (one million dollars) per occurrence. If a claims-made form of coverage is provided, the retroactive date of coverage shall be no later than the inception date of claims-made coverage, unless prior policy was extended indefinitely to cover prior acts. Coverage shall be extended beyond the policy year either by a supplemental extended reporting period (ERP) of as great a duration as available, and with no less coverage and with reinstated aggregate limits, or by requiring that any new policy provide a retroactive date no later than the inception date of claims-made coverage.

5.2.5. CONTRACTOR'S EQUIPMENT/INLAND MARINE/PROPERTY INSURANCE

If Contractor is using its own property in connection with the performance of its obligations under this Agreement, then Contractor's Equipment-Inland Marine Insurance and/or Property Insurance on an "All Risks" basis with replacement cost coverage for property and equipment in the care, custody and control of others is recommended. City is not responsible for Contractor's (or any Subcontractors, Representatives, or Agents) equipment or property.

5.2.6. BUILDER'S RISK INSURANCE

The City will provide at its expense, Builder's Risk Insurance for the project to cover all risks of loss in the complete and full value of the project. Contractor agrees to cooperate in a timely manner with providing any information or documentation required for the application and by the carrier as the project proceeds.

5.3. OTHER INSURANCE PROVISIONS

Upon approval of this Agreement by City Council, and then annually upon the anniversary date(s) of the insurance policy's renewal date(s) for as long as this Agreement remains in effect, the Contractor will furnish the City with a Certificate of Insurance(s) (using appropriate ACORD certificate, SIGNED by the Issuer, and with applicable endorsements) evidencing all of the

coverage set forth above and naming the City as an “Additional Insured.” In addition, when requested in writing from the City, Contractor will provide the City with certified copies of all applicable policies. The address where such certificates and certified policies shall be sent or delivered is as follows:

Attn: Contract and Procurement Specialist
 City of Clearwater
 Engineering Department
 P.O. Box 4748
 Clearwater, FL 33758-4748

1. The **Description** (of Operations/Locations/Vehicles) should specify Project Name and Project Number.
2. Contractor shall provide thirty (30) days written notice of any cancellation, non-renewal, termination, material change or reduction in coverage.
3. Contractor’s insurance as outlined above shall be primary and non-contributory coverage for Contractor’s negligence.
4. Contractor reserves the right to appoint legal counsel to provide for the Contractor’s defense, for any and all claims that may arise related to Agreement, work performed under this Agreement, or to Contractor’s design, equipment, or service. Contractor agrees that the City shall not be liable to reimburse Contractor for any legal fees or costs as a result of Contractor providing its defense as contemplated herein.

The stipulated limits of coverage above shall not be construed as a limitation of any potential liability to the City, and the City’s failure to request evidence of this insurance shall not be construed as a waiver of Contractor’s (or Subcontractors, Representatives, or Agents) obligation to provide the insurance coverage specified.

5.4. WAIVER OF RIGHTS

The Owner and Contractor intend that all policies purchased in accordance with Article on Insurance will protect the Owner, Contractor, Subcontractors, Engineer, Engineer's Consultants and all other persons or entities identified in the Supplementary Conditions to be listed as insured or additional insured in such policies and will provide primary coverage for all losses and damages caused by the perils covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insured or additional insured thereunder, the Owner and Contractor waive all rights against each other and their respective officers, directors, employees and agents for all losses and damages caused by, arising out of or resulting from any of the perils covered by such policies and any other property insurance applicable to the work; and, in addition, waive all such rights against Subcontractors, Engineer, Engineer's Consultants and all other persons or entities identified in the Supplementary Conditions to be listed as insured or additional insured under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance otherwise payable under any policy so issued. In addition, the Owner waives all rights against Contractor, Subcontractors, Engineer, Engineer's Consultant and the officers, directors, employees and agents of any of them for: (i) loss due to business interruption, loss of use or other consequential loss extending beyond direct physical loss or damage to the Owner property or the Work caused by, arising out of or resulting from fire or other peril, whether or not insured by the Owner and; (ii) loss or damage to the completed Project or part thereof caused by, arising out of or resulting from fire or other insured peril covered by any property insurance maintained on the completed Project or part thereof by the Owner during partial utilization, after substantial completion or after final payment.

6. CONTRACTOR'S RESPONSIBILITIES

6.1. SUPERVISION AND SUPERINTENDENCE

Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of others in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

Contractor shall be responsible to see that the completed work complies accurately with the Contract Documents. Contractor shall keep on the work at all times during its progress a competent resident superintendent, who shall not be replaced without notice to the Owner's Representative except under extraordinary circumstances. The superintendent will be Contractor's representative at the site and shall have authority to act on behalf of Contractor. All communications to the superintendent shall be as binding as if given to Contractor. The Contractor's superintendent shall keep a mobile cell phone on his person, so he can be contacted whenever necessary.

Contractor shall employ only competent persons to do the work and whenever the Owner's Representative shall notify Contractor, in writing, that any person on the work appears to be incompetent, unfaithful, disorderly, disrespectful or otherwise unsatisfactory, such person shall be removed from the project and shall not again be employed on it except with the written consent of the Owner's Representative. Contractor represents the City of Clearwater and shall conduct themselves in a professional manner to the public at all times.

Contractor shall reimburse Owner for additional engineering and inspection costs incurred as a result of overtime work in excess of the regular working hours or on the Owner normally approved holidays. At such times when Inspector overtime is required, the Contractor shall sign an overtime slip documenting such hours and the Contractor shall be provided a copy for his records. At the end of the project and prior to payment of withheld retainage funds, the Contractor shall deliver to the Owner a check made out to the Owner of Clearwater for full reimbursement of all Inspector overtime hours. Withheld retainage shall not be released until the Owner has received this check. Minimum number of chargeable hours for inspection costs on weekends or holidays shall be four hours. The cost of overtime inspection per hour shall be \$80.00 per hour.

Contractor shall provide and maintain in a neat and sanitary condition, such sanitary accommodations for the use of Contractor's employees as may be necessary to comply with the requirements of Laws and Regulations and the Engineer.

6.2. LABOR, MATERIALS AND EQUIPMENT

Contractor shall provide competent, suitably qualified personnel to survey, lay out and construct the work as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the site. Except as otherwise required for the safety or protection of persons or the work or property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all work at the site shall be performed during regular working hours. Contractor shall adhere to the Community Development Code, Section 3-1508 regarding noise restrictions from 6:00 p.m. to 7:00 a.m. any day and all-day Sunday. Contractor will not permit overtime work or the performance of work on Saturday, Sunday, or any legal holiday without Owner consent given after prior notice to Engineer.

Unless otherwise specified in the General Requirements, Contractor shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

All materials and equipment installed in the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the quality of materials and equipment. The Contractor shall provide suitable and secure storage for all materials to be used in the Work so that their quality shall not be impaired or injured. Materials that are improperly stored, may be rejected by the Engineer without testing.

All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, supplier, or distributor, except as otherwise provided in the Contract Documents.

The City of Clearwater, at its sole discretion, reserves the right to purchase major equipment or materials to be incorporated into the Work under the Owner Direct Purchase (ODP) Option, per Section III, Article 21. In such event, the Contractor shall cooperate and assist the Owner of Clearwater, at no additional cost, to implement the ODP documents and procedures.

6.3. SUBSTITUTES AND "OR EQUAL" ITEMS

Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent or "or equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be accepted by Engineer. If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer for approval. If in the Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or equal" item, it may be considered as a proposed substitute item. Contractor shall submit sufficient information as required by the Engineer to allow the Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and is an acceptable substitute, therefore. Request for review of proposed substitute and "or equal" will not be accepted by Engineer from anyone other than Contractor.

Request for substitute and "or equal" items by Contractor must be submitted in writing to Owner's Representative and will contain all information as Engineer deems necessary to make a determination. Request for substitute shall identify why a substitute is submitted and include advantages to the Owner. All data provided by Contractor in support of any proposed substitute or "or equal" item will be at Contractor's expense. Engineer will be allowed a reasonable time to evaluate each proposal or submittal made per this paragraph. Engineer will be sole judge of acceptability.

6.4. SUBCONTRACTORS, SUPPLIERS AND OTHERS

The Contractor shall deliver to the Owner's Representative before or at the preconstruction conference a list of all Subcontractors, suppliers and other persons and organizations proposed by the Contractor for Work to be performed on the Project. The Contractor shall include with this list

the qualifications and references for each Subcontractor, supplier or other person and organization for review and approval. Any changes to this list must be submitted to the Owner's Representative for approval prior to the substitution of any Subcontractors, suppliers or other persons and organizations before performing any Work on the Project for the Contractor.

Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers and other persons performing or furnishing any of the work under a direct or indirect contract with Contractor just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier or other person any contractual relationship between Owner or Engineer and any Subcontractor, Supplier or other person, nor shall it create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers and other persons performing or furnishing any of the work under a direct or indirect contract with Contractor. Contractor shall require all Subcontractors, Suppliers and such other persons performing or furnishing any of the work to communicate with the Engineer through Contractor.

The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the work among Subcontractors or Suppliers or delineating the work to be performed by any specific trade.

All work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.

Contractor shall not pay or employ any Subcontractor, Supplier or other person or organization whether initially or as a substitute, against whom Owner or Engineer may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier or other person or organization to furnish or perform any of the work against whom Contractor has reasonable objection.

Owner or Engineer will not undertake to settle any differences between Contractor and his Subcontractors or between Subcontractors.

6.5. USE OF PREMISES

Contractor shall confine construction equipment, the storage of materials and equipment and the operations of works to the site and land areas identified in and permitted by the Contract Documents on other land areas permitted by Laws and Regulations, right-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceed in or at law. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, Engineer, Engineer's Consultant and their officials, directors, employees and agents from and against all claims, costs, losses and damages arising out of or resulting from any claim or action, legal or equitable, brought by any such owner or occupant against Owner,

Engineer or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

During the progress of the Work, Contractor shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work or at intervals established by the Engineer, Contractor shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials. Contractor shall restore to original condition all property not designated for alteration by the Contract Documents.

6.5.1. STAGING AREAS

The Contractor shall obtain and deliver to the City written permission for the use of all staging and storage areas outside of the Limits of Construction. Use of right of way within the limits of construction must be approved by the City. All applicable erosion control, tree barricade and restoration, including time limits, specifications, etc., must be followed. Contractor must provide portable restroom that is lockable for the safety of the Contractor and the surrounding residents.

6.5.2. RESTORATION TIME LIMITS

The timely restoration of all impacted areas, especially in the Right-of-Ways, is very important to the Citizens of Clearwater therefore, these time limits are imposed:

- Debris piles shall be removed within five (5) consecutive calendar days.
- Concrete driveways and sidewalks shall be replaced within ten (10) consecutive calendar days of removal. Resident access shall be maintained at all times.
- All arterial and collector roadways shall be restored ASAP.
- Local streets and asphalt driveways shall be restored as soon as a sufficient quantity is generated, however, this is never to exceed fifteen (15) consecutive calendar days. Local and resident access shall be maintained at all times.
- Any irrigation systems or components damaged or impacted by construction activities shall be repaired or replaced “in-kind” within forty-eight (48) hours to minimize the loss of turfgrass or landscape plantings, particularly during periods of drought.
- Sod must be restored “in-kind” within fourteen (14) consecutive calendar days of a successful pipe pressure test, removal of concrete forms, backfill of excavations, replacement of driveways or sidewalks or another project specific milestone. It must be watered for a period of thirty (30) days after it is placed. Erosion control and dust control of denuded areas must be maintained at all times.

If the project or a portion of it does not involve right-of ways, then a different schedule of sod restoration may be considered.

6.6. LICENSE AND PATENT FEES, ROYALTIES AND TAXES

Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the work and if to the actual knowledge of Owner or Engineer its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner or Engineer in the Contract Documents.

To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner, Engineer, Engineer's Consultants and the officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages arising out of or resulting from any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents, and shall defend all such claims in connection with any alleged infringement of such rights.

Contractor shall pay all sales, consumer, use, and other taxes required to be paid by Contractor in accordance with the Laws and Regulations of the State of Florida and other governmental agencies, which are applicable during the performance of the work.

6.7. LAWS AND REGULATIONS

Contractor shall give all notices and comply with all Laws and Regulations applicable to furnishing and performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Owner's Representative shall be responsible for monitoring Contractor's compliance with any Laws or Regulations. If Contractor performs any work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses and damages caused by or arising out of such work: however, it shall not be Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations to the Owner to report and resolve discrepancies as described above.

6.7.1. E-VERIFY

Contractor and its Subcontractors shall register with and use the E-Verify system to verify the work authorization status of all newly hired employees. Contractor will not enter into a contract with any Subcontractor unless each party to the contract registers with and uses the E-Verify system. Subcontractor must provide Contractor with an affidavit stating that Subcontractor does not employ, contract with, or subcontract with an unauthorized alien. Contractor shall maintain a copy of such affidavit.

The City may terminate this Contract on the good faith belief that Contractor or its Subcontractors knowingly violated Florida Statutes 448.09(1) or 448.095(2)(c). If this Contract is terminated pursuant to Florida Statute 448.095(2)(c), Contractor may not be awarded a public contract for at least 1 year after the date of which this Contract was terminated. Contractor is liable for any additional costs incurred by the City as a result of the termination of this Contract.

See Section 448.095, Florida Statutes (2020).

See "VERIFICATION OF EMPLOYMENT ELIGIBILITY FORM" in Appendix.

6.8. PERMITS

Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. The Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of Bids. Contractor shall pay all charges of utility owners for connections to the work, and the Owner shall pay all charges of such utility owners for capital costs related thereto such as plant investment fees.

Unless otherwise stated in the Contract Documents, Clearwater Building Permit Fees will be waived.

6.9. SAFETY AND PROTECTION

Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to: (i) all persons on the work site or who may be affected by the work, (ii) all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and (iii) other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction. In the event of temporary suspension of the work, or during inclement weather, or whenever Owner's Representative may direct; Contractor shall, and shall cause Subcontractors, to carefully protect the Work and materials against damage or injury from the weather. If, in the opinion of the Owner's Representative, any portion of Work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or any Subcontractors to so protect the Work, such Work and materials shall be removed and replaced at the expense of Contractor. The Contractor shall initiate and maintain an accident prevention program which shall include but shall not be limited to the establishment and supervision of programs for the education and training of employees in the recognition, avoidance and prevention of unsafe conditions and acts. Contractor shall provide first aid services and medical care to his employees. The Contractor shall develop and maintain an effective fire protection and prevention program and good housekeeping practices at the site of contract performance throughout all phases of construction, repair, alteration, or demolition. Contractor shall require appropriate personal protective equipment in all operations where there is exposure to hazardous conditions. The Engineer may order that the work stop if a condition of immediate danger to the Owner's employees, equipment or if property damage exists. This provision shall not shift responsibility or risk of loss for injuries of damage sustained from the Contractor to Owner, and the Contractor shall remain solely responsible for compliance with all safety requirements and for the safety of all persons and property at the site of Contract performance. The Contractor shall instruct his employees required to handle or use toxic materials or other harmful substances regarding their safe handling and use. The Contractor shall take the necessary precautions to protect pedestrians and motorists from harm, and to prevent disruptions of such traffic due to construction activity.

Contractor shall comply with all applicable Laws and Regulations of any public body having jurisdiction for safety of persons or property and to protect them from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and utility owners when execution of the work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property. All damage, injury or loss to any property caused, directly or indirectly, in whole or part, by Contractor, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the work or anyone for whose acts any of them may be liable, shall be remedied by Contractor. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor that the Work is acceptable.

6.10. EMERGENCIES

In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, Contractor, with or without special instruction or authorization from Owner or the Owner's Representative, is obligated to act to prevent damage, injury or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If the Owner's Representative determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued to document the consequences of such action.

6.11. DRAWINGS

6.11.1. SHOP DRAWINGS, SAMPLES, RFIs, AND SUBMITTAL REVIEW

Contractor shall submit Shop Drawings to Engineer for review and approval as called for in the Technical Specifications or required by the Engineer. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to show Engineer the materials and equipment Contractor proposes to provide and to enable Engineer to review the information. Contractor shall also submit Samples to Engineer for review and approval. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified: (i) all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar information with respect thereto, (ii) all materials with respect to intended use, fabrication, shipping, handling, storage, assembly and installation pertaining to the performance of the Work, and (iii) all information relative to Contractor's sole responsibilities in respect to means, methods, techniques, sequences and procedures of construction and safety precautions and programs incident thereto. Contractor shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples with the requirements of the Work and the Contract Documents. Each submittal will have a transmittal cover sheet identifying the shop drawing name, number, and technical specification reference; will bear a stamp or specific written indication that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal. At the time of submission, Contractor shall give Engineer specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to Engineer for review and approval of each such variation.

The Contractor shall maintain a submittal log as mentioned in Article 2.5. The Engineer shall receive updated copies at each progress meeting, and the Engineer shall respond to each submittal within fourteen (14) consecutive calendar days. The Contractor shall maintain a request for information (RFI) log as mentioned in Article 2.5. The Engineer shall receive updated copies at each progress meeting, and the Engineer shall respond to each RFI within fourteen (14) consecutive calendar days. The untimely submission of Submittal or RFIs shall not be grounds for a delay claim from the Contractor.

Engineer's review and approval of Shop Drawings and Samples will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of

the completed Project as a functioning whole as indicated the Contract Documents. Engineer's review and approval will not extend to means, methods, techniques, sequences or procedures of construction (except where a particular means method, technique, sequence or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

Engineer's review and approval of Shop Drawings or Samples shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has in writing called Engineer's attention to each such variation at the time of submission and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval; nor will any approval by the Engineer relieve the Contractor from responsibility for complying with the requirements of paragraph above discussing field measurements by the Contractor.

Contractor shall furnish required submittals with complete information and accuracy in order to achieve required approval of an item within two (2) submittals. Owner's Representative reserves the right to back charge Contractor, for Engineer's costs for resubmittals that account for a number greater than twenty percent (20%) of the total number of first-time submittals, per the approved initial submittal log. Owner's Representative reserves the right to back charge Contractor for all third submittals. The number of first-time submittals shall be equal to the number of submittals agreed to by Engineer and Contractor. All costs to Engineer involved with subsequent submittal of Shop Drawings, Samples or other items requiring approval will be back charged to Contractor at the rate of 3.0 times direct technical labor cost by deducting such costs from payments due Contractor for Work completed. In the event, that Contractor requests a substitution for a previously approved item, all of Engineer's costs in the reviewing and approval of the substitution will be back charged to Contractor, unless the need for such substitution is beyond the control of Contractor.

6.11.2. AS-BUILT DRAWINGS

The Contractor shall keep and maintain one set of blueprints, As-Built Drawings, in good order and legible condition to be continuously marked-up at the job site. The Contractor shall mark and annotate neatly and clearly all project conditions, locations, configurations and any other changes or deviations which may vary from the details represented on the original Contract Plans, including revisions made necessary by Addenda, Shop Drawings, and Change Orders during the construction process. The Contractor shall record the horizontal and vertical locations, in the plan and profile, of all buried utilities that differ from the locations indicated or which were not indicated on the Contract Plans and buried (or concealed), construction and utility features which are revealed during the construction period. All abandoned during construction pipes and utilities must be clearly identified on the As-Built including the methods used to abandon.

The As-Built Drawings shall be available for inspection by the Engineer, Engineer's Consultant, and the Owner's Representative at all times during the progress of the Project.

The As-Built Drawings shall be reviewed by the Owner's Representative, or his designee, for accuracy and compliance with the requirements of "As-Built Drawings" prior to submittal of the monthly pay requests. The pay requests shall be rejected if the marked-up redline prints do not

conform to the “As-Built Drawings” requirements. As-Built Drawings shall be submitted to the Owner Inspector for approval upon completion of the project and prior to acceptance of final pay request. Final pay request shall not be processed until As-Built Drawings have been reviewed by the Engineer or the Engineer’s Consultant for accuracy and completeness.

Prior to placing new potable water mains in service, the Contractor shall provide the Engineer intersection drawings, as specified for the water mains.

The Owner’s acceptance of the As-Built Drawings does not relieve the Contractor of the sole responsibility for the accuracy and completeness of the As-Built Drawings.

6.11.2.1. General

The Contractor shall prepare an AS-BUILT SURVEY per chapter 5J-17.052, Florida Administrative Code (see definition below), signed and sealed by a Florida registered land surveyor. The Contractor will deliver to the Owner two hard copies of signed and sealed As-Built Drawings and an AutoCAD file.

5J-17.050 Definition: (10)(a) *As-Built Survey: a survey performed to obtain horizontal and/or vertical dimensional data so that constructed improvements may be located and delineated: also known as Record Survey.*

This survey shall be clearly titled “AS-BUILT SURVEY” and shall be signed and sealed by a Florida registered land surveyor. The survey must be delivered to the Owner of Clearwater Construction Division upon substantial completion of the project. If this condition is not met, the Owner will procure the services of a Professional Surveyor and Mapper registered in the State of Florida and will back charge the Contractor a fee of \$1,800 per day or any portion thereof to provide the Owner with the required As-Built Survey.

6.11.2.2. Sanitary and Storm Sewer Piping Systems

1. Manholes and inlets shall be located by survey coordinates (northing, easting, and elevation) based on the approved horizontal and vertical datum or utilize the stationing supplied on the construction plans. New and replaced service connections shall be dimensioned to the nearest downstream manhole. All manholes, cleanouts and catch basin invert and rim elevations, manhole and catch basin dimensions, pipe sizes, and pipe material shall also be noted on the plan view and also on the profile if one exists. The terminal ends of all subdrains, inverts of all pipe in structures, and the flow line of inlets shall also be noted on the plan view and also on the profile if one exists.
2. Pipe materials and areas of special construction shall be noted.

6.11.2.3. Pressure Pipe construction (Water, Reclaimed Water, Force Main)

All pipes shall be located by survey coordinates (northing, easting, and elevation) based on the approved horizontal and vertical datum or utilize the stationing supplied on the construction plans. Coordinates shall be at all pipe bends, tees, valves, reducers, and deflections. Also, all new and replaced service connections for potable and reclaimed water will be located as described above. Additionally, there must be survey coordinates no further than 100 feet apart on linear type construction and shall denote top of pipe elevation at those points.

6.11.2.4. Electrical and Control Wiring

The As-Built Drawings shall include all changes to the original Contract Plans. The As-Built Drawings shall also include the size, color, and number of wires and conduit. For projects where this information is too voluminous to be contained on the blue-line prints, the Contractor shall prepare supplemental drawings, on same size sheets as the blue-line prints, showing the additional conduit runs, 1-line diagrams, ladder diagrams, and other information. The wiring schematic diagrams shall show termination location and wiring identification at each point on the ladder diagram.

6.11.2.5. Horizontal and Vertical Control

The As-Built Survey shall be based on the original datum used for the construction design plans or if required by the Owner the datum shall be referenced to the North American Datum of 1983/90 (horizontal) and the North American Vertical Datum of 1988. The unit of measurement shall be the United States Foot. Any deviation or use of any other datum, (horizontal and or vertical), must be approved by the Owner of Clearwater Engineering Department.

6.11.2.6. Standards

The As-Built Survey shall meet the Minimum Technical Standards per Chapter 5J-17 and the Clearwater CAD STANDARDS set forth below. In addition to locating all improvements that pertain to the As-Built Survey it is the requirement of the Owner to have minimum location points at every change in direction and no more than 100 feet apart on all pressure pipes.

6.11.2.7. Other

The As-Built Drawings shall reflect any differences from the original Contract Plans, in the same level of detail and units of dimensions as the Plans.

6.11.3. CAD STANDARDS

6.11.3.1. Layer Naming

6.11.3.1.1. Prefixes and Suffixes

AB-...	prefix denotes As-Built information
DI-...	prefix denotes digitized or scanned entities
DEMO-...	prefix denotes demolition
P-...	prefix denotes proposed entities – line work and symbols
F-...	prefix denotes future entities (proposed but not part of this contract) - line work and symbols
X-...	prefix denotes existing entities – line work and symbols
... -CANOPY	Suffix denotes tree canopies
...-CL	suffix denotes centerline of road, ditch, swale etc.
...-LN	suffix denotes all linework
...-PT	suffix denotes points from survey data or from design stakeout
...-TX	suffix denotes text – use for all text, no matter the prefix

6.11.3.1.2. Layer Naming Definitions:

BENCH	benchmark, temporary benchmarks
BLDG	buildings, sheds, finished floor elevation

SECTION III – General Conditions

BOC	curbs
BOLLARD	bollards
BRUSH	brush lines
CABLE	cable TV lines and appurtenances
CONCSLAB	concrete slabs
DRIVE	driveways
EASEMENT	easements
EOP	edge of pavement without curbs
FENCE	all fences
FLOW	flow lines
GRADE	grade slopes, grade breaks
GROUND	soft ground (unpaved, unimproved)
HANDRAIL	handrails
HEDGE	hedges
LANDSCAPE	landscape areas
LOT	platted lot lines information
MISC	miscellaneous linework
MONU	property corners, monumentation
PHONE	telephone lines and appurtenances
PROPERTY	property lines information
ROAD	roads
ROW	Right-of-Way information
SEAWALL	seawalls
SHORE	shoreline, water elevation
SWALE	swales
TOB	top of bank
TOE	toe of slope
TRAFFIC	signal poles, control boxes
TREE	trees, bushes, planters
UT-ELEC	power lines and appurtenances
UT-GAS	gas lines and appurtenances
UT-RCW	reclaimed water
UT-SAN	sanitary lines and appurtenances
UT-STM	storm lines and appurtenances
UT-TCOM	telecommunication systems
UT-WAT	potable water lines and appurtenances, sprinklers
WALK	sidewalk
WALL	walls, except seawall

Other layers may be created as required or needed, using above format or easy to understand logic.

6.11.3.2. Layer Properties

All AutoCAD objects shall be drawn with their General Properties to be “ByLayer”, pertaining to “Color”, “Linetype”, and “Lineweight”.

6.11.3.3. Text Styles

All text shall use standard AutoCAD fonts.

Text style for X-... (existing) layers shall use the Simplex font, oblique angle of 0°, and a text height of 0.06 times the plot scale.

Text style for P-... (proposed) and F-... (future) layers shall use the Simplex font, oblique angle of 22.5°, and a text height of 0.1 times the plot scale.

6.11.4. DELIVERABLES

The As-Built Survey shall be produced on bond material, 24" x 36" at a scale of 1"=20' unless approved otherwise. The consultant shall deliver two hard copies and one digital copy of all drawings. Requested file formats are Autodesk DWG and Adobe PDF files.

Please address any questions regarding format to Mr. Tom Mahony, at (727) 562-4762 or e-mail address Thomas.Mahony@myClearwater.com.

6.12. CONTRACTOR'S GENERAL WARRANTY AND GUARANTEE

Contractor warrants and guarantees to Owner, Engineer and Engineer's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. Contractor's warranty and guarantee hereunder includes defects or damage caused by abuse, vandalism, modification, or operation by persons other than Contractor, Subcontractors or Suppliers. Until the acceptance of the Work by the Owner, the Work shall be under the charge and care of the Contractor, and he shall take every necessary precaution against injury or damage to any part thereof by action of the elements, or from any other cause whatsoever, arising from the execution or non-execution of the Work. The Contractor shall rebuild, repair, and make good, at his own expense, all injuries or damages to any portion of the Work occasioned by any cause before its completion and final acceptance by the Owner. In addition, "the Contractor shall remedy any defects in the work at his own expense and pay for any damage to other work resulting therefrom which appear within a period of one year from the date of final acceptance".

Contractor's warranty and guarantee hereunder excludes improper maintenance and operation by Owner's employees and normal wear and tear under normal usage for any portion of the Work, which has been partially accepted by the Owner for operation prior to final acceptance by the Owner. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents: (i) observations by Owner's Representative, (ii) recommendation of any progress or final payment by Owner's Representative, (iii) the issuance of a certificate of Substantial Completion or any payment by the Owner to contractor under the Contract Documents, (iv) use or occupancy of the Work or any part thereof by Owner, (v) any acceptance by Owner or any failure to do so, (vi) any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of Acceptance by the Engineer.

6.13. CONTINUING THE WORK

Contractor shall carry on the work and adhere to the progress schedule during all disputes or disagreements with the Owner. No work shall be delayed or postponed pending resolution of any disputes or disagreements, except as the Owner or Contractor may otherwise agree in writing.

6.14. INDEMNIFICATION

To the fullest extent permitted by law, Contractor agrees to defend, indemnify, and hold the City, its officers, agents, and employees, harmless from and against any and all liabilities, demands, claims, suits, losses, damages, causes of action, fines or judgments, including costs, attorneys', witnesses', and expert witnesses' fees, and expenses incident thereto, relating to, arising out of, or resulting from: (i) the services provided by Contractor personnel under this Agreement; (ii) any negligent acts, errors, mistakes or omissions by Contractor or Contractor personnel; and (iii) Contractor or Contractor personnel's failure to comply with or fulfill the obligations established by this Agreement.

Contractor will update the City during the course of the litigation to timely notify the City of any issues that may involve the independent negligence of the City that is not covered by this indemnification.

The City assumes no liability for actions of Contractor and will not indemnify or hold Contractor or any third party harmless for claims based on this Agreement or use of Contractor-provided supplies or services.

Notwithstanding anything contained herein to the contrary, this indemnification provision shall not be construed as a waiver of any immunity to which Owner is entitled or the extent of any limitation of liability pursuant to § 768.28, Florida Statutes. Furthermore, this provision is not intended to nor shall be interpreted as limiting or in any way affecting any defense Owner may have under § 768.28, Florida Statutes or as consent to be sued by third parties.

6.15. CHANGES IN COMPANY CONTACT INFORMATION

Contractor shall notify Owner by US mail addressed to the City Engineer of any changes in company contact information. This includes contact phone, address, project manager, email addresses, etc.

6.16. PUBLIC RECORDS

The CONTRACTOR will be required to comply with Section 119.0701, Florida Statutes.

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS, Rosemarie Call, phone: 727-562-4092 or Rosemarie.Call@myclearwater.com, 600 Cleveland Street, Suite 600, Clearwater, FL 33755.

The Contractor's duty to comply with public records law applies specifically to:

- a) Keep and maintain public records required by the City of Clearwater (hereinafter "public agency") to perform the service being provided by the Contractor hereunder.
- b) Upon request from the public agency's custodian of public records, provide the public agency with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided for in Chapter 119, Florida Statutes, as may be amended from time to time, or as otherwise provided by law.
- c) Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the

duration of the contract term and following completion of the contract if the Contractor does not transfer the records to the public agency.

- d) Upon completion of the contract, transfer, at no cost, to the public agency all public records in possession of the Contractor or keep and maintain public records required by the public agency to perform the service. If the Contractor transfers all public records to the public agency upon completion of the contract, the Contractor shall destroy any public records that are exempt or confidential and exempt from public records disclosure requirements. If the Contractor keeps and maintains public records upon completion of the contract, the Contractor shall meet all applicable requirements for the retaining public records. All records stored electronically must be provided to the public agency, upon request from the public agency's custodian of public records in a format that is compatible with the information technology systems of the public agency.
- e) A request to inspect or copy public records relating to a public agency's contract for services must be made directly to the public agency. If the public agency does not possess the requested records, the public agency shall immediately notify the Contractor of the request and the Contractor must provide the records to the public agency or allow the records to be inspected or copied within a reasonable time.
- f) The Contractor hereby acknowledges and agrees that if the Contractor does not comply with the public agency's request for records, the public agency shall enforce the contract provisions in accordance with the contract.
- g) A Contractor who fails to provide the public records to the public agency within a reasonable time may be subject to penalties under Section 119.10, Florida Statutes.
- h) If a civil action is filed against a Contractor to compel production of public records relating to a public agency's contract for services, the court shall assess and award against the Contractor the reasonable costs of enforcement, including reasonable attorney fees, if:
 - 1. The court determines that the Contractor unlawfully refused to comply with the public records request within a reasonable time; and
 - 2. At least 8 business days before filing the action, the plaintiff provided written notice of the public request, including a statement that the Contractor has not complied with the request, to the public agency and to the Contractor.
- i) A notice complies with subparagraph (h)2. if it is sent to the public agency's custodian of public records and to the Contractor at the Contractor's address listed on its contract with the public agency or to the Contractor's registered agent. Global Express Guaranteed, or certified mail, with postage or shipping paid by the sender and with evidence of delivery, which may be in an electronic format.
- j) A Contractor who complies with a public records request within 8 business days after the notice is sent is not liable for the reasonable costs of enforcement.

7. OTHER WORK

7.1. RELATED WORK AT SITE

The City reserves the right to have its own forces enter the construction site at any time and perform work as necessary in order to perform infrastructure repair or maintenance, whether related to the project or not. The Contractor will allow complete access to all utility owners for these purposes.

The City may have its own forces perform new work related to the project, however, this work will be identified in the Contract Scope of Work and coordination will be such that this activity is

denoted in the Contractor's CPM Schedule so as not to cause any delays or interference with the Contractor's work or schedule.

7.2. COORDINATION

If the Owner contracts with others for the performance of other work on the Project at the site, the following will be set forth in the Scope of Work: (i) the person who will have authority and responsibility for coordination of the activities among the various prime Contractors will be identified; (ii) the specific matters to be covered by such authority and responsibility will be itemized; and (iii) the extent of such authority and responsibilities will be provided. Unless otherwise provided in the Supplementary Conditions, the Owner shall have sole authority and responsibility in respect of such coordination.

8. OWNER'S RESPONSIBILITY

Except as otherwise provided in these General Conditions, the Owner shall issue all communications from the Owner to the Contractor through Owner's Representative.

The Owner shall furnish the data required of the Owner under the Contract Documents promptly and shall make payments to Contractor promptly when they are due as provided in these General Conditions.

The Owner is obligated to execute Change Orders as indicated in the Article on Changes In The Work.

The Owner's responsibility in respect of certain inspections, tests, and approvals is set forth in the Article on Tests and Inspections.

In connection with the Owner's right to stop work or suspend work, see the Article on Engineer may Stop the Work. The Article on Suspension of Work and Termination deals with the Owner's right to terminate services of Contractor under certain circumstances.

Owner shall not supervise, direct or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the Work. The Owner will not be responsible for Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.

9. OWNER REPRESENTATIVE'S STATUS DURING CONSTRUCTION

9.1. OWNER'S REPRESENTATIVE

Dependent of the project type, the Owner's Representative during the construction period will either be the Construction Manager, the Engineer, or a designee of the Project's Owner. The duties, responsibilities and the limitations of authority of Owner's Representative during construction are set forth in the Contract Documents and shall not be extended without written consent of Owner and Engineer.

9.2. CLARIFICATIONS AND INTERPRETATIONS

Engineer will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents regarding design issues only, in the form of Submittal responses, RFI responses, Drawings or otherwise, as Engineer may determine necessary, which shall be consistent with the intent of and reasonably inferable from Contract Documents. All other clarifications and interpretations of the Contract Documents shall be issued from the Owner's Representative. Such written clarifications and interpretations will be binding on the Owner and Contractor. If Contractor believes that a written clarification or interpretation justifies an adjustment in the Contract Price or the Contract Time and the parties are unable to agree to the amount or extent thereof, if any, Contractor may make a written claim therefore as provided in the Articles for Change of Work and Change of Contract Time.

9.3. REJECTING OF DEFECTIVE WORK

The Owner's Representative or the Engineer will have authority to disapprove or reject Work which Owner's Representative or the Engineer believes to be defective, or that Owner's Representative or the Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. The Owner's Representative or the Engineer will also have authority to require special inspection or testing of the Work whether or not the Work is fabricated, installed or completed.

9.4. SHOP DRAWINGS, CHANGE ORDERS, AND PAYMENTS

In connection with Engineer's authority as to Shop Drawings and Samples, see articles on Shop Drawings and Samples. In connection with Owner's Representative authority as to Change Orders, see the articles on Changes of Work, Contract Price and Contract Time. In connection with Owner's Representative authority as to Applications for Payment, see the articles on Payments to Contractor and Completion.

9.5. DECISIONS ON DISPUTES

The Owner's Representative will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the work thereunder. Claims, disputes and other matters relating to the acceptability of the work or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the work and Claims under the Articles for Changes of Work, Changes of Contract Time and Changes of Contract Price will be referred initially to Owner's Representative in writing with a request for a formal decision in accordance with this paragraph. Written notice of each such claim, dispute or other matter will be delivered by the claimant to Owner's Representative and the other party to the Agreement promptly, but in no event later than thirty (30) days, after the start of the occurrence or event giving rise thereto, and written supporting data will be submitted to Owner's Representative and the other party within sixty (60) days after the start of such occurrence or event unless Owner's Representative allows an additional period of time for the submission of additional or more accurate data in support of such claim, dispute or other matter. The opposing party shall submit any response to Owner's Representative and the claimant within thirty (30) days after receipt of the claimant's last submittal unless Owner's Representative allows additional time. Owner's Representative will render a formal decision in writing within thirty (30) days after receipt of the opposing party's submittal, if any, in accordance with this paragraph. Owner Representative's written decision on such claim, dispute or other matter will be final and binding upon the Owner

and Contractor unless (i) an appeal from Owner Representative's decision is taken within thirty (30) days of the Owner Representative's decision, or the appeal time which may be stated in a Dispute Resolution Agreement between Owner and Contractor for the settlement of disputes or (ii) if no such Dispute Resolution Agreement has been entered into, a written notice of intention to appeal from Owner Representative's written decision is delivered by the Owner or Contractor to the other and to Owner's Representative within thirty (30) days after the date of such decision and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction to exercise such rights or remedies as the appealing party may have with respect to such claim, dispute or other matter in accordance with applicable Laws and Regulations within sixty (60) days of the date of such decision, unless otherwise agreed in writing by the Owner and Contractor.

When functioning as interpreter and judge, Owner's Representative will not show partiality to the Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by Owner's Representative with respect to any such claim, dispute or other matter will be a condition precedent to any exercise by the Owner or Contractor of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such claim, dispute or other matter pursuant the Article on Dispute Resolution.

9.6. LIMITATIONS ON OWNER REPRESENTATIVE'S RESPONSIBILITIES

Neither Owner Representative's authority or responsibility under this paragraph or under any other provision of the Contract Documents nor any decision made by Owner's Representative in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise or performance of any authority or responsibility by Owner's Representative shall create, impose or give rise to any duty owed by Owner's Representative to Contractor, any Subcontractor, any Supplier, any other person or organization or to any surety for or employee or agent of any of them.

Owner's Representative will not supervise, direct, control or have authority over or be responsible for Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the work. Owner's Representative will not be responsible for Contractor's failure to perform or furnish the work in accordance with the Contract Documents.

Owner's Representative will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the work.

Owner Representative's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds and certificates of inspection, tests and approvals and other documentation required to be delivered by the Contractor will only be to determine generally that their content complies with the requirements of the Contract Documents and, in the case of certificates of inspections, tests and approvals that the results certified indicate compliance with the Contract Documents.

The limitations upon authority and responsibility set forth in this paragraph shall also apply to Owner Representative's CEI, the Engineer's Consultants, and assistants.

10. CHANGES IN THE WORK

Without invalidating the Agreement and without notice to any surety, the Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such additions, deletions, or revisions will be authorized by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as may otherwise be specifically provided).

If the Owner and Contractor are unable to agree as to the extent, if any, of an adjustment in the Contract Price or an adjustment of the Contract Time that should be allowed as a result of a Work Change Directive, a claim may be made therefore as provided in these General Conditions.

Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Time with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented as provided in these General Conditions except in the case of an emergency as provided or in the case of uncovering work as provided in article for Uncovering Work.

The Owner and Contractor shall execute appropriate Change Orders or Written Amendments recommended by Owner's Representative covering:

- changes in the work which are (i) ordered by the Owner (ii) required because of acceptance of defective work under the article for Acceptance of Defective Work or correcting defective Work under the article for Owner May Correct Defective Work or (iii) agreed to by the parties;
- changes in the Contract Price or Contract Time which are agreed to by the parties; and
- changes in the Contract Price or Contract Time which embody the substance of any written decision rendered by Owner's Representative pursuant to the article for Decisions on Disputes;
- provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the progress schedule as provided in the article for Continuing the Work.

If notice of any change affecting the general scope of the work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Time) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be Contractor's responsibility, and the amount of each applicable Bond will be adjusted accordingly.

11. CHANGES IN THE CONTRACT PRICE

11.1. CHANGES IN THE CONTRACT PRICE

The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to Contractor for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by Contractor shall be at Contractor's expense without change in the Contract Price. The Contract Price may only be adjusted by a Change Order or by a Written Amendment. Any claim for an adjustment in the Contract Price shall be based on a written notice of claim stating the general nature of the claim, to be delivered by the party making the claim to the other party and to Owner's Representative or promptly (but in no event later than thirty days) after the start of the occurrence or event giving rise to the claim. Notice of the amount of the claim with supporting

data shall be delivered within sixty (60) days after the start of such occurrence or event, unless Owner's Representative allows additional time for claimant to submit additional or more accurate data in support of the claim, and shall be accompanied by claimant's written statement that the claimed adjustment covers all known amounts to which the claimant is entitled as a result of said occurrence or event. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with this paragraph. The value of any Work covered by a Change Order or of any claim for an adjustment in the Contract Price will be determined as follows: (i) where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (ii) where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit), (iii) where the Work is not covered by unit prices contained in the Contract Documents and agreement is reached to establish unit prices for the Work.

Where the work involved is not covered by unit prices contained in the Contract Documents and where the Owner's Representative, the Owner, the Engineer, the Engineer's Consultant, and Contractor cannot mutually agree on a lump sum price, the City of Clearwater shall pay for directed changes in the Work, on "COST REIMBURSEMENT" basis. The Contractor shall apply for compensation, detailing Contractor's forces, materials, equipment, Subcontractors, and other items of direct costs required for the directed work.

The application for Cost Reimbursement shall be limited to the following items:

1. Labor, including foremen, for those hours associated with the direct work (actual payroll cost, including wages, fringe benefits, labor insurance and labor taxes established by law). Expressly excluded from this item are all costs associated with negotiating the subject change.
2. Materials associated with the change, including sales tax. The costs of materials shall be substantiated through vendors' invoices.
3. Rental or equivalent rental costs of equipment, including necessary transportation costs if specifically used for the Work. The rental rates shall not exceed the current rental rates prevailing in the locality or as defined in the rental Rate Blue Book for Construction Equipment (a.k.a. DataQuest Blue Book). The rental rate is defined as the full-unadjusted base rental rate for the appropriate item of construction equipment and shall cover the costs of all fuel, supplies, repairs, insurance, and other costs associated with supplying the equipment for work ordered. Contractor-owned equipment will be paid for the duration of time required to complete the work. Utilize lowest cost combination of hourly, daily, weekly, or monthly rates. Do not exceed estimated operating costs given in Blue Book. Operating costs will not be allowed for equipment on stand-by.
4. Additional costs for Bonds, Insurance if required by the City of Clearwater.

The following fixed fees shall be added to the costs of the directed work performed by the Contractor or Subcontractor.

- A. A fixed fee of fifteen percent (15%) shall be added to the costs of Item 1 above. If work is performed by a Subcontractor, the Contractor's fee shall not exceed five percent (5%), and the Subcontractor's fee shall not exceed ten percent (10%).
- B. A fixed fee of ten percent (10%) shall be added to the costs of Item 2 above.
- C. No markup shall be added to the costs of Items 3 and 4.

The fixed fees shall be considered the full compensation for all cost of general supervision, overhead, profit, and other general expense.

11.2. ALLOWANCES AND FINAL CONTRACT PRICE ADJUSTMENT

It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be furnished and performed for such sums as may be acceptable to Owner and Engineer. Contractor agrees that: (i) the allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and (ii) Contractor's costs for unloading and handling on the site, labor, installation costs, overhead, profit and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances and no demand for additional payment on account of any of the foregoing will be valid.

Prior to final payment, an appropriate Change Order will be issued as recommended by Owner's Representative to reflect actual amounts due Contractor on account of Work covered by allowances and all the Work actually performed by the Contractor, and the Contract Price shall be correspondingly adjusted.

11.3. UNIT PRICE WORK

Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the established unit price for each separately identified item of unit price work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Owner's Representative. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item. The Owner or Contractor may make a claim for an adjustment in the Contract Price if: (i) the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Contract Documents; and (ii) there is no corresponding adjustment with respect to any other item of Work; and (iii) if Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or the Owner believes that the Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease. On unit price contracts, Owner endeavors to provide adequate unit quantities to satisfactorily complete the construction of the project. It is expected that in the normal course of project construction and completion that not all unit quantities will be used in their entirety and that a finalizing change order which adjusts contract unit quantities to those unit quantities actually used in the construction of the project will result in a net decrease from the original Contract Price. Such reasonable deduction of final Contract Price should be anticipated by the Contractor in his original bid.

12. CHANGES IN THE CONTRACT TIME

The Contract Time (or Milestones) may only be changed by a Change Order or a Written Amendment. Any claim for an adjustment of the Contract Time (or Milestones) shall be based on written notice delivered by the party making the claim to the other party and to Owner's Representative promptly, but in no event later than thirty (30) days, after the occurrence of the

event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within sixty (60) days after such occurrence, unless Owner's Representative allows an additional period of time to ascertain more accurate data in support of the claim, and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event. All claims for adjustment in the Contract Time (or Milestones) shall be determined by Owner's Representative. No claim for an adjustment in the Contract Time (or Milestones) will be valid if not submitted in accordance with the requirements of this paragraph.

All time limits stated in the Contract Documents are of the essence of the Agreement.

Where Contractor is prevented from completing any part of the work within the Contract Time (or Milestones) due to delay beyond the control of Contractor, the Contract Time (or Milestones) may be extended in an amount equal to the time lost due to such delay if a claim is made therefore as provided in the article for Changes in the

Work. Delays beyond the control of Contractor shall include, but not be limited to, acts by the Owner, acts of utility owners or other contractors performing other work as contemplated by the article for Other Work, fires, floods, epidemics, abnormal weather conditions or acts of God. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

Where Contractor is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both the Owner and Contractor, an extension of the Contract Time (or Milestones) in an amount equal to the time lost due to such delay shall be Contractor's sole and exclusive remedy for such delay. In no event shall the Owner be liable to Contractor, any Subcontractor, any Supplier, any other person, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from (i) delays caused by or within the control of Contractor, or (ii) delays beyond the control of both parties including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God or acts by utility owners or other contractors performing other work as contemplated by paragraph for Other Work.

13. TESTS AND INSPECTIONS, CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.1. TESTS AND INSPECTION

Contractor shall give Owner's Representative and Engineer timely notice of readiness of the Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

Contractor shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents. The costs for these inspections, tests or approvals shall be borne by the Contractor except as otherwise provided in the Contract Documents.

If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of such public body including all Owner Building Departments and Owner Utility Departments, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, pay all costs in connection therewith, and furnish Owner's Representative the required certificates of inspection or approval. Unless otherwise stated in the Contract Documents, Owner

permit and impact fees will be waived. Contractor shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work, or of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation of the Work.

If any Work (or the work of others) that is to be inspected tested or approved is covered by Contractor without written concurrence of Owner's Representative, it must, if requested by Owner's Representative, be uncovered for observation. Uncovering Work as provided in this paragraph shall be at Contractor's expense unless Contractor has given Owner's Representative and Engineer timely notice of Contractor's intention to cover the same and Owner's Representative has not acted with reasonable promptness in response to such notice.

13.2. UNCOVERING THE WORK

If any Work is covered contrary to the written request of Owner's Representative, it must, if requested by Owner's Representative, be uncovered for Owner Representative's observation and replaced at Contractor's expense.

If Owner's Representative considers it necessary or advisable that covered Work be observed by Owner's Representative or inspected or tested by others, Contractor, at Owner Representative's request, shall uncover, expose or otherwise make available for observation, inspection or testing as Engineer or Owner's Representative may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, Contractor shall pay all claims, costs, losses and damages caused by, arising out of or resulting from such uncovering, exposure, observation, inspection and testing and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and the Owner shall be entitled to an appropriate decrease in the Contract Price for the costs of the investigation, and, if the parties are unable to agree as to the amount thereof, may make a claim therefore as provided in the article for Change in Contract Price. If, however, such Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Time (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction; and, if the parties are unable to agree as to the amount or extent thereof, Contractor may make a claim therefore as provided the article for Change in Contract Price and Change of Contract Time.

13.3. OWNER'S REPRESENTATIVE MAY STOP THE WORK

If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, Engineer or Owner's Representative may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner's Representative to stop the Work shall not give rise to any duty on the part of Owner's Representative or Owner to exercise this right for the benefit of Contractor or any surety or other party. If the Owner's Representative stops Work under this paragraph, Contractor shall be entitled to no extension of Contract Time or increase in Contract Price.

13.4. CORRECTION OR REMOVAL OF DEFECTIVE WORK

If required by Engineer or Owner's Representative, Contractor shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has

been rejected by Engineer or Owner's Representative, remove it from the site and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses and damages caused by or resulting from such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.5. WARRANTY/CORRECTION PERIOD

If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, Contractor shall promptly, without cost to the Owner and in accordance with the Owner's written instructions; (i) correct such defective Work, or, if it has been rejected by the Owner, remove it from the site and replace it with Work that is not defective and (ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If Contractor does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, the Owner may have the defective Work corrected or the rejected. Work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

In special circumstances where a particular item of equipment is placed in continuous service before Final Completion of all the Work, the correction period for that item may start to run from an earlier date if specifically, and expressly so provided in the Specifications or by Written Amendment.

Where defective Work (and damage to other Work resulting therefrom) has been corrected, removed or replaced under this paragraph the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

13.6. ACCEPTANCE OF DEFECTIVE WORK

If, instead of requiring correction or removal and replacement of defective Work, the Owner prefers to accept it, the Owner may do so.

Contractor shall pay all claims, costs, losses, and damages attributable to the Owner's evaluation of and determination to accept such defective Work such costs to be approved by Owner's Representative as to reasonableness. If any such acceptance occurs prior to Owner Representative's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and the Owner shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, the Owner may make a claim therefore as provided in article for Change of Contract Price. If the acceptance occurs after the Owner Representative's recommendation for final payment an appropriate amount will be paid by Contractor to the Owner.

13.7. OWNER MAY CORRECT DEFECTIVE WORK

If Contractor fails within a reasonable time after written notice from Owner's Representative to correct defective Work or to remove and replace rejected Work as required by Owner's Representative in accordance with the article for Correction and Removal of Defective Work or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, the Owner may, after seven

days' written notice to Contractor, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph the Owner shall proceed expeditiously. In connection with such corrective and remedial action, the Owner may exclude Contractor from all or part of the site, take possession of all or part of the Work, and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the site or for which the Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's Representatives, Agents and Employees, the Owner's other contractors, and Owner's Representative, Engineer, and Engineer's Consultants access to the site to enable the Owner to exercise the rights and remedies under this paragraph. All claims, costs, losses and damages incurred or sustained by the Owner in exercising such rights and remedies will be charged against Contractor and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and the Owner shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, the Owner may make a claim therefore as provided in the article for Change of Contract Price. Such claims, costs, losses and damages will include but not be limited to all costs of repair or replacement of work of others destroyed or damaged by correction, removal or replacement of Contractor's defective Work. Contractor shall not be allowed an extension of the Contract Time (or Milestones) because of any delay in the performance of the Work attributable to the exercise by the Owner of the Owner's rights and remedies hereunder.

14. PAYMENTS TO CONTRACTOR AND COMPLETION

Requests for payment shall be processed in accordance with F.S. 218.735 and as described herein. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.1. APPLICATION FOR PROGRESS PAYMENT

Contractor shall submit (not more often than once a month) to Owner's Representative for review an Application for Payment filled out and signed by Contractor covering the Work completed once each month and accompanied by such supporting documentation as is required by the Owner's Representative and the Contract Documents. Unless otherwise stated in the Contract Documents, payment will not be made for materials and equipment not incorporated in the Work. Payment will only be made for that portion of the Work, which is fully installed including all materials, labor, and equipment. A retainage of not less than five (5%) of the amount of each Application for Payment for the total of all Work, including As-Built Survey and Inspector overtime reimbursement, completed to date will be held until final completion and acceptance of the Work covered in the Contract Documents. No progress payment shall be construed to be acceptance of any portion of the Work under contract.

The Contractor shall review with the Engineer or the Construction Inspector all quantities and work for which payment is being applied for and reach agreement prior to submittal of an Official Pay Request. The Engineer or the Construction Inspector will verify that the on-site marked up As-Built Drawings are up to date with the work and are in compliance with the Contract Documents.

In addition to all other payment provisions set out in this contract, the Owner's Representative may require the Contractor to produce for Owner, within fifteen (15) days of the approval of any progress payment, evidence and/or payment affidavit that all Subcontractors and Suppliers have been paid any sum or sums then due. A failure on the part of the Contractor to provide the report as required herein shall result in further progress or partial payments being withheld until the report is provided.

14.2. CONTRACTOR'S WARRANTY OF TITLE

Contractor warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to the Owner no later than the time of payment, free and clear of liens. No materials or supplies for the Work shall be purchased by Contractor or Subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. Contractor warrants that he has good title to all materials and supplies used by him in the Work, free from all liens, claims or encumbrances. Contractor shall indemnify and save the Owner harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies incurred in the furtherance of the performance of this Contract. Contractor shall at the Owner's request, furnish satisfactory evidence that all obligations of nature hereinabove designated have been paid, discharged, or waived. If Contractor fails to do so, then the Owner may, after having served written notice on said Contractor either pay unpaid bills, of which the Owner has written notice, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged, whereupon payment to Contractor shall be resumed in accordance with the terms of this Contract, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to the Contractor or the Surety. In paying any unpaid bills of the Contractor, the Owner shall be deemed the agent of Contractor and any payment so made by the Owner shall be considered as payment made under the Contract by the Owner to Contractor, and the Owner shall not be liable to Contractor for any such payment made in good faith.

14.3. REVIEW OF APPLICATIONS FOR PROGRESS PAYMENTS

The Owner's Representative will within twenty (20) business days after receipt authorize and process payment by the Owner a properly submitted and documented Application for payment unless the application requires review by an Agent. If the Application for payment requires review and approval by an Agent, properly submitted and documented Applications for payment will be paid by the Owner within twenty-five (25) business days. If an Application for payment is rejected, notice shall be given within twenty (20) business days of receipt indicating the reasons for refusing payment. The reasons for rejecting an Application will be submitted in writing, specifying deficiencies, and identifying actions that would make the Application proper. In the latter case, Contractor may make the necessary corrections and resubmit the Application. The Owner's Representative or Agent may refuse to recommend the whole or any part of any payment to Owner. Owner's Representative or Agent may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or test, nullify any such payment previously recommended, to such extent as may be necessary in Owner Representative's or Agent's opinion to protect the Owner from loss because: (i) the Work is defective, or completed Work has been damaged requiring correction or replacement, (ii) the Contract Price has been reduced by amendment or Change Order, (iii) the Owner has been required to correct defective Work or complete Work, or (iv) Owner's Representative or Agent has actual knowledge of the occurrence of any of the events enumerated in the article on Suspension of Work and Termination.

The Owner may refuse to make payment of the full amount recommended by the Owner's Representative or Agent because: (i) claims have been made against the Owner on account of Contractor's performance or furnishing of the Work, (ii) Liens have been filed in connection with the Work, except where Contractor has delivered a specific Bond satisfactory to the Owner to

secure the satisfaction and discharge of such Liens, (iii) there are other items entitling the Owner to a set-off against the amount recommended, or (iv) the Owner has actual knowledge of any of the events described in this paragraph. The Owner shall give Contractor notice of refusal to pay in accordance with the time constraints of this section with a copy to the Owner's Representative or Agent, stating the reasons for such actions, and Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by the Owner and Contractor, when Contractor corrects to the Owner's satisfaction the reasons for such action.

14.4. PARTIAL UTILIZATION

Use by the Owner at the Owner's option of any substantially completed part of the Work which (i) has specifically been identified in the Contract Documents, or (ii) Owner, Engineer, Owner's Representative, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by the Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, may be accomplished prior to Final Completion of all the Work subject to the following:

The Owner at any time may request Contractor in writing to permit the Owner to use any such part of the Work which the Owner believes to be ready for its intended use and substantially complete. If Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner, Owner's Representative, and Engineer that such part of the Work is substantially complete and request Owner's Representative to issue a certificate of Substantial Completion for that part of the Work. Contractor at any time may notify Owner, Owner's Representative, and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Owner's Representative to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, Owner, Contractor, Owner's Representative, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner, Owner's Representative, and Contractor in writing giving the reasons, therefore. If Engineer considers that part of the Work to be substantially complete, the provisions of the articles for Substantial Completion and Partial Utilization will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

14.5. FINAL INSPECTION

Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Owner's Representative will make a final inspection with Engineer, Owner and Contractor and will within thirty (30) days notify Contractor in writing of particulars in which this inspection reveals that the Work is incomplete or defective. The Owner's Representative will produce a final punch list, deliver it to the Contractor within five (5) days of completion and assign a date for this work to be completed not less than thirty (30) days from delivery of the list. Failure to include any corrective work or pending items does not alter the responsibility of the Contractor to complete all the construction services purchased pursuant to the contract. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.6. FINAL APPLICATION FOR PAYMENT

After Contractor has completed all such corrections to the satisfaction of Owner's Representative and has delivered in accordance with the Contract Documents all maintenance and operating instructions, As-Built, schedules, guarantees, Bonds, certificates or other evidence of insurance

required by the paragraph for Bonds and Insurance, certificates of inspection, Inspector overtime reimbursement as required in the Contract Documents and other documents, Contractor may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by paragraph for Bonds and Insurance, and (ii) executed consent of the surety to final payment using the form contained in Section V of the Contract Documents.

Prior to application for final payment, Contractor shall clean and remove from the premises all surplus and discarded materials, rubbish, and temporary structures, and shall restore in an acceptable manner all property, both public and private, which has been damaged during the prosecution of the Work and shall leave the Work in a neat and presentable condition.

14.7. FINAL PAYMENT AND ACCEPTANCE

If through no fault of Contractor, final completion of the Work is significantly delayed and if Owner's Representative so confirms, the Owner shall, upon receipt of Contractor's final Application for payment and recommendation of Owner's Representative, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by the Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph for Bonds and Insurance, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Owner's Representative with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that such payment shall not constitute a waiver of claims.

If on the basis of Owner Representative's observation of the Work during construction and final inspection, and Owner Representative's review of the final Application for Payment and accompanying documentation, all as required by the Contract Documents, Owner's Representative is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Owner's Representative will indicate in writing his recommendation of payment and present the Application to Owner for payment. Thereupon, Owner's Representative will give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of this article. Otherwise, Owner's Representative will return the Application to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application. If the Application and accompanying documentation are appropriate as to form and substance, the Owner shall, within twenty (20) days after receipt thereof pay Contractor the amount recommended by Owner's Representative.

14.8. WAIVER OF CLAIMS

The making and acceptance of final payment will constitute: a waiver of all claims by the Owner against Contractor, except claims arising from unsettled Liens, from defective Work appearing after final inspection, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and a waiver of all claims by Contractor against the Owner other than those previously made in writing and still unsettled.

15. SUSPENSION OF WORK AND TERMINATION

15.1. OWNER MAY SUSPEND THE WORK

At any time and without cause, Owner's Representative may suspend the Work or any portion thereof for a period of not more than ninety (90) days by notice in writing to Contractor, which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes an approved claim therefore as provided in the articles for Change of Contract Price and Change of Contract Time.

15.2. OWNER MAY TERMINATE

Upon the occurrence of any one or more of the following events:

- Contractor persistently fails to perform the work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule as adjusted from time to time);
- Contractor disregards Laws and Regulations of any public body having jurisdiction;
- Contractor violates Article 6.7.1 of this Section III;
- Contractor disregards the authority of Owner's Representative;
- Contractor otherwise violates in any substantial way any provisions of the Contract Documents; or if the Work to be done under this Contract is abandoned, or if this Contract or any part thereof is sublet, without the previous written consent of the Owner, or if the Contract or any claim thereunder is assigned by Contractor otherwise than as herein specified, or at any time Owner's Representative certifies in writing to the Owner that the rate of progress of the Work or any part thereof is unsatisfactory or that the work or any part thereof is unnecessarily or unreasonably delayed;
- Lack of funding. The City's performance and obligation to pay under this Contract is contingent upon an annual appropriation by the Clearwater City Council.

The Owner may, after giving Contractor (and the surety, if any), seven days' written notice and, to the extent permitted by Laws and Regulations, terminate the services of Contractor, exclude Contractor from the site and take possession of the Work and of all Contractor's tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which the Owner has paid Contractor but which are stored elsewhere, and finish the Work as the Owner may deem expedient. In such case Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages sustained by the Owner arising out of or resulting from completing the Work such excess will be paid to Contractor.

If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to the Owner. Such claims, costs, losses and damages incurred by the Owner will be reviewed by Owner's Representative as to their reasonableness and when so approved by Owner's Representative incorporated in a Change Order, provided that when exercising any rights or remedies under this paragraph the Owner shall not be required to obtain the lowest price for the Work performed.

Where Contractor's services have been so terminated by the Owner, the termination will not affect any rights or remedies of the Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by the Owner will not release Contractor from liability.

Upon seven (7) days' written notice to Contractor and Owner's Representative, the Owner may, without cause and without prejudice to any other right or remedy of the Owner, elect to terminate the Agreement. In such case, Contractor shall be paid (without duplication of any items):

- for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
- for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
- for all claims, costs, losses and damages incurred in settlement of terminated contracts with Subcontractors, Suppliers and others;
- and for reasonable expenses directly attributable to termination.

Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.3. CONTRACTOR MAY STOP WORK OR TERMINATE

If, through no act or fault of Contractor, the Work is suspended for a period of more than ninety (90) days by the Owner or under an order of court or other public authority, or the Owner's Representative fails to act on any Application for Payment within thirty (30) days after it is submitted or the Owner fails for thirty (30) days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven (7) days' written notice to the Owner and Owner's Representative, and provided the Owner or Owner's Representative does not remedy such suspension or failure within that time, terminate the Agreement and recover from the Owner payment on the same terms as provided in the article for the Owner May Terminate. However, if the Work is suspended under an order of court through no fault of Owner, the Contractor shall not be entitled to payment except as the Court may direct. In lieu of terminating the Agreement and without prejudice to any other right or remedy, if Owner's Representative has failed to act on an Application for Payment within thirty (30) days after it is submitted, or the Owner has failed for thirty (30) days to pay Contractor any sum finally determined to be due, Contractor may upon seven (7) days' written notice to the Owner and Owner's Representative stop the Work until payment of all such amounts due Contractor. The provisions of this article are not intended to preclude Contractor from making claim under paragraphs for Change of Contract Price or Change of Contract Time or otherwise for expenses or damage directly attributable to Contractor's stopping Work as permitted by this article.

16. DISPUTE RESOLUTION

If and to the extent that the Owner and Contractor have agreed on the method and procedure for resolving disputes between them that may arise under this Agreement, such dispute resolution method and procedure will proceed. If no such agreement on the method and procedure for resolving such disputes has been reached, subject to the provisions of the article for Decisions on Disputes, the Owner and Contractor may exercise such rights or remedies as either may otherwise

have under the Contract Documents or by Laws or Regulations in respect of any dispute provided, however, that nothing herein shall require a dispute to be submitted to binding arbitration.

17. MISCELLANEOUS

17.1. SUBMITTAL AND DOCUMENT FORMS

The form of all submittals, notices, change orders, pay applications, logs, schedules and other documents permitted or required to be used or transmitted under the Contract Documents shall be determined by the Owner's Representative subject to the approval of Owner.

17.2. GIVING NOTICE

Whenever any provision of the Contract Documents requires the giving of written notice, notice will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.3. NOTICE OF CLAIM

Should the Owner or Contractor suffer injury or damage to person or property because of any error, omission or any act of the other party or of any of the other party's officers, employees or agents or others for whose acts the other party is legally liable, claim will be made in writing to the other party within a reasonable time of the first observance of such injury or damage. The provisions of this paragraph shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose.

17.4. PROFESSIONAL FEES AND COURT COSTS INCLUDED

Whenever reference is made to "claims, costs, losses and damages," the phrase shall include in each case, but not be limited to, all fees and charges of engineers, architects, attorneys and other professionals and all court or other dispute resolution costs.

17.5. ASSIGNMENT OF CONTRACT

The Contractor shall not assign this contract or any part thereof or any rights thereunder without the approval of Owner, nor without the consent of surety unless the surety has waived its rights to notice of assignment.

17.6. RENEWAL OPTION

Annual Contracts issued through the Engineering Department may be renewed for up to three (3) years, upon mutual consent of both the Owner and the Contractor/Vendor. All terms, conditions and unit prices shall remain constant unless otherwise specified in the contract specifications or in the Invitation to bid. Renewals shall be made at the sole discretion of the Owner and must be agreed to in writing by both parties. All renewals are contingent upon the availability of funds, and the satisfactory performance of the Contractor as determined by the Construction Department.

17.7. ROLL-OFF CONTAINERS AND/OR DUMPSTERS

All City construction projects shall utilize City of Clearwater Solid Waste roll-off containers and/or dumpsters for their disposal and hauling needs. For availability or pricing contact City of Clearwater, Solid Waste Department, by phone: (727) 562-4929.

18. ORDER AND LOCATION OF THE WORK

The City reserves the right to accept and use any portion of the work whenever it is considered to the public interest to do so. The Engineer shall have the power to direct on what line or street the Contractor shall work and order thereof.

19. MATERIAL USED

All material incorporated into the final work shall be new material unless otherwise approved by the Engineer. If requested by the Engineer, the Contractor shall furnish purchase receipts of all materials.

20. CONFLICT BETWEEN PLANS AND SPECIFICATIONS

The various Contract Documents shall be given precedence, in case of conflict, error or discrepancy, as follows: Modifications, Contract Agreement, Addenda, Supplementary General Conditions, General Conditions, Supplementary Technical Specifications and Technical Specifications. In a series of Modifications or Addenda the latest will govern. In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality, more stringent or greater quantity of Work shall be provided in accordance with the Engineer/Architect's interpretation.

21. OWNER DIRECT PURCHASE (ODP)

21.1. SALES TAX SAVINGS

The Owner reserves the right to purchase certain portions of the materials or equipment for the Project directly in order to save applicable sales tax in compliance with Florida Law since owner is exempt from the payment of sales tax. The contract price includes Florida sales and other applicable taxes for materials, supplies, and equipment which will be a part of the Contractor's Work. Owner-purchasing of construction materials or equipment, if selected, will be administered on a deductive Change Order basis. The contract price shall be reduced by the actual cost of the materials or equipment purchased by owner plus the normally applicable sales tax, even if the actual cost is in excess of the cost for the materials or equipment as-bid by the Contractor. For purposes of calculating Engineering Fees, Contractor Fees, Architects' Fees, and any other amounts that are based on the contract amount, however, the original, as-bid contract amount shall be used.

Direct purchase shall be considered for single items or materials that exceed \$10,000 in value and/or items identified in Section V, Bidders Proposal. The Contractor shall provide the Owner an ODP Summary of all intended suppliers, vendors, equipment, and materials for consideration as ODP materials or equipment (refer to ODP Instructions in Contract Appendix).

21.2. TITLE AND OWNER RISK

Owner will issue Purchase Orders and provide a copy of Owner's Florida Consumer Certification of Tax Exemption and Certificate of Entitlement directly to the Vendor for ODP materials or equipment. Invoices for ODP materials or equipment shall be issued to the Owner, and a copy sent to the Contractor.

Notwithstanding the transfer of ODP materials or equipment by the Owner to the Contractor's possession, the Owner shall retain legal and equitable title to any and all ODP materials or equipment; therefore, the owner assumes the risk of damage or loss at the time of purchase or delivery of items, unless material is damaged as the result of negligence by the Contractor.

21.3. CONTRACTOR'S RECEIPT OF MATERIALS

The Contractor shall be fully responsible for all matters relating to the receipt of materials or equipment furnished to the Owner including, but not limited to, verifying correct quantities, verifying documents of orders in a timely manner, coordinating purchases, providing and obtaining all warranties and guarantees required by the Contract Documents, and inspection and acceptance of the goods at the time of delivery. The Owner shall coordinate with Contractor and Vendor delivery schedules, sequence of delivery, loading orientation, and other arrangements normally required by the Contractor for the particular materials or equipment furnished. The Contractor shall provide all services required for the unloading and handling of materials or equipment. The Contractor agrees to indemnify and hold harmless the Owner from any and all claims of whatever nature resulting from non-payment of goods to suppliers arising from the action of the Contractor.

As ODP materials or equipment are delivered to the job site, the Contractor shall visually inspect all shipments from the suppliers and approve the vendor's invoice for items delivered. The Contractor shall assure that each delivery of ODP materials or equipment is accompanied by documentation adequate to identify the Purchase Order against which the purchase is made. This documentation may consist of a delivery ticket and/or an invoice from the supplier conforming to the Purchase Order together with such additional information as the Owner may require. The Contractor will then forward an electronic copy of the invoice and supporting documentation to the Owner for payment within fourteen (14) calendar days of receipt of said goods or materials. Such payment shall be directly from public funds, from Owner to Vendor.

The Contractor shall insure that ODP materials or equipment conform to the Specifications and determine prior to acceptance of goods at time of delivery if such materials or equipment are patently defective, and whether such materials or equipment are identical to the materials or equipment ordered and match the description on the bill of lading. If the Contractor discovers defective or non-conformities in ODP materials or equipment upon such visual inspection, the Contractor shall not utilize such nonconforming or defective materials or equipment in the Contractor's Work and instead shall properly notify the Owner of the defective or nonconforming condition so that repair or replacement of those materials or equipment can occur without undue delay or interruption to the Project. If the Contractor fails to perform such inspection and otherwise incorporates into the Contractor's Work such defective or nonconforming ODP materials or equipment, the condition of which it either knew or should have known by performance of an inspection, Contractor shall be responsible for all damages to the Owner, resulting from Contractor's incorporation of such materials or equipment into the Project, including liquidated damages.

21.4. ODP RECORDS, WARRANTIES, AND INDEMNIFICATION

The Contractor shall maintain records of all ODP materials or equipment it incorporates into Contractor's Work from the stock of ODP materials or equipment in its possession. The Contractor shall account monthly to the Owner for any ODP materials or equipment delivered into the Contractor's possession, indicating portions of all such materials or equipment which have been incorporated in the Contractor's Work.

The Contractor shall be responsible for obtaining and managing all warranties and guarantees for all materials, equipment and products as required by the Contract Documents. All repair, maintenance, or damage-repair calls shall be forwarded to the Contractor for resolution with the appropriate supplier, vendor, or Subcontractor.

The Owner shall indemnify and hold Contractor harmless from any sales tax (and interest and penalties incurred in connection therewith) in the event there is a final determination that purchases made by Owner, which Owner treats as being exempt from sales tax, are subject to sales tax. "Final determination" shall mean an assessment by the Department of Revenue that is no longer subject to protest, or a determination of a court having jurisdiction over such matters that is final and not subject to appeal. Contractor agrees to promptly notify owner of any audit, assessment, proposed assessment or notice of deficiency issued with regard to the Project and relating to ODP materials or equipment. ODP Purchase Orders must be closed out prior to closing out the contract/Contractor Purchase Order. If material costs needed for project exceed the ODP Purchase Order amount, the ODP Purchase Order will not be increased. Amounts in excess of the ODP Purchase Order will be paid for by the Contractor.

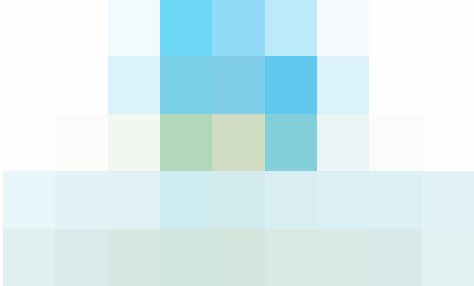
22. RESIDENT NOTIFICATION OF START OF CONSTRUCTION

22.1. GENERAL

The Contractor shall notify all residents along the construction route or within a 500-foot radius, unless stated otherwise in the Contract Documents, with a printed door hanger notice indicating the following information about the proposed construction work and the Contractor performing the work: City seal or logo; the scheduled date for the start of construction; the type of construction; general sequence and scheduling of construction events; possibility of water service disruption and/or colored water due to construction efforts; Contractor's name, the Superintendent's name, Contractor address and telephone number; Contractor's company logo (optional); requirement for residents to remove landscaping and/or other private appurtenances which are in conflict with the proposed construction; and other language as appropriate to the scope of Contract work. Sample door hanger including proposed language shall be approved by the City prior to the start of construction. Notification shall be printed on brightly colored and durable card stock and shall be a minimum of 4-1/4 by 11 inches in size. Notification (door hanger) shall be posted to residences and businesses directly affected by the Contractor's activities no later than seven (7) days prior to the start of construction activity. Directly affected by the Contractor's activities shall mean all Contractor operations including staging areas, equipment and material storage, principal access routes across private property, etc. Contractor cannot start without proper seven (7) day notice period to residents. Contractor is required to maintain sufficient staff to answer citizen inquiries during normal business hours and to maintain appropriate message recording equipment to receive citizen inquires after business hours.

Resident notification by the Contractor is a non-specific pay item to be included in the bid items provided in the contract proposal.

22.2. EXAMPLE



NOTICE OF CONSTRUCTION
 TODAY'S DATE: ___ / ___ / ___
PLEASE EXCUSE US FOR ANY INCONVENIENCE

We are the construction contractor performing the *(state project name)* for the City of Clearwater in your area. The work will be performed in the public right-of-way adjacent to your property. This notice is placed a minimum of seven (7) days in advance of construction to notify property owners of the pending start of construction.

(Brief description of the construction process to be expected by the property owners)

The construction process may necessitate the removal of certain items from the right-of-way. Typical items such as sprinklers, grass, and postal approved mailboxes will be replaced by the contractor within a reasonably short period of time. The replacement of driveways and sidewalks will be made using standard asphalt or concrete materials. The property owner is responsible for the expense and coordination to replace driveways and sidewalks which have customized colors, textures and/or materials. Small trees, shrubs, landscaping materials, unauthorized mailboxes or structures within the right-of-way which must be removed due to the construction process will not be replaced. The property owner is responsible to relocate any such items which the property owner wishes to save prior to the start of construction. Vehicles parked on the streets or within the right-of-way may be required to be placed elsewhere.

We are available to answer any questions you may have regarding the construction process or any particular item that must be relocated. Please contact our Construction Manager _____ at (727) _____. We will be more than happy to assist you.

Construction is anticipated to begin on: _____.

Company Name
Company Address
Contractor Phone Number

23. PROJECT INFORMATION SIGNS

23.1. SCOPE AND PURPOSE

The Owner desires to inform the general public on the Owner's use and expenditure of public funding for general capital improvement and maintenance projects. To help accomplish this purpose, the Contractor is required to prepare and display public project information signs during the full course of the contract period. These signs will be displayed at all location(s) of active work. Payment to Contractor for the preparation, installation and management of project sign(s) shall be

included in the cost of the work. The number of and type of signs will be stated in SECTION IV, SCOPE OF WORK.

23.2. PROJECT SIGN, FIXED OR PORTABLE

Sign type shall be "fixed" on stationary projects and "portable" on projects which have extended locations or various locations. The particular wording to be used on the signs will be determined after contract award has been approved. Contractor will be provided the wording to be used on sign at the preconstruction conference.

23.3. FIXED SIGN

Fixed sign shall be 4-foot by 6-foot (4'x6') in size. Sign material shall be Aluminum DIBOND or exterior grade plywood with a minimum thickness of 1/2-inches painted white on both sides with exterior rated paint. Sign shall be attached to a minimum of two (2) 4-inch by 4-inch (3½"x3½") below grade pressure treated (P.T.) wooden posts and braced as necessary for high winds. Posts shall be long enough to provide secure anchoring in the ground. Bottom of sign must be a minimum of 24-inches above the ground. Alternate mounting system or attachment to fencing or other fixed structure can be considered for approval.

23.4. PORTABLE SIGNS

Portable sign shall be a minimum of 24-inches by 30-inches (24"x30") in size and will be attached to a standard sized portable traffic barricade. Sign material shall be aluminum, 0.080-inches or thicker, background of white reflective sheeting, and shall be silkscreen or vinyl lettering. Portable sign shall be two signs located and attached to each side of the traffic barricade.

23.5. SIGN COLORING

Background shall be white. Project Descriptive Name shall be in blue lettering. All other lettering shall be black. Basic lettering on sign shall be in all capital letters, of size proportional to the sign itself. Each sign shall depict the City's logo. The Project Manager/City Representative shall provide the appropriate electronic logo file(s) to the Contractor.

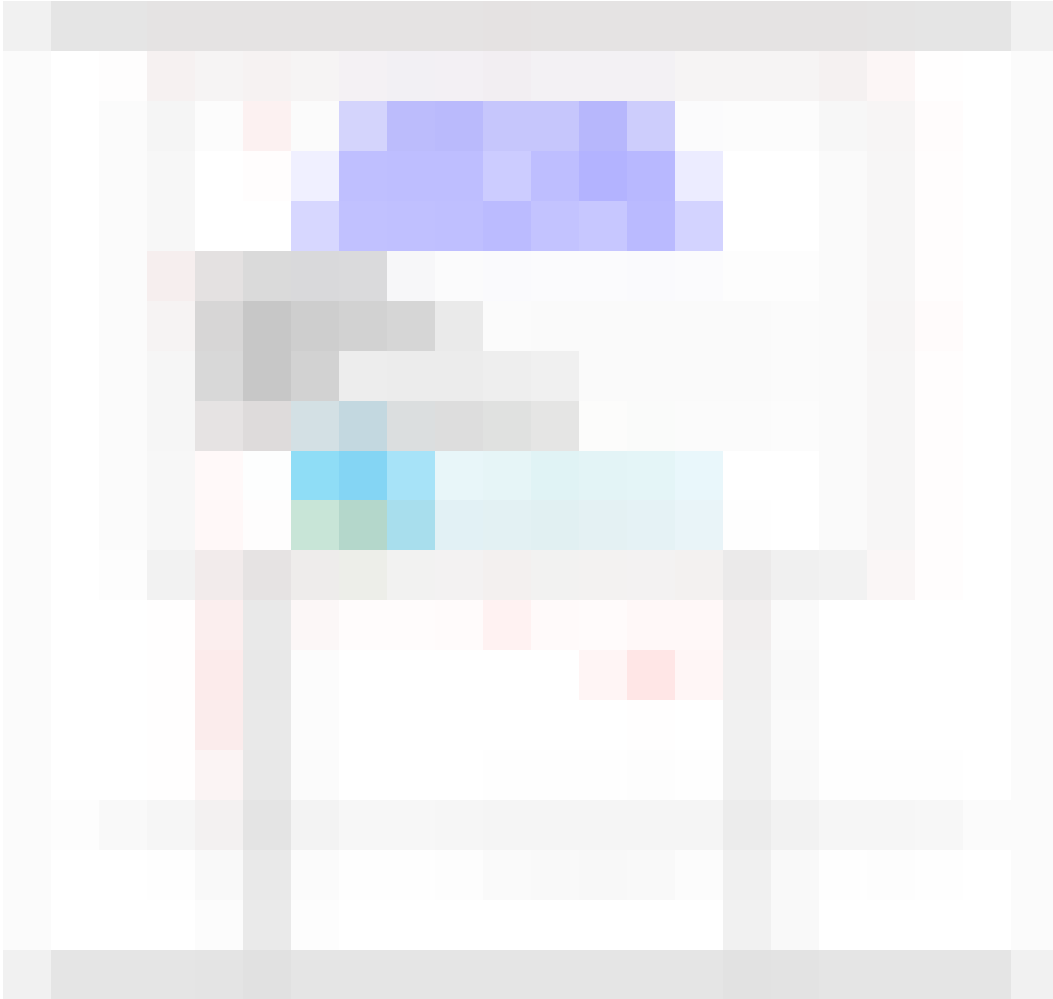
23.6. SIGN PLACEMENT

Signs shall be placed where they are readily visible by the general public which pass by the project site. Signs are not to be placed where they may become a hazard or impediment to either pedestrian or vehicular traffic. For construction projects outside of the Owner's right-of-way, the signs will be placed on the project site. For projects constructed inside of the Owner's right-of-way, the signs will be placed in the right-of-way. Portable signs are to be moved to the locations of active work on the project. Multiple portable signs will be necessary where work is ongoing in several locations at the same time. Fixed signs are to be placed at the start of construction and will remain in place until the request for final payment.

23.7. SIGN MAINTENANCE

The Contractor is responsible for preparation, installation, movement, maintenance, replacement, removal, and disposal of all project signs during the full course of the contract period. The Contractor will place and secure portable signs from dislocation by wind or other actions. Signs are to be cleaned as necessary to maintain legibility and immediately replaced if defaced.

23.8. TYPICAL PROJECT SIGN



Project Sign Details:

Font Type: Franklin Gothic Medium, (ALL CAPS)
Font Colors: Blue - Pantone 3015 and Black.

24. AWARD OF CONTRACT, WORK SCHEDULE AND GUARANTEE

It will be required that the work will commence not later than five (5) calendar days after the Engineer gives written Notice to Proceed (NTP), which notice shall be given as outlined in Article 2 of these General Conditions.

It is further required that all work within this contract be completed within the indicated number of consecutive calendar days as determined in Section IV, Scope of Work. Contract Time to commence at start date noted on the Notice to Proceed. If the Contractor fails to complete the work within the stipulated time, the City will retain the amount stated in the Contract, per calendar day, for each day that the contract remains incomplete. The work shall be discontinued on Saturdays, Sundays, and approved Holidays. If it becomes necessary for the Contractor to perform work on Saturdays, Sundays, and approved City of Clearwater Employee Holidays, that in the opinion of the Engineer, will require the presence of Inspectors, the Contractor shall pay the City of

Clearwater, Florida, the amount of Four Hundred Eighty Dollars (\$480.00) per each eight-hour (8) day for each Inspector given such assignment.

The Contractor shall remedy any defects in the work at his own expense and pay for any damage to other work resulting therefrom which appear within a period of one (1) year from the date of final acceptance.

25. SCRUTINIZED COMPANIES AND BUSINESS OPERATIONS WITH CUBA AND SYRIA CERTIFICATION FORM AND ISRAEL CERTIFICATION FORM

Pursuant to Section 287.135, Florida Statutes, any vendor, company, individual, principal, subsidiary, affiliate, or owner on the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, or is engaged in business operations in Cuba or Syria, is ineligible for, and may not bid on, submit a proposal for, or enter into or renew a contract with the City of Clearwater for goods or services for an amount equal to or greater than one million (\$1,000,000.00) dollars. Any vendor, company, individual, principal, subsidiary, affiliate, or owner on the Scrutinized Companies that Boycott Israel List, or is engaged in a boycott of Israel, is ineligible for, and may not bid on, submit a proposal for, or enter into or renew a contract with the City of Clearwater for goods or services for ANY amount.

Each entity submitting a bid, proposal, or response to a solicitation must certify to the City of Clearwater that it is not on the aforementioned lists, or engaged in business operations in Cuba or Syria, or engaged in a boycott of Israel at the time of submitting a bid, proposal or response, in accordance with Section 287.135, Florida Statutes. Business Operations means, for purposes specifically related to Cuba or Syria, engaging in commerce in any form in Cuba or Syria, including, but not limited to, acquiring, developing, maintaining, owning, selling, possessing, leasing or operating equipment, facilities, personnel, products, services, personal property, real property, military equipment, or any other apparatus of business or commerce. Boycott Israel or boycott of Israel means refusing to deal, terminating business activities, or taking other actions to limit commercial relations with Israel, or persons or entities doing business in Israel or in Israeli-controlled territories, in a discriminatory manner. A statement by a company that it is participating in a boycott of Israel, or that it has initiated a boycott in response to a request for a boycott of Israel or in compliance with, or in furtherance of, calls for a boycott of Israel, may be considered as evidence that a company is participating in a boycott of Israel.

The certification forms (the Certification) are attached hereto, and must be submitted, along with all other relevant contract documents, at the time of submitting a bid, proposal, or response. Failure to provide the Certification may deem the entity's submittal non-responsive. If the City of Clearwater determines that an entity has submitted a false certification form, been placed on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List or the Scrutinized Companies that Boycott Israel List, or engaged in business operations in Cuba or Syria, or engaged in a boycott of Israel, then the contract may be terminated at the option of the City of Clearwater. Other than the submission of a false certification, the City of Clearwater, on a case-by-case basis and in its sole discretion, may allow a company to bid on, submit a proposal for, or enter into or renew a contract for goods or services, if the conditions set forth in Section 287.135, Florida Statutes, apply.

The City retains the right to pursue civil penalties and any other applicable rights and remedies as provided by law for the false submission of the attached certification forms.

See Section V of the Contract for Certification Forms to be executed and submitted with the Bid/Proposal Form.

SECTION IIIA

SUPPLEMENTAL GENERAL CONDITIONS

These Supplemental General Conditions amend or supplement the General Conditions of the Construction Contract and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplementary remain in full force and effect. The terms used in these Supplemental General Conditions have the meanings stated in the General Conditions.

1. In Paragraph 1 Definitions, delete the definition for Contract Time in its entirety and insert the following in its place:

Contract Time - The number of days or the dates stated in the Contract to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) achieve Final Completion.

2. In Paragraph 1 Definitions, add the following new paragraph:

Final Completion – The time at which the Work has progressed to the point where, in the opinion of the Engineer, the Work, including all “punch list” items, is fully and finally completed in a good and workmanlike manner, in accordance with the Contract Documents; is free of all defects and deficiencies; all required final governmental inspections and approvals have been obtained; and all final paperwork, including that necessary to prepare a Final Change Order (if required), has been submitted and approved.

3. Delete Paragraph 2.3 in its entirety and insert the following in its place:

COMMENCEMENT OF CONTRACT TIME/NOTICE TO PROCEED; STARTING THE PROJECT

The Contract Times will commence to run on the day indicated in the Notice to Proceed. The Contractor shall start to perform the Work on the date the Contract Time commences to run. No Work shall be done at the site prior to the date that the Contract Time commences to run. A Notice to Proceed may be issued at any time within 60 days after the Effective Date of the Agreement. A Notice to Proceed will not be issued prior to the Contractor providing the City a certified copy of the **recorded** payment and performance bond, pursuant to §255.05(1)(b), Florida Statutes.

4. In Paragraph 6.1, delete the last sentence in the 4th paragraph and insert the following in its place:

The cost of overtime inspection per hour shall be the City’s actual cost per hour, not to exceed \$120 per hour. When inspection is being provided by the Engineer or a consultant to the City, the cost of overtime inspection per hour shall be 3.0 times the Engineer’s or consultant’s direct technical labor cost.

5. In Paragraph 6.11.1, delete the first full sentence of the first paragraph and insert the following in its place:

Contractor shall submit Shop Drawings and Samples as called for in the Technical Specifications, and all other items specified to be submitted in the Division 1 specifications, to Engineer for review as called for in the Technical Specifications or required by the Engineer. Items required to be submitted in accordance with Division 1 shall be submitted in accordance with the requirements for Shop Drawings as specified in the General Requirements.

6. Delete the last paragraph in Paragraph 6.11.1 in its entirety and insert the following in its place:

Contractor shall furnish required submittals with complete information and accuracy. Owner reserves the right to backcharge Contractor for Engineer's actual direct technical labor cost times a 3.0 multiplier for the review of any first time submittals that account for a number greater than fifty (50), not to exceed \$400 each. Contractor may combine or group similar items into a single submittal, such as valves or valve O&M manuals, or may group submittals pertaining to a single item into a single submittal, such as a valve shop drawing and the corresponding O&M manual. Contractor shall not combine unrelated items into a single submittal, such as valves and concrete mix. Owner reserves the right to backcharge Contractor for Engineer's actual direct technical labor cost times a 3.0 multiplier for the review of any re-submittals, or submittals requiring confirmation, that account for a number greater than ten (10), not to exceed a cost of \$300 each. In the event that Contractor requests a substitution for a previously approved item, all of Engineer's costs in the reviewing and approval of the substitution will be backcharged to Contractor, unless the need for such substitution is beyond the control of Contractor. Said costs shall be Engineer's actual direct technical labor cost times a 3.0 multiplier, not to exceed \$400 each.

7. Delete Paragraph 24 in its entirety and insert the following in its place:

24 CONTRACT TIMES AND LIQUIDATED DAMAGES

24.1 Time is of the Essence

24.1.1 It is mutually agreed between the parties that time is of the essence. All Contract Time(s) for Milestones, if any, Substantial Completion, Final Completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

24.2 Substantial Completion

24.2.1 Contractor shall achieve Substantial Completion of the Work within 153 days from the date on which Owner issues Contractor a Notice to Proceed.

24.2.2 The term Substantial Completion means the time at which the Work has progressed to the point where, in the opinion of Engineer, the Work is otherwise sufficiently complete in accordance with the Contract Documents, so that the Work can be utilized for the purposes for which it is

intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

24.3 Final Completion

24.3.1 Contractor shall achieve Final Completion of the Work within 183 days from the date on which Owner issues Contractor a Notice to Proceed.

24.4 Liquidated Damages

24.4.1 Contractor and Owner recognize that time is of the essence of this Contract and that Owner will suffer financial loss if the Work is not completed within the times specified herein, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay as follows:

24.4.2 In the event Contractor fails to achieve Substantial Completion of the Work within the time specified above, Contractor shall be required to pay Owner the sum as specified in the Contract per day for each and every calendar day elapsing after the time specified above, until the Contractor has achieved Substantial Completion.

24.4.3 In the event Contractor fails to achieve Final Completion of the Work within the time specified above, the Owner shall also have the right to:

- A. Terminate the Contractor without further notice;
- B. Complete any of the remaining items and backcharge Contractor for all costs incurred, and exercise all other rights and remedies available at law or in equity.

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100 SERIES: GENERAL

101. SCOPE OF WORK

Project Name: East WTF Influent Pump Station Rehabilitation Project

Project Number: 13-0016-UT

Scope of Work:

The scope of work includes the following: demolition and disposal of the existing odor control scrubber tower; demolition and disposal of the influent pumps and piping assembly; the installation of new bypass manhole; the installation of the new influent pumps and pipe assembly; the replacement of the existing influent flow meter assembly; the application of new coating inside the wet well and bypass manhole; the installation of a new large bubble mixing system and a new spray cleaning system; the installation of new electrical equipment; and the operation of temporary bypass pumping during construction.

The Contractor shall provide copies of a current Contractor License/Registration with the state of Florida and Pinellas County in the bid response.

The Contractor shall provide (1) fixed project signs as described in Section III, Section 23 of the Contract Documents. The final number of project signs will be determined at the beginning of the project based on the Contractor's schedule of work submitted for approval. Additional project signs may be required at no additional cost to the city due to the Contractor's schedule of work.

Contract Period: 480 Consecutive Calendar Days

102. FIELD ENGINEERING

102-1. LINE AND GRADE PERFORMED BY THE CONTRACTOR

Unless otherwise specified, the Contractor shall provide and pay for field engineering service required for the project. Such work shall include survey work to establish lines and levels and to locate and lay out site improvements, structures, and controlling lines and levels required for the construction of the work. Also included are such Engineering services as are specified or required to execute the Contractor's construction methods. Engineers and Surveyors shall be licensed professionals under the laws of the State of Florida. The Contractor shall provide three (3) complete sets of As-Built Surveys to the Engineer prior to final payment being made as outlined in Section III (General Conditions), Section 6.11.2 of these Contract Documents.

102-1.1. GRADES, LINES AND LEVELS

Existing basic horizontal and vertical control points for the project are those designated on the Drawings or provided by the city. Control points (for alignment only) shall be established by the Engineer. The Contractor shall locate and protect control points prior to starting site work and shall preserve all permanent reference points during construction. In working near any permanent property corners or reference markers, the Contractor shall use care not to remove or disturb any such markers. In the event that markers must be

removed or are disturbed due to the proximity of construction work, the Contractor shall have them referenced and reset by a Professional Land Surveyor licensed in the State of Florida.

102-1.2. LAYOUT DATA

The Contractor shall layout the work at the location and to the lines and grades shown on the Drawings. Survey notes indicating the information and measurements used in establishing locations and grades shall be kept in notebooks and furnished to the Engineer with the record drawings for the project.

102-2. LINE AND GRADE PERFORMED BY THE CITY

If line and grade is supplied by the city, at the completion of all work the Contractor shall be responsible to have furnished to the project inspector a replacement of the wooden lath and stakes used in the construction of this project. Excessive stake replacement caused by negligence of Contractor's forces, after initial line and grade have been set, as determined by the City Engineer, will be charged to the Contractor at the rate of \$200.00 per hour. Time shall be computed for actual time on the project. All time shall be computed in one-hour increments. Minimum charge is \$200.00. The Contractor shall provide three (3) complete sets of As-built Surveys to the Engineer prior to final payment being made as outlined in Section III (General Conditions), Section 6.11.2 of these Contract Documents.

103. DEFINITION OF TERMS

For the Purpose of these Technical Specifications, the Definition of Terms from *Section III, Article 1 – Definitions* of these Contract Documents shall apply.

For the purpose of the Estimated Quantities, the Contractor's attention is called to the fact that the estimate of quantities as shown on the Proposal is approximate and is given only as a basis of calculation upon which the award of the contract is to be made. The city does not assume any responsibility that the final quantities will remain in strict accordance with estimated quantities nor shall the Contractor plead misunderstandings or deception because of such estimate of quantities or of the character or location of the work or of other conditions or situations pertaining thereto.

The basis of payment for work and materials will be the actual amount of work done and materials furnished. Contractor agrees that they will make no claim for damages, anticipated profits, or otherwise on account of any difference between the amounts of work performed and materials actually furnished and the estimated amounts thereof.

103-1. REFERENCE STANDARDS

Reference to the standards of any technical society, organization, or associate, or to codes of local or state authorities, shall mean the latest standard, code, specification, or tentative standard adopted and published at the date of receipt of bids, unless specifically stated otherwise.

The most stringent specification prevails in the case where more than one specification is referenced for the same task.

Contractor shall utilize applicable Florida Department of Transportation (FDOT) Standards and Specifications for tasks that are not covered by city's Standards and Specifications.

104. STREET CROSSINGS, ETC.

At such crossings, and other points as may be directed by the Engineer, trenches shall be bridged in an open and secure manner, so as to prevent any serious interruption of travel upon the roadway or sidewalk, and also to afford necessary access to public or private premises. The material used, and the mode of constructing said bridges, and the approaches, thereto, must be satisfactory to the Engineer.

The cost of all such work must be included in the cost of the trench excavation.

105. AUDIO/VIDEO RECORDING OF WORK AREAS

105-1. CONTRACTOR TO PREPARE AUDIO/VIDEO RECORDING

Prior to commencing work, the Contractor shall have a continuous color audio/video recording taken along the entire length of the Project including all affected project areas. Streets, easements, rights-of-way, lots or construction sites within the Project must be recorded to serve as a record of pre-construction conditions.

105-2. SCHEDULING OF AUDIO/VIDEO RECORDING

The video recordings shall not be made more than twenty-one (21) days prior to construction in any area.

105-3. PROFESSIONAL VIDEOGRAPHERS

The Contractor shall engage the services of a professional videographer. The color audio/video recording shall be prepared by a responsible commercial firm known to be skilled and regularly engaged in the business of pre-construction color audio/video recording documentation. Use of drones must be in accordance with Federal Aviation Administration (FAA) regulations.

105-4. EQUIPMENT

All equipment, accessories, materials, and labor to perform this service shall be furnished by the Contractor. The total audio/video system shall reproduce bright, sharp, clear pictures with accurate colors and shall be free from distortion, tearing, rolls or any other form of imperfection. The audio portion of the recording shall reproduce the commentary of the camera operator with proper volume, clarity and be free from distortion and interruptions. In some instances, audio/video coverage may be required in areas not accessible by conventional wheeled vehicles. Such coverage shall be obtained by walking.

105-5. RECORDED AUDIO INFORMATION

Each recording shall begin with the current date, project name and be followed by the general location, i.e., viewing side and direction of progress. Accompanying the video recording of each video shall be a corresponding and simultaneously recorded audio recording. This audio recording, exclusively containing the commentary of the camera operator or aide, shall assist in viewer orientation and in any needed identification, differentiation, clarification, or objective description of the features being shown in the video portion of the recording. The audio recording shall also be free from any conversations.

105-6. RECORDED VIDEO INFORMATION

All video recordings must continuously display transparent digital information to include the date and time of recording. The date information shall contain the month, day, and year. The time information shall

contain the hour, minutes, and seconds. Additional information shall be displayed periodically. Such information shall include, but not be limited to, project name, contract number, direction of travel and the viewing side. This transparent information shall appear on the extreme upper left hand third of the screen. Camera pan, tilt, zoom-in and zoom out rates shall be sufficiently controlled such that recorded objects will be clearly viewed during video playback. In addition, all other camera and recording system controls, such as lens focus and aperture, video level, pedestal, chrome, white balance, and electrical focus shall be properly controlled or adjusted to maximize picture quality.

105-7. VIEWER ORIENTATION

The audio and video portions of the recording shall maintain viewer orientation. To this end, overall establishing views of all visible house and business addresses shall be utilized. In areas where the proposed construction location will not be readily apparent to the video viewer, highly visible yellow flags shall be placed by the Contractor in such a fashion as to clearly indicate the proposed centerline of construction. When conventional wheeled vehicles are used as conveyances for the recording system, the vertical distance between the camera lens and the ground shall not exceed ten feet (10'). The camera shall be firmly mounted such that transport of the camera during the recording process will not cause an unsteady picture.

105-8. LIGHTING

All recording shall be done during time of good visibility. No videoing shall be done during precipitation, mist, or fog. The recording shall only be done when sufficient light is present to properly illuminate the subjects of recording and to produce bright, sharp video recordings of those subjects.

105-9. SPEED OF TRAVEL

The average rate of travel during a particular segment of coverage shall be directly proportional to the number, size, and value of the surface features within the construction area's zone of influence. The rate of speed in the general direction of travel used during videoing shall not exceed forty-four (44) feet per minute.

105-10. VIDEO LOG/INDEX

All videos shall be permanently labeled and shall be properly identified by video number and project title. Each video shall have a log of that video's contents. The log shall describe the various segments of coverage contained on the video in terms of the names of the streets or location of easements, coverage beginning and end, directions of coverage, video unit counter numbers, engineering survey or coordinate values (if reasonably available) and the date.

105-11. AREA OF COVERAGE

Video coverage shall include all surface features located within the zone of influence of construction supported by appropriate audio coverage. Such coverage shall include, but not be limited to, existing driveways, sidewalks, curbs, pavements, drainage system features, mailboxes, landscaping, culverts, fences, signs, Contractor staging areas, adjacent structures, etc., within the area covered by the project. Of particular concern shall be the existence of any faults, fractures, or defects. Taped coverage shall be limited to one side of the Site, street, easement or right of way at any one time.

105-12. COSTS OF VIDEO SERVICES

The cost to complete the requirements under this section shall be included in the contract items provided in the proposal sheet. There is no separate pay item for this work.

106. STREET SIGNS

The removal, covering or relocation of street signs by the Contractor is prohibited.

All street signs shall be removed, covered, or relocated by the city’s Traffic Engineering Division in accordance with Sections 700, 994, 995, and 996 of FDOT’s Standard Specifications.

The Contractor shall notify the city’s Traffic Engineering Division a minimum of twenty-four (24) hours in advance of the proposed sign relocation, covering or removal.

107. WORK ZONE TRAFFIC CONTROL

107-1. CONTRACTOR RESPONSIBLE FOR WORK ZONE TRAFFIC CONTROL

The Contractor shall be responsible to furnish, operate, maintain and remove all work zone traffic control associated with the Project, including detours, advance warnings, channelization, hazard warnings and any other necessary features, both at the immediate work site and as may be necessary at outlying points.

107-2. WORK ZONE TRAFFIC CONTROL PLAN

The Contractor shall prepare a detailed traffic control plan designed to accomplish the level of performance outlined in the Scope of the Work and/or as may be required by construction permits issued by Pinellas County and/or the FDOT for the Project, incorporating the methods and criteria contained in Part VI, Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility and Incident Management Operations in the Manual on Uniform Traffic Control Devices published by the U.S. Department of Transportation and adopted as amended by the Florida Department of Transportation, or most recent addition. This plan shall be reviewed and approved by city Engineering Department Traffic Operations personnel regardless if Maintenance of Traffic (MOT) plan details are included in the contract plans.

107-2.1. WORK ZONE SAFETY

The general objectives of a program of work zone safety are to protect workers, pedestrians, bicyclists and motorists during construction and maintenance operations. This general objective may be achieved by meeting the following specific objectives:

- Provide adequate advance warning and information regarding upcoming work zones.
- Provide the driver clear directions to understanding the situation they will be facing as the driver proceeds through or around the work zone.
- Reduce the consequences of an out of control vehicle.
- Provide safe access and storage for equipment and material.
- Promote speedy completion of projects (including thorough cleanup of the site).
- Promote use of the appropriate traffic control and protection devices.
- Provide safe passageways for pedestrians through, in, and/or around construction or maintenance work zones.

“When an existing pedestrian way or bicycle way is located within a traffic control work zone, accommodation must be maintained and provision for the disabled must be provided. Only approved pedestrian longitudinal channelizing devices may be used to delineate a temporary traffic control zone pedestrian walkway. Advanced notification of sidewalk closures and marked detours shall be provided by

appropriate signs.” Per the 2014 FDOT Standard Specifications for Road and Bridge Construction or latest revision.

FDOT Design Standards (DS): 102-5 Traffic Control, 102-5.1 Standards, are the minimum standards for the use in the development of all traffic control plans (use the latest edition).

All traffic control plans must be submitted to the city Engineering Department, Traffic Operations Division for review and approval prior to installation. Contractor shall also provide notification to city Engineering, Traffic Operations Division a minimum of 72-hours in advance of mobilization. Approved MOT must always be on site and accessible to the city Project Manager and/ or Representative.

107-3. ROADWAY CLOSURE GUIDELINES

Roadway types: Major Arterials, Minor Arterials, Local Collectors, and Local

Following are typical requirements to be accomplished prior to closure. The number of requirements increases with traffic volume and the importance of access. Road closures affecting business or sole access routes will increase in process requirements as appropriate. For all but local streets, no road or lane closures are allowed without prior approval by the City Engineer or designated Representative (Engineering Traffic Operations Manager).

107-3.1. ALL ROADWAYS

Obtain permits for Pinellas County or Florida Department of Transportation roadways.

Traffic control devices conform to national and state standards.

107-3.1.1. PUBLIC NOTIFICATION

Standard property owner notification prior to start of construction for properties directly affected by the construction process.

107-3.2. MAJOR ARTERIALS, MINOR ARTERIALS, LOCAL COLLECTORS

Consult with city Engineering Traffic Operations Division staff for preliminary traffic control options.

Develop Formal Traffic Control Plan for Permit Submittal to Regulatory Agency as necessary.

107-3.2.1. PUBLIC NOTIFICATION

Message Board Display, Minimum of seven (7) day notice period prior to road closure and potentially longer for larger highway. The message board is to be provided by the Contractor.

107-3.3. MAJOR ARTERIALS, MINOR ARTERIALS

107-3.3.1. PUBLIC NOTIFICATION

Releases can be issued as PowerPoint Presentation for C-View System utilizing television monitors.

107-3.4. MAJOR ARTERIALS

107-3.4.1. PUBLIC NOTIFICATION

News Releases shall be issued by the city Public Communication Department. The Message Board may need to be displayed for a period longer than seven (7) days.

107-4. APPROVAL OF WORK ZONE TRAFFIC CONTROL PLAN

The Contractor is invited and encouraged to confer in advance of bidding, and is required, as a specification of the work, to confer in advance of beginning any work on the Project, with the Traffic Operations Division, Municipal Services Building, 100 South Myrtle Avenue, telephone (727) 562-4747, for the purpose of approval of the Contractor's proposed detailed traffic control plan. All maintenance of traffic (MOT) plans shall be signed and sealed by a Professional Engineer or an individual who is certified in the preparation of MOT plans in the State of Florida. Contractor is required to submit the MOT preparer's accreditation along with the plan submittal.

107-5. INSPECTION OF WORK ZONE TRAFFIC CONTROL OPERATION

The city Engineering Traffic Operations Division may inspect and monitor the traffic control plan and traffic control devices of the Contractor. The city's Construction Inspector assigned to the project may make known requirements for any alterations or adjustments to the traffic control devices. The Contractor shall take direction from the city representative.

107-6. PAYMENT FOR WORK ZONE TRAFFIC CONTROL

Payment for work zone traffic control is a non-specific pay item to be included in the construction costs associated with other specific pay items unless specifically stated otherwise.

107-7. CERTIFICATION OF WORK ZONE TRAFFIC CONTROL SUPERVISOR

The city may require that the Supervisor or Foreman controlling the work for the Contractor on the Project have a current International Municipal Signal Association, Work Zone Traffic Control Safety Certification or Worksite Traffic Supervisor Certification from the American Traffic Safety Association with additional current Certification from the Florida Department of Transportation. This requirement for Certification will be noted in the Scope of Work and/or sections of these Technical Specifications. When the certified supervisor is required for the Project, the supervisor will be on the Project site at all times while work is being conducted.

The Worksite Traffic Supervisor shall be available on a twenty-four (24) hour per day basis and shall review the project on a day-to-day basis as well as being involved in all changes to traffic control. The Worksite Traffic Supervisor shall have access to all equipment and materials needed to maintain traffic control and handle traffic related situations. The Worksite Traffic Supervisor shall ensure that routine deficiencies are corrected within a twenty-four (24) hour period.

The Worksite Traffic Supervisor shall be available on the site within 45 minutes after notification of an emergency situation, prepared to positively respond to repair the work zone traffic control or to provide alternate traffic arrangements.

Failure of the Worksite Traffic Supervisor to comply with the provisions of this sub section may be grounds for decertification or removal from the project or both. Failure to maintain a designated Worksite Traffic Supervisor or failure to comply with these provisions will result in temporary suspension of all activities except traffic and erosion control and such other activities deemed to be necessary for project maintenance and safety.

108. OVERHEAD ELECTRIC LINE CLEARANCE

108-1. CLEARANCE OPTIONS

When working in the vicinity of overhead power lines, the Contractor shall utilize one of the following options:

- Option 1: Having the power lines de-energized and visibly grounded.
- Option 2: Maintaining a minimum distance of twenty feet (20') of clearance for voltages up to 350 kV and fifty feet (50') of clearance for voltages more than 350 kV.
- Option 3: Determine the line voltage and provide clearance in accordance with the following table.

108-2. REQUIRED MINIMUM CLEARANCE DISTANCES

VOLTAGE [nominal, kV, alternating current]	MINIMUM CLEARANCE DISTANCE [feet]
Up to 50	10
Over 50 to 200	15
Over 200 to 350	20
Over 350 to 500	25
Over 500 to 750	35
Over 750 to 1,000	45
Over 1,000	(as established by the utility owner/operator or registered professional engineer who is a qualified person with respect to electric power transmission and distribution)

Note: The value that follows “to” is up to and includes that value. For example, over 50 to 200 means up to and including 200kV.

The equipment supplied and installed shall meet the requirements of the National Electric Code and all applicable local codes and regulations

200 SERIES: SITWORK

201. EXCAVATION FOR UNDERGROUND INFRASTRUCTURE WORK

The Contractor is responsible to take all necessary steps to conduct all excavation in a manner which provides for the successful completion of the proposed work while at all times maintaining the safety of the workmen, the general public and both public and private property. The Contractor's methods of work will be consistent with the standard practices and requirements of all appropriate Safety Regulatory Agencies, particularly the Occupational Safety and Health Administration (OSHA) requirements for excavation. Unless otherwise specifically stated in these plans and specifications, the methods of safety control and compliance with regulatory agency safety requirements are the full and complete responsibility of the Contractor.

For the purposes of the Contractor's safety planning in the bidding process, the Contractor is to consider all excavation to be done in the performance of this contract to be in soil classified as OSHA "Type C". The Contractor's attention is called to specific requirements of OSHA for excavation shoring, employee entry, location of excavated material adjacent to excavation, the removal of water from the excavation, surface encumbrances and in particular the requirement of a "Competent Person" to control safety operations. The Contractor shall submit to the city if requested prior to the start of work a safety plan for the excavation and work activities. The Contractor will identify their Competent Person to city staff at the start of construction. Clearwater Fire Dept. requires a Trench Permit and site inspection for any depths greater than five feet (5') and any excavation that exceeds twenty feet (20') shall require the submittal of a trench shoring plan prepared by a Professional Engineer actively licensed in the State of Florida.

City staff is required from time to time to perform inspections, tests, survey location work, or other similar activity in an excavation prepared by the Contractor. City staff, in conformance with the OSHA Excavation Safety Requirements, is to only enter an excavation in compliance with these OSHA standards. The city's staff reserve the option to refuse entry into the Contractor's excavation if, in the opinion of the city's staff, the entry into the Contractor's excavation is unsafe or does not conform to OSHA requirements. If this circumstance occurs, the Contractor must either provide the necessary safety requirements or provide alternate means for the accomplishment of the city's work at the Contractor's expense.

The construction quantities, if any, contained in the bid proposal for this contract do not contain sufficient quantities to allow the Contractor to perform excavation work using strictly the "open cut" method whereby no shoring systems are used and trench side slopes are cut to conform to OSHA safety requirements without a shoring system. In addition to safety reasons, the Contractor is required to use excavation and trench-shoring methods in compliance with all safety requirements which allow the Contractor to control the amount of restoration work necessary to complete the project.

Not more than four hundred feet (400') of trench shall be opened at one time in advance of the completed work unless written permission is received from the city and/or the Engineer for the distance specified. For pipe installation projects, the trench shall be a minimum of six inches (6") wider on each side than the greatest external horizontal width of the pipe or conduit, including hubs, intended to be laid in them. The bottom of the trench under each pipe joint shall be slightly hollowed, to allow the body of the pipe to rest throughout its length. In case a trench is excavated at any place, except at joints, below the grade of its bottom as given, or directed by the Engineer, the filling and compaction to grade shall be done in such manner as the Engineer shall direct, without additional compensation.

201-1. EXCAVATION, BACKFILLING, AND COMPACTION FOR UNDERGROUND INFRASTRUCTURE

201-1.1. GENERAL

Scope of Work: The work included under this Section consists of dewatering, excavating, trenching, sheeting/shoring, grading, backfilling, and compacting those soil materials required for the construction of the structures, piping, ditches, utility structures and appurtenances as shown on the Drawings and specified herein.

Definitions:

- A. **Maximum Density:** Maximum weight in pounds per cubic foot of a specific material as determined by ASTM D1557.
- B. **Optimum Moisture Content:** The optimum moisture content shall be determined by ASTM D 1557 specified to determine the maximum dry density for relative compaction. Field moisture content shall be determined on the basis of the fraction passing the 3/4-inch sieve.
- C. **Rock Excavation:** Excavation of any hard-natural substance which requires the use of special impact tools such as jack hammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.
- D. **Suitable Soil Materials:** Suitable materials for fills shall be a non-cohesive, non-plastic granular local sand and shall be free from vegetation, organic material, marl, silt or muck and shall be classified as A-1, A-3 or A-2-4 in accordance with AASHTO Designation M-145. Not more than 10 percent (%) by weight of fill material shall pass the No. 200 Sieve. The Contractor shall furnish all additional fill material required.
- E. **Unsuitable Soil Materials:** Unsuitable materials are classified as A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, and A-8 in accordance with AASHTO Designation M-145.

Plan for Earthwork:

- A. The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the work, the general and local conditions and all other matters which can in any way affect the work under this Contract according to the General Conditions.
- B. Prior to commencing the excavation, the Contractor shall submit a plan of his proposed operations, including maintenance of traffic, to the Engineer and the city for review and approval. The Contractor shall consider, and his plan for excavation shall reflect, the equipment and methods to be employed in the excavation. The prices established in the Proposal for the work to be done will reflect all costs pertaining to the work. No claims for extras based on substrata or groundwater table conditions shall be allowed.

Trench Safety:

- A. All trench excavations which exceed 5 feet in depth shall comply at all times with the applicable trench safety standards as stated in the OSHA excavation safety standards 29 CFR S. 1926.650 Subpart P as regulated and administered by the Florida Department of Labor and Employment Security as the "Florida Trench Safety Act".
- B. The Contractor shall comply with all of the requirements of the Florida Trench Safety Act. The Contractor shall acknowledge that included in various items of his bid proposal and in the total bid price are costs for complying with the provisions of the Act.

Testing: A Certified Testing Laboratory employed by the Contractor shall make such tests as are required to demonstrate compliance with these specifications. The Contractor shall schedule his work to permit a

reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress. All costs for all testing shall be paid by the Contractor.

Changed Job Conditions: If, in the opinion of the Engineer or the city Representative, conditions encountered during construction warrant a change in the structure footing elevation, or in the depth of removal of unsuitable material from that indicated in the soils report, an adjustment will be made in the contract price as provided in the General and Special Conditions.

Utility Construction Surveys:

- A. Prior to commencing excavation, backfill or dewatering for utilities, the Contractor shall conduct a survey of those existing structures which, in the opinion of the Engineer, may be subject to settlement or distress resulting from excavation or dewatering operations.
- B. The Contractor shall monitor the structures surveyed to ascertain evidence of settlement or distress during construction. If settlement or distress becomes evident, the Contractor shall be required to repair the structures to the previous condition to the satisfaction of the Engineer and the city. All costs for repairs shall be paid by the Contractor.

Submittals:

- A. Submit to the Engineer for review the proposed methods of construction, including dewatering, excavation, bedding, filling, compaction, and backfilling for the various portions of the work. Review shall be for method only. The Contractor shall remain responsible for the adequacy and safety of the methods.
- B. Submit to the Engineer for review and approval the sieve analyses and soil classifications completed by the Geotechnical Engineer hired by the Contractor, for materials to be used for pipe bedding and trench and structural backfill including Structural Fill, Class I and Class II soil materials, Crushed Stone bedding materials and Coarse Sand materials.
- C. Submit to the Engineer for review, the soil compaction results

201-1.2. mATERIALS

General Requirements:

- A. All fill materials from on and off-site sources shall be subject to the approval of the Engineer and the city.
- B. All fill material shall be unfrozen and free of organic material, trash, or other objectionable material. Excess or unsuitable material as designated by the Engineer shall be removed from the job site by the Contractor.

Common Fill Materials:

- A. Common fill shall be sand, free of clay, organic material, muck, loam, wood, trash and other objectionable material which may be compressible, or which cannot be compacted properly. It shall not contain stones, rock, concrete or other rubble larger than 1-1/2-inches in diameter. It shall have physical properties which allow it to be easily spread and compacted.
- B. Common fill shall be no more than 10 percent by weight finer than the No. 200 mesh sieve.
- C. The Contractor shall utilize as much excavated material as possible for reuse as backfill material in accordance with the Contract Drawings and Project Specifications or as directed by the Engineer.
- D. The Engineer shall direct the Contractor on the type of material allowed in certain sections of the earthwork operations.

Structural Fill:

Structural fill shall be well graded sand to gravel-sand having the following gradation:

U.S. Sieve Size	Percent Passing by Weight
1-inch	100%
No. 4 Sieve	75% to 100%
No. 40 Sieve	15% to 80%
No. 100 Sieve	0 to 30%
No. 200 Sieve	0 to 10%

Class I Soils*:

Manufactured angular, granular material, 1/4-inch to 1-1/2- inches in size, including materials having significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Sieve analysis for crushed stone is given below separately.

- A. Crushed Stone: Crushed stone shall consist of clean mineral aggregate free from clay, loam or organic matter conforming with particle size limits as included in *Table 201-A* below. Unless approved otherwise by the engineer, crushed stone for PVC, FRP or HDPE pipe bedding shall conform with ASTM C33 stone size No. 89 and crushed stone for ductile iron pipe shall conform to ASTM C33 stone size No. 68 or 78.

* Soils defined as Class I soils are not defined in ASTM D2487.

Class II Soils:**

- A. GW: Well-graded gravels and gravel-sand mixtures, little or no fines, clean. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve.
- B. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines, clean. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve.
- C. SW: Well-graded sands and gravelly sands, little or no fines, clean. More than fifty (50) percent passing No. 4 sieve. More than 95 percent retained on No. 200 sieve.
- D. SP: Poorly graded sands and gravelly sands, little or no fines, clean. More than fifty (50) percent passing No. 4 sieve. More than 95 percent retained on No. 200 sieve.

** In accordance with ASTM D2487, less than 5 percent passing No. 200 sieve.

Coarse Sand:

Sand shall consist of clean mineral aggregate with particle size limits as follows:

U.S. Sieve Size	Percent Passing By Weight
No. 10 Sieve	100%
No. 20 Sieve	0 to 30%
No. 40 Sieve	0 to 5%

Other Material:

All other material, not specifically described, but required for proper completion of the work shall be selected by the Contractor and approved by the Engineer.

201-1.3. cLEARING AND gRUBBING**201-1.3.1. GENERAL**

- A. Clearing: Clearing shall completely remove and dispose of all timber, shrubs, brush, stumps, limbs, roots, grass, weeds, other vegetative growth, rubbish and all other objectionable obstructions resting on or protruding through the surface of the ground. Remove all evidence of their presence from the surface including sticks and branches. Remove and dispose of trash piles and rubbish that is scattered over the construction site or collects there during construction. Those trees, shrubs, vegetative growth, and fencing, if any, which are designed by the Engineer to remain, shall be

preserved and protected as hereinafter specified. Clearing operations shall be conducted so as to prevent damage to existing structures and installations and to those under construction, so as to provide for safety of employees and others.

- B. Grubbing: Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs, and any other organic or metallic debris remaining after clearing not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18-inches below the subgrade or the bottom of utility trenches. All depressions excavated below the original ground surface for or by the removal of such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.
- C. Stripping: Remove and dispose of all organics and sod, topsoil, grass, and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped. Grass, grass roots and organic material in areas to be excavated or filled shall be stripped to the depth as noted in the soils report. In areas so designated, topsoil shall be stockpiled. Stripped material and unsuitable material, such as organic material, shall be disposed of by the Contractor unless directed otherwise by the Engineer.
 - 1. In areas so designated, topsoil shall be stripped and stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. Any topsoil remaining after all work is in place shall be disposed of by the Contractor.

201-1.3.2. CLEARING AND GRUBBING OPERATIONS

Clearing and Grubbing Limits: All excavation areas associated with new structures, slabs, utilities and roadways shall be cleared and grubbed to the following depths:

- A. Proposed Structures: 2-feet below existing grade within a 5-foot margin of each structure and replaced with compacted structural fill material as specified in *Section 201-2.2*
- B. Building Site Areas not specifically noted above: 2-feet below existing grade within a 5-foot margin of each building site area and replaced with compacted structural fill material as specified in *Section 201-2.2*.
- C. Utility Trenches: 1.5-feet below the bottom of the utility trench within the entire width of the trench and replaced with compacted Class II Soils, Type SW or SP material as specified in *Section 201-2.2*.
- D. Roadway and Paved Area: 2-feet below existing grade within a 5-foot margin of areas paved and replaced with compacted common fill material as specified.
- E. All Other Areas: 1-foot below completed surface and replaced with compacted common fill material as specified.

Areas to be Stripped: All excavation and embankment areas associated with new structures, slabs, walks, and roadways shall be stripped. Stockpile areas shall be stripped.

201-1.3.3. DISPOSAL OF DEBRIS MATERIAL

- A. Disposal of Clearing and Grubbing Debris: The Contractor shall dispose of all material and debris from the clearing and grubbing operations by hauling such material and debris away to an approved disposal site and dispose of in accordance with all local laws, codes, and ordinances. Disposal by burning or burial on-site shall not be permitted. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be considered a subsidiary obligation of the Contractor, the cost of which shall be included in the contract price.
- B. Disposal of Stripped Material: Remove all stripped material and dispose off-site in a legal manner, unless otherwise directed by the Engineer to stockpile the material, such as topsoil, for use in the final Work.

201-1.3.4. PRESERVATION OF TREES AND SHRUBBERY

- A. Trees and Shrubbery: All existing trees, shrubbery, and other vegetative material may not be shown on the Drawings. Inspect the site as to the nature, location, size, and extent of vegetative material to be removed or preserved, as specified herein. Preserve, in place, trees that are specifically shown on the Drawings and designated to be preserved.
- B. Tree Protection: Those trees which are designated for preservation shall be carefully protected from damage. The Contractor shall erect such barricades, guards, and enclosures as may be considered necessary for the protection of the trees during all construction operations.
- C. Preservation and Protection of Trees, Shrubs, and Other Plant Material:
 - 1. All plant materials (trees, shrubbery, and plants) beyond the limits of clearing and grubbing shall be saved and protected from damage resulting from the work. No filling, excavating, trenching, or stockpiling of materials will be permitted within the drip line of these trees or plants. The drip line is defined as a circle drawn by extending a line vertically to the ground from the outermost branches of a tree, plant, or group of plants. To prevent soil compaction within the drip line area, no equipment will be permitted within this area.
 - 2. When trees are close together, restrict entry to area within drip line by fencing or a protective barrier. In areas where no fence or barrier is erected, the trunks of all trees 2-inches or greater in caliper shall be protected by encircling the trunk entirely with boards held securely by 10-gauge wire and staples. This protection shall extend from ground level to a height of 6-feet. Neatly cut and remove tree branches where such cutting is necessary to affect construction operations. The cutting and removing must be performed or supervised by an I.S.A certified arborist. Remove branches other than those required to affect the work to provide a balanced appearance of any tree. Scars resulting from the removal of branches shall be treated with a tree sealant.

201-1.3.5. PRESERVATION OF DEVELOPED PRIVATE PROPERTY

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

201-1.3.6. PRESERVATION OF PUBLIC PROPERTY

The appropriate paragraphs of *Sections 203-2.3.4. and 203-2.3.5.* of these specifications shall apply to the preservation and restoration of all damaged areas of public lands, parks, rights-of-way, easements, etc.

201-1.4. EXCAVATION PROTECTION

201-1.4.1. SHEETING AND BRACING

- A. Furnish, put in place, and maintain such sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent utilities or structures, other aboveground structures, utility poles, etc. from being undermined, and to protect workers from

hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier piles and beams or other approved methods. If the Engineer or the city is of the opinion that at any points, sufficient or proper supports have not been provided, they may order additional supports to be put in place at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids from occurring adjacent to the sheeting, but if voids are formed, they shall be immediately filled and compacted. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill, at no additional expense to the city.

- B. The Contractor shall construct the sheeting outside the neat lines of the foundation unless deemed otherwise for the Contractor's method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressure to which the structure or trench shall be subjected. Any deformation, movement or bulging which may occur, shall be corrected by the Contractor at his own expense, to provide the necessary clearances and dimensions.
- C. Where sheeting and bracing is required to support the sides of excavations for utility structures, other structures, power poles, etc., the Contractor shall engage a Professional Geotechnical Engineer, registered in the state of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall conform to the design, and certification of the installation shall be provided by the Professional Geotechnical Engineer.
- D. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.
- E. The Contractor shall leave in place to be embedded in the backfill all sheeting and bracing not shown on the Drawings but which the Engineer or the city may direct him in writing to leave in place at any time during the progress of the work for the purpose of preventing injury to any structures or property, whether public or private. The Engineer or the city may direct that timber or steel sheeting used for sheeting and bracing be cut off at any specified elevation.
- F. The right of the Engineer or the city to order sheeting and bracing to be left in place shall not be construed as creating any obligation on their part to issue such orders, and their failure to exercise their right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.
- G. Steel or wood sheeting installed for utility pipeline construction shall not, under any circumstances be withdrawn, if driven below the top of any utility pipeline. Steel sheeting, soldier piles and wood sheeting earth support systems installed for utility pipeline construction shall be cut-off and left-in-place at least 3-feet below the ground surface, but no lower than 2-feet above the top of the utility pipe.
- H. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the new construction or other structures, utilities, or property outside the construction area. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by compacting with tools specifically adapted to that purpose, or otherwise as may be directed by the Engineer or the city.

201-1.5. EXCAVATING FOR UTILITY STRUCTURES

Excavation work shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

Excavation shall be made to such dimensions as will give suitable room for building the foundations and the structures, for bracing and supporting, for pumping and draining, for installing the pipelines, and for all other work required.

- A. Excavation for precast or prefabricated structures shall be carried to an elevation two (2) feet lower than the proposed outside bottom of the structure to provide space for the backfill and bedding material.
- B. Excavation for structures constructed or cast-in-place in dewatered or dry excavations shall be carried down to the 2-feet below the bottom of the structure where dewatering methods are such that a dry evacuation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the founding elevation in dewatered excavations shall be replaced with Class B concrete.

Prior to backfilling, document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during excavation and construction. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the work.

Encounters with subsurface obstructions shall be hand excavated.

Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or caused by other construction methods, shall be removed and replaced with crushed stone as required by the Engineer at the Contractor's expense.

The bottom of excavations shall be rendered firm and dry before placing any structure or pipe. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor, in a legal manner. The bedding schedule for pipes shall be as shown in *Table 201-C*.

If the sub-grade is unsuitable, the Contractor shall, remove and replace all unsuitable material below pipe with selected common fill or bedding rock, compacted to 95 percent Modified Proctor density.

All pavements and sidewalks shall be cut prior to removal, with saws or accepted power tools.

Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered.

All structure and pipe locations and elevations as required herein must be permanently documented by the Contractor, on the As-Builts, prior to the Engineer's approval of the Application for Payment for that work.

201-1.6. TRENCH EXCAVATION FOR UTILITY PIPELINES

201-1.6.1. TRENCH EXCAVATION FOR PIPE LAYING - GENERAL

- A. The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. Four hundred (400) feet shall be the maximum length of open trench for any pipeline under construction. All trench excavation shall be open cut from the surface.
- B. Alignment, Grade, and Minimum Cover: The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith shall be in conformance with the requirements of *Section 500* covering installation of pipe.
- C. Where pipe grades or elevations are not definitely fixed by the Contract Drawings, trenches shall be excavated to a depth sufficient to provide a depth of backfill cover over the top of the pipe of Between the range of 30- 42-inches. Greater pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes conduits, drains, drainage structures, or

other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation.

201-1.6.2. LIMITED TRENCH WIDTHS

- A. Trenches shall be excavated to a width which shall provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. However, minimum permissible sidewall clearances between the installed pipe and each trench wall, expressed in inches, shall be as follows:

Nominal Pipe Size, in Inches	Nominal Sidewall Clearance, in Inches
60	24
54	21
48	19
36 or smaller	12

- B. Stipulated minimum sidewall clearances are not minimum average clearances but are minimum clear distances which shall be required.
- C. Cutting trench banks on slopes to reduce earth load to prevent sliding and caving will be permitted only in areas where the increased trench width will not interface with surface features or encroach on right-of-way limits. Slopes shall not extend lower than one foot above the top of the pipe.

201-1.6.3. MECHANICAL EXCAVATION

The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, and other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

Mechanical excavation equipment used for trench excavation shall be of the type, design, and construction, and shall be so operated, such that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from an elevation one foot above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that the pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance shall not be permitted.

201-1.6.4. PAVEMENT CUTTING

Cuts in concrete pavement, asphalt pavement, and asphaltic base pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with an asphalt or concrete saw in a manner which will provide a clean groove for the full depth of pavement along each side of the trench and along the perimeter of cuts for structures.

Asphalt pavement and asphaltic base pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 6-inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting shall be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the centerline of the trench.

Pavement removed for connections to existing lines or structures shall not be greater than necessary for the installation as determined by the Engineer. Road restoration shall be full road width.

201-1.6.5. ARTIFICIAL FOUNDATIONS IN TRENCHES

Whenever so ordered by the Engineer due to the presence of unsuitable material at the designed depth, the Contractor shall excavate to such depth below grade as the Engineer may direct and the trench bottom shall be brought to grade with such material as the Engineer may order installed. All piling, concrete, or other

foundations made necessary by unstable soil shall be installed as directed by the Engineer. Compensation for extra excavation and piling, concrete, or other foundations, except where provided by contract unit prices, shall be made in accordance with the contract provisions for extra work.

201-1.6.6. BELL HOLES

Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

201-1.7. UNDERCUT OF EXCAVATIONS

If the bottom of any structure or trench excavation is below that shown on the Drawings or specified because of Contractor error, convenience, or unsuitable subgrade due the Contractor's excavation methods, the Contractor shall refill to normal grade with approved fill at his own cost. Fill material and compaction method shall be as directed by the Engineer.

201-1.8. STABILIZATION OF EXCAVATIONS

Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact.

Subgrades for concrete structures or trench bottoms which are otherwise solid, but which becomes mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. Not more than 1/2-inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations shown on the Drawings.

All stabilization work shall be performed by and at the expense of the Contractor.

201-1.9. BACKFILL AND COMPACTION

201-1.9.1. MATERIALS

- A. To the maximum extent available, excess earth obtained from structure and trench excavation shall be used for the construction of fills and embankments.
- B. Materials used as backfill shall be free from rocks or stones larger than 1-1/2-inches in their greatest dimension; brush or vegetation, stumps, logs, roots, debris, and organic or other deleterious materials; and must be acceptable to the Engineer.
- C. Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the Engineer. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials be in any backfill, fill or embankment.

201-1.9.2. BACKFILL PLACEMENT AND COMPACTION

- A. Backfill materials shall be placed in approximately horizontal layers not to exceed 8-inches in uncompacted thickness. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction.
- B. Each layer of material being compacted shall have the optimum uniform moisture content to ensure satisfactory compaction. The Contractor shall be required to add water and harrow, disc, blade, or otherwise work the material in each layer to ensure uniform moisture content and adequate compaction.

- C. Each layer shall be thoroughly compacted by rolling or other method acceptable to the Engineer to 95% of relative density at optimum moisture content as determined by Modified Proctor Method, ASTM D1557, latest revision.
- D. Whenever a trench passes through a backfill or embankment area, material shall be placed and compacted to an elevation 12-inches above the top of the pipe before the trench is excavated.
- E. Backfill and compact excavations and construct embankments for structures according to the schedule listed in *Table 201-B*. Backfill and bedding schedule for pipes is listed in *Table 201-C*. (Modified Proctor for compaction shall be as determined by ASTM D-1557, latest revision).
- F. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.
- G. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. Backfill operation shall be performed to comply with all rules and regulations and in such a manner that it does not create a nuisance or safety hazard.
- H. Embankments shall be constructed true to lines, grades and cross sections shown on the plans or ordered by the Engineer or the city. Embankments shall be placed in successive layers of not more than 8-inches in thickness, loose measure, for the full width of the embankment. As far as practicable, traffic over the work during the construction phase shall be distributed so as to cover the maximum surface area of each layer.
- I. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to the Engineer. Approval will be considered only after the Contractor has performed tests, at the Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. The Engineer's approval shall be in writing.

201-1.9.3. STRUCTURE FOUNDATION PREPARATION

The existing ground beneath proposed tankage, building foundations and equipment base slabs and slabs on grade shall be removed and the area proof rolled. Proof-rolling should consist of at least 10 passes of a self-propelled vibrator compactor capable of delivering a minimum impact force of 30,000 to 35,000 pounds per drum to the soils. Each pass should overlap the preceding pass by 30 percent to insure complete coverage. Backfilled areas shall be compacted in 8-inch layers to a density of not less than 95 percent of Modified Proctor Dry Density as determined by ASTM D1557, latest revision, for a depth of not less than 2-feet below the bottom of the foundations or concrete slabs. Any unsuitable foundation material shall be removed and replaced with suitable material.

Slabs on Grade: Subgrades for concrete slabs shall be removed, backfilled, and compacted to the required grade. The top 2-feet of concrete slab subgrade in cut sections and all fill material shall be compacted in 8-inch layers to a density of not less than 95 percent of Modified Proctor Dry Density as determined by ASTM D1557, latest revision.

201-1.10. DRAINAGE FROM EXCAVATIONS

Trenches across roadways, driveways, walks, or other traffic ways adjacent to drainage ditches or water courses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the traffic way to prevent impounding water after the pipe has been laid.

Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches.

All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the original sections, grades, and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary.

201-1.11. FINAL GRADING

After other outside work has been finished, and backfilling completed and settled, all areas on the site of the work which are to be graded shall be brought to grade within the tolerance of ± 0.1 feet at the indicated elevations, slopes, and contours where seeding or sodding is not required or, where sodding is required within three (3) inches of finished grade. Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to hand work. All surfaces shall be graded to secure effective drainage. Unless otherwise shown, a slope of at least one percent shall be provided.

After grading and where seeding is required, topsoil shall be evenly spread to a minimum depth of six (6) inches. Topsoil shall be from an Engineer approved source and shall be free of trash, debris and surface vegetation.

Grading and surfacing shall be completed to the satisfaction of the Engineer and the Owner.

201-1.12. EXCESS EXCAVATED MATERIAL

Insofar as needed, suitable excavated materials shall be used in fills and embankments as shown on the Drawings. All suitable excess excavated material shall be placed at an on-site stockpile area as directed by the city.

The Contractor shall segregate different types of excavated materials (i.e. sands, clayey sands) as much as possible in the stockpile areas. All unsuitable materials shall be disposed of by the Contractor offsite, in a legal manner.

The Contractor shall slope and compact the stockpile with a light roller type vehicle to maintain stability.

The Contractor shall maintain proper soil and erosion control measures.

201-1.13. SETTLEMENT

The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within the guarantee period stipulated in the General Conditions of the Contract.

The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from the Engineer or the city.

TABLE 201-A**STANDARD SIZES OF COARSE AGGREGATE AMOUNTS FINER****THEN EACH LABORATORY SIEVE (SQUARE OPENINGS), MASS PERCENT**

Aggregate Size No.	Nominal Size Square Openings	U. S. Sieve Size, Percent Passing By Weight								
		1-1/2-in	1-in.	3/4-in.	1/2-in.	3/8-in.	No. 4	No. 8	No. 16	No. 50
57	1-in. to No. 4	100%	95%-100%	--	25%-60%	--	0-10%	0-5%	--	--
68	3/4-in. to No. 8	--	100%	90%-100%	--	30%-65%	5%-25%	0-10%	0-5%	--
78	1/2-in. to No. 8	--	--	100%	90%-100%	40%-75%	5%-25%	0-10%	0-5%	--
89	3/8-in. to No. 16	--	--	--	100%	90%-100%	20%-55%	5%-30%	0-10%	0-5%

TABLE 201-B**COMPACTION AND BACKFILL SCHEDULE****FOR STRUCTURES**

Area	Material	Compaction
Beneath structures, foundations, slabs, and pavements. (minimum 2-foot depth below concrete foundation bottom)	Structural Fill (<i>Section 201-2.2.</i> , Structural Fill)	8-inch lifts compacted to 95% Modified Proctor maximum dry density (98% Modified Proctor maximum dry density under pavement). Fill should not be placed over any in-place soils until those layers have been compacted to 95% Modified Proctor maximum dry density (98% Modified Proctor maximum dry density under pavement).
Around structures, foundations and slabs (minimum 5-foot outside structure)	Structural Fill (<i>Section 201-2.2.</i> , Structural Fill)	8-inch lifts compacted to 95% Modified Proctor maximum dry density (98% Modified Proctor maximum dry density under pavement). Use light rubber-tired or vibratory plate compactors.
From cleared existing surface to subgrade for paved and gravel roadway surfaces	Common Fill (<i>Section 201-2.2.</i> , Common Fill)	12-inch lifts, compacted to 95% Modified Proctor maximum dry density (98% Modified Proctor maximum dry density under pavement).
Disturbed area requiring seeding and mulching	Topsoil	2-inch to 4-inch lifts, compacted to 85% Modified Proctor maximum dry density.

202. OBSTRUCTIONS

Any pipes, conduits, wires, mains, footings, driveways, or other structures encountered shall be carefully protected from damage or displacement. Any damage thereto shall be fully, promptly, and properly repaired by the Contractor to the satisfaction of the Engineer and the city of Clearwater thereof. Any survey monument or benchmark which must be disturbed shall be carefully referenced before removal, and unless otherwise provided for, shall be replaced upon completion of the work by a Florida registered Professional Surveyor and Mapper (PSM). Any concrete removed due to construction requirements shall be removed to the nearest expansion joint or by saw cut. Contractor shall consult Inspector/Project Manager for the approved means of removal and replacement.

203. DEWATERING

203-1. GENERAL

The work to be performed under this Section shall include the design and installation of a temporary dewatering system(s) until completion of construction to remove subsurface waters from structure or utility trench excavations as required. The Contractor shall furnish all equipment; labor and materials necessary to remove storm water or subsurface groundwater from excavation areas in accordance with the requirements set forth, as shown on the Drawings, and/or geotechnical report.

Qualifications: For major dewatering activities the temporary dewatering system shall be designed, installed and operated by a firm who regularly engages in the design, installation and operation of dewatering systems and who is fully experienced, reputable, and qualified in the design, installation and operation of such dewatering systems. The firm shall have a successful record of operation for a minimum of five (5) years prior to bid date. The dewatering system firm shall have experience for installation of at least three (3) successful dewatering operations of a similar nature and size in the state of Florida.

The dewatering system shall be developed to the point that it is capable of dewatering the site surrounding all structures or utility trenches as shown on the Drawings. Each dewatering system shall be capable of dewatering and maintaining groundwater levels at the respective excavations. Observation wells shall be constructed for the purpose of testing each system.

The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove and dispose of all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. In critical dewatering situations, the Contractor shall have on hand at the construction site, backup dewatering pumps and other critical components of the dewatering system that are operational and could be used in the event of breakdowns of the primary equipment.

The Contractor's plan shall include temporary culverts, barricades, and other protective measures to prevent damage to property or injury to any person or persons.

Prior to construction, the dewatering plan shall be prepared and submitted to the city's Engineering Department, Public Utilities Department, Industrial Pretreatment Program (IPP) Coordinator, Wastewater Environmental Manager and the Public Utilities Department Director or Assistant Director for review and approval. It shall include site-specific notes and details presenting the Contractor's proposed dewatering and disposal methods. The city will field-inspect the dewatering operation throughout construction.

All costs for dewatering shall be included in the unit price bid per linear foot of pipe, or, in the case of other underground structures, in the cost of such structures.

203-1.1. Definition of Terms for Dewatering System

Minor Dewatering Activity: A single stage well point dewatering system, operating for less than 30 days total duration, and not requiring a Notice of Dewatering Activity filed with the local Water Management District.

Major Dewatering Activity: Any major dewatering system, operating for more than 30 days duration, requiring a Notice of Dewatering Activity filed with the local Water Management District. Major dewatering systems shall include, but not be limited to, multi-stage well point dewatering systems, drilled horizontal or vertical sock drain systems, dewatering deep well pump systems and educator dewatering systems.

203-2. OBSERVATION WELLS

For major dewatering activities, prior to excavation, the Contractor shall install groundwater observation wells at locations as directed and designed by the Contractor's Geotechnical Engineer and as approved by the Engineer adjacent to structures or underground utility under construction for the purpose of monitoring water levels during excavations.

Where required, the observation well construction shall consist of well screen, casing, and cap of approved size and material of construction. The observation well shall be placed in a 2-1/2-inch bore hole which shall be carried to an elevation at least 4 feet below the final bottom grade of structure or utility trench excavation. The annular space surrounding the intake point and the riser pipe shall be sealed in such a way as to prevent infiltration from surface water. The observation well shall be developed in such a manner as to ensure proper indication of subsurface water levels adjacent to the well.

The Contractor shall be responsible for maintaining the observation wells and for observing and recording the elevation of groundwater until the structure or utilities requiring excavation are completed and backfilled. Each observation well shall be observed and recorded daily. Measurements shall be supplied daily to the Engineer and the city. The Engineer may require that the observation wells reflect true groundwater levels by adding water to the well, recording the drop in the level from the time the water was added. Any plugged observation well shall be redeveloped, if necessary, to indicate true groundwater levels.

Observation wells shall be fully grouted and abandoned when the dewatering system is removed as directed by the Geotechnical Engineer, and in a manner acceptable to the Geotechnical Engineer.

203-3. PUMPING AND DRAINAGE - GENERAL

Unless specifically authorized by the Engineer, all pipes, except sub drains, shall be laid "in the dry". In the dry shall be defined to be within 2 percent of the optimum moisture content of the soil. The Contractor shall dewater trench excavation as required for the proper execution of the work, using one or more of the following approved methods: well point system, trenched gravity under drain system, or sumps with pumps.

Well point systems must be efficient enough to lower the water level in advance of the excavation and maintain it continuously in order that the trench bottom and sides shall remain firm and reasonably dry. The well points shall be designed especially for this type of service, and the pumping unit used shall be capable of maintaining a high vacuum, and at the same time, of handling large volumes of air as well as of water.

Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils 2-feet below the proposed bottom of excavation and to preserve the integrity of adjacent structures. As a minimum, the water level shall be 2-feet below the trench bottom. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding soils. Dewatering by trench pumping shall not be permitted if migration of fine-grained natural material from bottom, side walls, or bedding material may occur.

A well point system, trench drain, sump pump operation, or other dewatering method shall be utilized to maintain the excavation in a dry condition for preparation of the trench bottom and until the structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. No water shall be allowed to contact masonry or concrete within 24 hours after being placed.

Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain the excavation bottom free from standing water.

The Contractor shall take all additional necessary precautions and prevent uplift of any structure during construction.

Flotation of structures or piping shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of the dewatering system.

The conveying of water other than storm water surface runoff in open ditches or trenches will not be allowed unless prior approval is obtained. Permission to use any drainage ditches, storm sewers, drains or other storm drainage facilities for water conveyance or disposal purposes during dewatering operations shall be obtained from the controlling authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. However, the Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and the Contractor shall leave the facilities unrestricted and as clean as originally found. Any damage to existing facilities shall be repaired or restored, as directed by the Engineer or the authority having jurisdiction, at no cost to the city or the Owner of the facilities.

The Contractor shall be responsible for disposing of all water resulting from trench dewatering operations and shall dispose of the water without damage or undue inconvenience to the work, the surrounding area, or the general public. The Contractor may be required to divert the water from the dewatering process to a location determined by the Engineer or city Project Manager or Inspector and obtain a discharge permit from Florida Department of Environmental Protection (FDEP). Alternatively, if Contractor elects to contain produced groundwater on the project site, a dewatering plan must be submitted to the Engineer or city for approval (even if a discharge permit is not required).

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

203-3.1. DEWATERING EQUIPMENT

The dewatering equipment shall be standard dewatering equipment of proven ability as designed, manufactured, and installed by firms having experience in the design and production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods.

The Contractor shall provide adequate equipment for the removal of surface or subsurface waters that may accumulate in the excavation. Flotation and migration of fines shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages that may result from the operation and/or failure of this system.

Sound levels for dewatering pumps shall meet governmental agencies ordinance levels. Sound levels in excess of such ordinance are sufficient cause to have the work halted until equipment can be quieted to these levels. Work stoppage by the Engineer, city or other governmental agencies for excessive noise shall not relieve the Contractor of the other portions of this specification including, but not limited to contract time and contract price. Engine-driven pumps shall be equipped with critical grade type silencers, sound blankets or other types of sound mitigation measures to comply with Noise Ordinances. Engine driven dewatering pumps shall have a maximum rating of 80 decibels at a distance of 5 feet from the engine for sound attenuation, nor shall the pump engine noise exceed 50 decibels at a distance of 50 feet from the engine. There may be practical and feasible, electrical "power drops" and electric motor-driven equipment shall be used in lieu of portable generators.

The dewatering system shall operate in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the proposed structures or utilities and to preserve the integrity of any adjacent structures.

Removal of dewatering equipment shall be accomplished following backfilling and compaction, and after the Contractor and the Engineer both agree, that the system is no longer required. All materials and equipment constituting the dewatering system shall be removed by the Contractor.

Immediately upon completion of the dewatering operations, the Contractor shall remove all of his equipment, materials, and supplies from the site of the Work, remove all surplus materials and debris, fill in all holes or excavations, grout all groundwater monitoring wells installed for the dewatering operations and grade the site to elevations of the surface levels which existed before the work started. The site shall be thoroughly cleaned and graded as directed by the Engineer and approved by the city.

203-3.2. DEWATERING CONSIDERATIONS

The Contractor shall install a temporary dewatering system for the removal of subsurface water encountered during construction of the proposed structures or underground utilities. The Contractor shall provide adequate equipment for the removal of storm or subsurface waters which may accumulate in the excavations.

If well points are used, Contractor shall adequately space well points to maintain the necessary dewatering. Provide suitable filter sand and/or other means to prevent pumping of fine sands and silts. A continual check shall be maintained by the Contractor to ensure that the subsurface soil is not being removed by the dewatering operations. Pumping from well points shall be continuous and standby pumps shall be provided.

The Contractor's proposed method of dewatering shall include groundwater observation wells to determine the water level during construction. Observation wells shall be installed along pipelines as required to verify depth to water level and at locations approved by the Engineer.

At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from the surface shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped or drained by gravity to maintain an excavation bottom free from standing water.

Flotation shall be prevented by the Contractor by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible for all damages which may result from failure to adequately keep excavations dewatered.

The Contractor shall construct and place all pipelines, structures, concrete work, structural fill, backfill and bedding material in-the-dry. If subsurface water is encountered, utilize suitable equipment to adequately dewater the excavation so that it will be “in-the-dry” for work and pipe laying. For the purposes of this specification, “in-the-dry” is defined to be within ± 2 percent of the optimum moisture content of the soil. A well point system or other dewatering method accepted by the respective jurisdictional agency (agencies) shall be utilized, if necessary, to maintain the excavation in a dry condition for preparation of the trench bottom and for pipe laying. The Contractor shall not make the final 24-inches of excavation until the water level is a minimum of 2-feet below proposed bottom of the excavation.

Dewatering by trench pumping will not be permitted if migration of fine-grained natural material from bottom, side walls, or bedding material will occur.

In the event that satisfactory dewatering cannot be accomplished due to subsurface conditions or where dewatering could damage existing structures, obtain the Owner’s and the Engineer's approval of wet trench construction procedures before commencing construction.

203-3.3. DISPOSAL OF PUMPED WATER

Discharge water to on-site disposal areas (if shown on the Drawings) or as required by permits.

The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent properties or facilities. No water shall be discharged without appropriate treatment for adverse contaminants. No water shall be drained in work built or under construction without prior consent from the Owner. Water shall be filtered to remove sand and fine soil particles before disposal into any drainage system.

Discharge water from dewatering operations to temporary infiltration pits, if possible.

Discharge to storm sewers, canals, stream, or wetlands, only if specifically allowed for in Dewatering Permit.

No discharges from dewatering operations shall be allowed to wastewater collection systems or wastewater pumping stations at any time.

In no case, shall discharges from dewatering operations result in turbidity reaching wetlands or any waterways. If turbidity exceeds limits allowed by jurisdictional permitting agency(ies), stop all activities, and install additional erosion and sedimentation control as required by the Southwest Florida Water Management District or the FDEP.

Flooding of streets, roadways, driveways, or private property shall not be permitted during dewatering activities. Contractor shall not dam-up, divert, or cause water to flow in excess in existing gutters, roadway pavements or other structures. For proper water discharges and disposal from dewatering operations, the Contractor may be required to divert or provide discharge piping to transport the water to a suitable place for legal discharge, as determined by the Engineer and the city.

203-3.4. GROUNDWATER TREATMENT (IF REQUIRED)

If the concentrations of tested groundwater quality parameters exceed those allowable in the FDEP Generic Permit for the Discharge of Produced Groundwater from any Non-Contaminated Site Activity (62-621.300(2), F.A.C.), the Contractor shall treat the effluent discharged from the dewatering system.

The Contractor shall immediately notify the Engineer and the city Engineering Department and discuss the parameters that exceed allowable limits.

The Contractor shall meet with the FDEP to determine treatment and disposal alternatives that are acceptable to the FDEP.

The Contractor shall apply for and obtain any and all permits and/or treatment approvals that FDEP requires including but not limited to the following:

1. Generic Permit for Discharges from Petroleum Contaminated Sites (62-621.300(1)). Allows discharges from sites with automotive gasoline, aviation gasoline, jet fuel, or diesel fuel contamination; or,
2. Permit for all Other Contaminated Sites (62-04; 62-302; 62-620 & 62-660). The coverage is available only through the individual NPDES permit issued by FDEP, allows discharges from sites with general contaminant issues i.e. ground water and/or soil contamination other than petroleum fuel contamination; or,
3. Generic Permit for the Discharge of Produced Ground Water from Any Non-Contaminated Site Activity (62-621.300(2), F.A.C.); or,
4. Generic Permit for Stormwater Discharge from Large or Small Construction Activities (62-621.300(4)(a), F.A.C.); or,
5. An Individual Wastewater Permit (62-604.300(8) (a).

The Contractor shall implement the appropriate treatment that is acceptable to FDEP, the Engineer and the city to attain compliance for all excess limits encountered during dewatering activities. Treatment may include, but is not limited to: Chemical, Physical, Biological, Electrolysis, Ion Exchange, Aeration, Activated Carbon Absorption, or any combination of the these.

The Contractor shall make every effort to minimize the spread of contamination into uncontaminated areas. Provide for the health and safety of all workers at the job site and make provisions necessary for the health and safety of the public that may be exposed to any potentially hazardous conditions. Ensure provision

adhere to all applicable laws, rules or regulations covering hazardous conditions and will be in a manner commensurate with the level of severity of the conditions.

If necessary, provide contamination assessment and remediation personnel to handle site assessment, determine the course of action necessary for site security and perform the necessary steps under applicable laws, rules and regulations for additional assessment and/or remediation work to resolve the contamination issue.

Delineate the contamination area(s) and any staging or holding area required and develop a work plan that will provide the schedule of projected completion dates for the final resolution of the contamination issue.

Maintain jurisdiction over activities inside any delineated contamination areas and any associated staging or holding areas. Be responsible for the health and safety of workers within the delineated areas. Provide continuous access to representatives of regulatory or enforcement agencies having jurisdiction.

203-4. PERMIT REQUIREMENTS

The dewatering of any excavation areas and the disposal of water during construction shall be in strict accordance with the latest revisions of the National Pollutant Discharge Elimination System (NPDES), and all local and state government rules and regulations.

The Contractor shall be responsible for submitting the Notice of Intent to use the Generic Permit for the Discharge of Groundwater from Dewatering Operations and associated fee in accordance with FDEP Requirements, F.A.C. 62-621.300(2)(b) and must receive written notice from the FDEP prior to discharging produced groundwater into the city's streets, storm sewers or waterways.

The Contractor shall obtain and pay all respective fees for all local, state, and federal permits required applicable to the withdrawal, treatment and disposal/discharge of water produced from the dewatering operations, prior to the start of work.

Contractor shall be responsible for acquiring and complying with all permits required to discharge produced water from dewatering and shall protect waterways from turbidity during the operation. Prior to discharging produced groundwater from any construction site, the contractor must collect samples and analyze the groundwater, which must meet acceptable discharge limits per FDEP "Generic Permit for the Discharge of Produced Ground Water from Any Non-Contaminated Site Activity" Chapter 62-621.300(2), FAC. The Contractor shall have on-site and available for review the analytical testing results performed in accordance with FDEP Chapter 62-621.300(2), FAC.

Consumptive Use Permit (CUP): If pumping requirements exceed certain limits, the Contractor shall pay for and obtain a CUP from the regional Water Management District for such pumped volumes. If a consumptive use permit is required by the local Water Management District, the Contractor shall be responsible for obtaining said permit. Comply with all conditions of the Dewatering Permit issued by the Water Management District. Apply for permit extensions or modifications, when required.

All water produced from dewatering shall be pumped from the trench or other excavation and shall be disposed of in strict accordance with applicable permits. The Contractor will be allowed to discharge product water from dewatering into storm sewers, or ditches having adequate capacity, canals or suitable disposal pits, or other surface waters in accordance with the Dewatering Plan, provided that the water has been sampled and tested by the Contractor, is in compliance with the concentration limits specified in 62-621.300(2) FAC, and the Contractor has obtained an FDEP Generic Permit for the production of groundwater. The frequency of water sampling and testing shall be determined by the Engineer based on existing conditions and field observations.

204. UNSUITABLE MATERIAL REMOVAL

All unsuitable material, such as muck, clay, rock, etc., shall be excavated from under pipes, structures and roadways and removed from the site. All material removed is property of the Contractor, who shall dispose of said material off-site at their expense. The limits and depths of the excavation shall be determined in the field by the Engineer. Approved replacement materials shall meet the requirements of Section 304.

204-1. BASIS OF MEASUREMENT

The basis of measurement shall be the number of cubic yards of clean fill placed as determined by either cross sections of the excavation, truck measure, or lump sum as specified in the Scope of Work and Contract Proposal. Included in the cost of removing unsuitable material is the cost to place suitable material/clean fill.

204-2. BASIS OF PAYMENT

The unit price for the removal of unsuitable material shall include: all materials, equipment, tools, labor, disposal, hauling, excavating, dredging, placing, compaction, dressing surface and incidentals necessary to complete the work. If no pay item is given, the removal of unsuitable material shall be included in the most appropriate bid item.

205. UTILITY TIE IN LOCATION MARKING

The tie in locations for utility laterals of water, sanitary sewer, and gas shall be plainly marked on the back of the curb. Marking placed on the curb shall be perpendicular with respect to the curb of the tie in location on the utility lateral. Marks shall not be placed on the curb where laterals cross diagonally under the curb. The tie in location shall be the end of the utility lateral prior to service connection.

Markings shall be uniform in size and shape and colors in conformance with the current code adopted by the American Public Works Association:

SAFETY RED	Electric Power Lines, Cables, Conduit and Lighting Cables
HIGH VISIBILITY SAFETY YELLOW	Gas, Oil, Steam, Petroleum or Gaseous Materials
SAFETY ALERT ORANGE	Communication, Alarm or Signal Lines, Cables or Conduit
SAFETY BLUE	Potable Water
SAFETY GREEN	Sewer Systems and Drain Lines
PURPLE	Reclaimed Water, Irrigation and Slurry Lines
WHITE	Proposed Excavation
PINK	Temporary Survey Markings

Marks placed on curbs shall be rectangular in shape and placed with the long dimension perpendicular to the flow line of the curb. Marks placed on valley gutter and modified curb shall be six-inch (6") x three inch (3") and placed at the back of the curb. Marks placed on State Road and vertical curb shall be four-inch (4") x two inch (2") and be placed on the curb face.

206. CLEARING AND GRUBBING

The work included in this specification includes the removal and disposal of all structures, appurtenances, asphalt, concrete, curbs, walls, trees, roots, vegetation, boulders, conduits, poles, posts, pipes, inlets, brush, stumps, debris and other obstructions resting on or protruding through the ground surface necessary to prepare the area for construction.

Clearing and grubbing shall be performed in accordance with *Section 110 of FDOT's Standard Specifications*. Unless otherwise specified in the contract documents, the Contractor shall take ownership of all removed material and dispose of them off-site in accordance with all Local, State and Federal Requirements.

206-1. BASIS OF MEASUREMENT

The basis of measurement shall be either a lump sum quantity or the number of acres cleared and grubbed as specified on the plans or directed by the Engineer.

206-2. BASIS OF PAYMENT

The pay item for clearing and grubbing shall include: all removal and disposal of materials and structures as well as all materials, hauling, equipment, tools, labor, leveling of terrain, landscape trimming and all incidentals necessary to complete the work.

207. EROSION AND SEDIMENT CONTROL

207-1. GENERAL

Erosion and sediment control shall conform to the requirements of the FDOT Standard Specifications for Prevention, Control, and Abatement of Erosion and Water Pollution. Contractor shall use temporary erosion and sediment control features found in the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (E&SC Manual) or the city of Clearwater Standard Indices. Contractor shall prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) and National Pollutant Discharge Elimination System (NPDES) permit in accordance with FDEP criteria for an NPDES construction activity permit.

Visit www.dep.state.fl.us/water/stormwater/npdes for more information. Contractor shall obtain a FDEP generic permit for the discharge of produced groundwater. All soil erosion and sediment control measures shall be installed prior to disturbance and maintained through project completion.

207-2. TRAINING OF PERSONNEL

The city may require that the Supervisor or Foreman controlling the work for the Contractor on the Project have a current FDEP Florida Stormwater, Erosion, and Sedimentation Control Inspector Training & Certification. All personnel working on the Project shall complete illicit discharge training once per calendar year. Contractor shall provide documentation to the city prior to Notice to Proceed (NTP). Example of training and training sign-in sheet will be provided by the city to the Contractor at the Pre-Construction Meeting.

207-3. STABILIZATION OF DENUDED AREAS

No disturbed area may be denuded for more than thirty (30) calendar days unless otherwise authorized by the City Engineer. During construction, denuded areas shall be covered by mulches such as straw, hay, filter fabric, seed and mulch, sod, or some other temporary vegetation. Within sixty (60) calendar days after final grade is established on any portion of a project site, that portion of the site shall be provided with established permanent soil stabilization measures per the original site plan, whether by impervious surface or landscaping.

207-4. PROTECTION AND STABILIZATION OF SOIL STOCKPILES

Fill material stockpiles shall be protected at all times by on-site drainage controls which prevent erosion of the stockpiled material. Control of dust from such stockpiles may be required, depending upon their location and the expected length of time the stockpiles will be present. In no case shall an un-stabilized stockpile remain after thirty (30) calendar days.

207-5. PROTECTION OF EXISTING STORM SEWER SYSTEMS

During construction, all storm sewer inlets in the vicinity of the project shall be protected by temporary erosion and sediment control features found in the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (E&SC Manual) or the city of Clearwater Standard Indices, or equals approved by the City Engineer before installation.

207-6. SWALES, DITCHES AND CHANNELS

All swales, ditches and channels leading from the site shall be sodded within three (3) days after finished grade is established. All other interior swales, etc., including detention areas will be sodded and maintained by the Contractor prior to issuance of a Certificate of Occupancy.

207-7. UNDERGROUND UTILITY CONSTRUCTION

The construction of underground utility lines and other structures shall be done in accordance with the following standards: no more than 400 linear feet of trench shall be open at any one time; and, wherever consistent with safety and space consideration, excavated material shall be cast to the uphill side of trenches. Trench material shall not be cast into or onto the slope of any stream, channel, road ditch or waterway. No trench shall be open at the end of a workday, weekdays, or weekends.

207-8. MAINTENANCE

All erosion and siltation control devices shall be checked daily by the Contractor, especially after each rainfall. The erosion and sedimentation control devices shall be cleaned out and/or repaired as required so sediment removal for the device does not exceed fifty (50) percent of its capacity. Contractor shall prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) Construction Inspection Report on a weekly basis and within 24 hours of a storm that is 0.50 inches or greater. No additional payment will be made to the Contractor for the re-establishment of erosion control devices which may become damaged, destroyed, or otherwise rendered unsuitable for their intended function during the construction of the Project. Near completion of the project, after obtaining written approval by the Engineer, the Contractor shall dismantle and remove the temporary devices used for sediment control during construction. All erosion control devices in seeded areas shall be left in place until the grass is established. Seed areas around devices, and mulch after removing or filling temporary control devices. Cleanup all areas.

207-9. COMPLIANCE

Failure to comply with the aforementioned requirements as determined by the city's project manager or inspector may result in a fine and/or more stringent enforcement procedures such as (but not limited to) issuance of a "Stop Work Order".

208. CONSTRUCTION AND REPAIR OF SEAWALLS AND OTHER BEACH EROSION CONTROL STRUCTURES

208-1. EXISTING SEAWALLS AND REVETMENTS

Existing seawalls and revetments on natural water bodies may be replaced with a revetment or with a vertical seawall with the provision of rip rap placed at the base of the wall up to the mean high water line for the entire length of the seawall. Revetments and seawalls may be replaced with a vertical seawall in manmade water bodies, provided that the seawall is within the property line and maintains the established shoreline.

208-2. TOP OF CAP ELEVATION

The top of cap elevation for all replacement and new seawalls and seawall caps shall not exceed 4.8 feet North American Vertical Datum (NAVD 88) If the top of a seawall cap is constructed at an elevation differing from the adjacent property owner top of cap elevation by greater than one foot, then a return wall is required to sufficiently provide for the break in grade at the property line. Seawalls exceeding 4.8 feet NAVD 88 in height prior to the effective date of this Section may be maintained, repaired, and replaced to their current height.

208-3. SEAWALLS AND REVETMENTS LOCATED SEAWARD OF THE CCL

Seawalls and revetments located seaward of the coastal construction setback line are controlled by regulations of the Division of Beaches and Shores of the Florida Department of Environmental Protection. Replacement of a seawall or revetment that is located seaward of the coastal construction setback line necessitates submission of a permit application to the state department of environmental protection.

208-4. PLACEMENT OF NEW SEAWALL

The placement of a new seawall waterward of an existing seawall is permitted, subject to the following conditions:

- A. A Florida registered professional engineer must certify the new seawall design.
- B. The new seawall shall not extend more than 18 inches from the waterward face of the original alignment of the existing vertical seawall location.
- C. The new seawall shall be placed vertically plumb.
- D. Placing a seawall in front of an existing seawall shall only be permitted once unless the seawall behind the new seawall is removed.
- E. Existing seawall sections that interfere with new seawall location shall be removed.
- F. The new seawall shall include an adequate closure of gaps at each property line.
- G. For zoning purposes, the setbacks for the property will be measured from either the property line or the waterside of the original seawall slab, whichever is more restrictive, and will not be adjusted to accommodate the new seawall addition. For purposes of pier construction, the shore normal dimensions will be measured from the waterside of the original seawall slab.

208-5. POST CONSTRUCTION SURVEY

Prior to final inspection and approval of a new or replacement seawall or seawall cap, a post-construction survey shall be required. Repairs of existing seawalls and seawall caps which do not alter the height or location shall not be subject to this requirement.

208-6. RIP-RAP

On all-natural waterways, an apron of rip-rap shall be placed at the base of all new and repaired seawalls up to the mean high water line for the entire length of the seawall to absorb the wave energy and protect the underlying soft earth or sand from being carried away, as well as to provide habitat for desirable marine species. This rip-rap shall be required at the base of all new seawalls and at the time that an existing seawall is repaired where the replacement constitutes greater than 50 percent of the entire length of the seawall or includes the replacement of a panel.

208-7. RETAINING WALL IN LIEU OF VERTICAL SEAWALL

A retaining wall may be built as an alternative to a vertical seawall, provided that all activities, including dredging, filling, slope grading, or equipment access and similar activities and all portions of the wall are located landward of the mean high water line.

209. MAINTENANCE OF OPERATIONS

209-1. GENERAL

This Section sets forth the requirements for scheduling and performing the work to keep existing utilities in continuous, reliable operation.

The Contractor shall furnish all labor, materials, equipment, and incidentals necessary to maintain existing utilities service during construction. Contractor shall also keep on hand adequate equipment, supplies, and incidentals to repair pipe breaks and to contain and dispose of all spilled materials.

209-2. EXECUTION

- A. Before any work begins, the Contractor shall submit for city review a Maintenance of Flow Plan. The Maintenance of Flow Plan shall include all procedures to be performed by the Contractor to maintain continuous operation of the city's existing utility services. The Plan shall also include emergency response and remedial action measures.

Maintenance of Flow Plan:

1. The Contractor shall prepare a Maintenance of Flow Plan with two points of contact that describes in detail the work that will be performed by the Contractor to maintain continuous operation of the city's existing utility services. Maintenance of Flow Plan shall address the temporary and permanent flow diversion of utilities and other city facilities.
2. Temporary diversion of the utility flows shall be done using a minimum of two (2) bypass pumps (one duty, one standby) to pump from the upstream manhole to the downstream manhole. Bypass pumps shall have hospital grade sound attenuation. The Contractor shall obtain peak wet weather flow rates in the utility from the city and shall demonstrate in the Maintenance of Flow Plan that adequate pumping capacity is provided to accommodate peak wet weather flow. The Contractor and city personnel that are experienced in the

collection system shall determine the float levels in the field, pump on, standby or lag pump on, and high-level alarm. The Contractor shall have full responsibility for the operation and management of the temporary diversion/ bypass. The high-level alarm shall be connected to an auto dialer or remote monitoring system to notify the Contractor of an alarm condition. The bypass pump suction manhole shall use the collection system for a temporary wet well storage; however, surcharging in the existing utility system shall be limited. Once the high-level float alarm is triggered, it shall allow enough time for emergency Contractor personnel to arrive on scene and resolve the problem prior to any utility overflows. The bypass suction and discharge pipes may require the removal of the manhole tops which will result in excess odor escaping from the manholes. The Contractor shall provide a means to seal odors within the bypass manholes to minimize odors during the temporary diversion.

3. The Maintenance of Flow Plan shall include a sequence of construction with projected time, in days, for each step in the sequence.
 4. If the work required to maintain utility operation must occur during evening, night or weekend hours, the Contractor shall notify the affected residents in advance of the projected work. The Contractor shall reimburse the city for overtime work, including inspector overtime, in excess of regular working hours. The Contractor must also get permission from city Project Manager before working outside of Noise Ordinance hours.
 5. Identify the person(s) responsible for executing the Maintenance of Flow Plan and the systems to be put in place for monitoring the existing utility system's ability to maintain flow.
- B. All utility relocation work shall be completed prior to construction. The Contractor shall familiarize himself with the site, including the locations, sizes, and conditions of the existing utilities in and around the work zones where relocation of existing utilities is required. The location of storm sewer inlets, drainage swales, and runoff patterns should be identified, and a Plan developed to contain potential releases.
 - C. The Contractor shall carry out his operations in accordance with all applicable OSHA regulations, including confined space entry requirements, as well as local, city, and state requirements, and in accordance with the approved MOT plan. In addition, the Contractor shall protect the public from harm while performing the work by using barricades, warning lights and other means as necessary.
 - D. The Contractor shall keep existing utilities in service during all phases of construction and coordinate any system shutdowns with the city sufficiently in advance to provide alternative service. The Contractor shall provide a minimum of 10 days' notice. Contractor shall protect the city's utility system for any spills or overflows during construction. The city's Project Manager and Dispatch (727-462-6633) shall be notified of any spills or overflows immediately.
 - E. Any temporary work, facilities, roads, walks, protection of existing structures, piping, blind flanges, valves, equipment, etc. that may be required shall be furnished and maintained by the Contractor. The cost shall be included in the appropriate bid items.
 - F. The Contractor shall schedule the work in such a manner so that all existing utility systems are maintained in continuous operation. All short-term or partial utility system shutdowns shall be approved in writing by the city. If, in the opinion of the city, a shutdown is not required in order for the Contractor to perform the work, the Contractor shall utilize alternative methods to accomplish the work. The city shall be provided a minimum of ten (10) business days' notice of Contractor's need for any existing utility system shutdown or if there is a need of assistance from the Public Utilities Department. Contractor must also provide the city with at least two (2) business days' notice before Contractor is allowed to work at city facilities.
 - G. Required shutdowns shall not begin until all materials are on-hand, pre-assembled, as possible, and ready for installation. Upon commencement of the shutdown period, the Contractor shall proceed with the work continuously, start to finish, until the work is completed, and the system is tested, cleared for service, and ready for operation. If the Contractor completes all required work before

the specified shutdown period has ended, the city may immediately place the system back in service.

- H. The city shall have the sole authority to prohibit or order work stopped. The city reserves the right to cancel scheduled shutdowns if conditions warrant. Delays to the Contractor caused by cancellations will be considered in evaluating requests for a time extension. They will not be considered an entitlement to additional compensation. However, compensation may be considered at city's sole discretion.
- I. During inclement weather, all work which might be damaged or rendered inferior by such weather conditions shall be suspended. The orders and decisions of the city as to suspensions shall be final and binding. During suspension of the work from any cause, the work shall be suitably covered and protected to preserve it from injury by the weather or otherwise, if the city shall so direct surplus materials shall be removed. Contractor shall protect the city's utility system from inflow during inclement weather during the construction.
- J. The Contractor shall submit a Critical Path Method (CPM) work schedule at the pre-construction meeting showing all critical items of work and anticipated shut down times. Note that no activity will be allowed until the CPM is approved by the city or the Engineer of Record (EOR).
- K. Contractor must submit a detailed schedule and process description for proposed testing. Training of all new equipment must be videotaped including two weeks of training prior to startup. If there are multiple sites under the same contract each site startup shall occur as soon as it is complete. If there are multiple shifts at any site(s) where city staff require training, Contractor shall hold multiple trainings convenient for each shift.
- L. Required shutdowns shall not begin until all materials are on-hand, pre-assembled to the extent possible, and ready for installation. Upon commencement of the shutdown period, the Contractor shall proceed with the work continuously, start to finish, until the work is completed, and the system is tested, cleared for service, and ready for operation. If the Contractor completes all required work before the specified shutdown period has ended, the city may immediately place the system back in service.

209-3. BASIS OF MEASUREMENT

There shall be no separate measurement and payment for this task.

210. DETECTION OF FACILITIES

The locations of all existing underground piping, structures, and other facilities are shown based on information received from the respective owner. The locations are shown without express or implied representation, assurance, or guarantee that they are complete, correct, or a represent a true picture of the actual underground facilities to be encountered. It is the Contractor's responsibility to verify the correct location and sizing of all utilities (including connection points).

All appropriate utility companies and agencies shall be contacted 72 hours prior to excavation. Call "One Call"/ "Sunshine 811" at 8-1-1; "Sunshine 811" administrative offices may be reached at (800) 638-4097.

The Contractor shall at all times employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage, or destruction of existing utilities or cause interference.

The Contractor shall conduct exploratory excavations as necessary for the purpose of locating underground pipelines, structures, and utilities in advance of construction. Test pits shall be excavated in areas of potential conflicts between existing and proposed facilities and at piping connections to existing facilities a minimum of 48 hours and 1000 ft in advance of work. If there is a potential conflict, the Contractor shall notify the Owner and Engineer immediately and provide as much information as possible including but not

limited to location, elevation, utility type, material, and size. Test pits shall be backfilled immediately after their purpose has been satisfied. There shall be no additional compensation for exploratory excavations.

211. RELOCATIONS

211-1. RELOCATION SHOWN ON DRAWINGS

Relocations shown on the Drawings: Public utility installations or structures, including but not limited to poles, signs, fences, piping, conduits and drains that interfere with the positioning of the work which are shown on the Drawings to be removed, relocated, replaced or rebuilt by the Contractor shall be considered as part of the general cost of doing the Work and shall be included in the prices bid for the various contract items. No separate payment shall be made, therefore.

All existing castings, including valve boxes, junction boxes, manholes, hand holes, pull boxes, inlets and similar structures in the areas of construction that are to remain in service and in areas of trench restoration and pavement replacement, shall be adjusted by the Contractor to bring them flush with the surface of the finished work.

All existing utility systems which conflict with the construction of the work herein, which can be temporarily removed and replaced, shall be accomplished at the expense of the Contractor. Work shall be done by the utility unless the utility approves in writing that the Work may be done by the Contractor.

211-2. RELOCATIONS NOT SHOWN ON DRAWINGS

Where public utility installations or structures are encountered during the course of work, and are not indicated on the Drawings or in the specifications, and when in the opinion of the city, removal, relocation, replacement, or rebuilding is necessary to complete the work, such work shall be accomplished by the utility having jurisdiction or such work may be requested in writing by the city for the Contractor to perform and fairly compensated once work is complete.

If such work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement, or rebuilding as necessary.

212. RESTORATION PROCEDURES

212-1. INTERIM RESTORATION

All excavations shall be backfilled and compacted as specified by the city and Engineer at the end of each working day. For excavations within existing paved areas, the limerock base or soil cement base shall be spread and compacted to provide a smooth surface free of aggregate material. The Contractor shall keep the site accessible to the city Staff at all times for the purpose of operating and maintaining the existing facility during construction.

All pipe and fittings shall be neatly stored in a location, which will cause the least disturbance to the public. All debris shall be removed and properly disposed of by the end of each working day.

212-2. FINAL RESTORATION

After completing all installations, pressure testing, bacteriological testing, and associated work, final restoration shall be performed. In no event shall final restoration begin after substantial completion. Any

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additional restoration required after testing shall be repaired in a timely manner at no additional cost to the city. Maintenance of all restored facilities shall be the Contractor's responsibility. This maintenance shall be performed on an on-going basis during the course of construction. The Contractor's Progress Schedule shall reflect the above restoration requirements.

300 SERIES: MATERIALS

301. CONCRETE

The Contractor shall notify the Construction Inspector a minimum of twenty-four (24) hours in advance of all concrete placements. Contact Building Inspectors from the city Planning Department if building a structure is required. The Contractor shall give Building Inspectors a minimum of 48 hours in advance to inspect.

Unless otherwise noted elsewhere or directed, the following requirements shall be adhered to:

All concrete work shall be performed in accordance with the latest editions of the Design and Control of Concrete Mixtures by the Portland Cement Association, the American Concrete Institute, and FDOT's Standard Specifications. Unless otherwise specified, all concrete shall have fiber mesh reinforcing and have a minimum compressive strength of 3000 psi at twenty-eight (28) days. The cement type shall be Type I and shall conform to AASHTO M85 latest edition. The aggregate shall conform to ASTM C33 or latest current edition. All ready-mix concrete shall conform to ASTM C94 or latest edition. The slump for all concrete shall be in the range of three inches (3") to five inches (5"), except when admixtures or special placement considerations are required.

All concrete shall be tested in the following manner:

Placement of less than five cubic yards (5 cy) shall be tested at the Engineer's discretion. Otherwise, for each class, for each day, for every fifty cubic yards (50 cy) or part thereof exceeding five cubic yards (5 cy), one set of three (3) compressive strength cylinders will be required (1 at 7 days and 2 at 28 days). At the discretion of the Engineer, unacceptable test results may require the Contractor to provide further tests, as determined by the Engineer, to determine product acceptability, or need for removal, and compensation or denial thereof.

302. EXCAVATION AND FORMS FOR CONCRETE WORK

302-1. EXCAVATION

Excavating for concrete work shall be made to the required depth of the subgrade or base upon which the concrete is to be placed. The base or subgrade shall be thoroughly compacted to a point six inches (6") outside said concrete work before the forms are placed.

302-2. FORMS

Forms for concrete work shall be either wood or metal, except curbs. Curb forms shall be metal only, unless at radius, intermittent sections less than ten (10) linear feet or with written permission from the Engineer. The forms shall be free from warps or bends, shall have a depth equal to the dimensions required for the depth of the concrete deposited against them and shall be of sufficient strength when staked to resist the pressure of concrete without moving or springing.

303. REINFORCEMENT

When required, reinforcement shall be placed in the concrete work. Reinforcement deformation shall be performed as per ASTM A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement or latest edition. Reinforcement steel grades shall be billet intermediate or hard. Twisted Bars shall not be used, Fabric Reinforcement shall conform to the requirements of ASTM A1064

or latest edition that is relevant. Welded deformed steel wire fabric for Concrete reinforcement shall meet the requirements of AASHTO M 221 (ASTM A1064) or latest edition that is relevant. Welded wires shall be elevated with the use of chairs. Epoxy coated reinforcing Steel Bars shall meet ASTM A775/A77 requirements or latest edition.

303-1. BASIS OF PAYMENT

Reinforcement shall not be paid for separately. The cost of such work shall be included in the contract unit price for the item of work specified.

304. BACKFILL

304-1. MATERIALS AND GENERAL

Material for backfill other than under Gabion mattresses shall be carefully selected from the excavated material or from other sources as may be required by the Engineer. Such material shall be granular, free from any deleterious material including but not limited to clay, muck, organic matter or debris, contain no rocks or other hard fragments greater than three inches (3") in the largest dimension and all fill shall be similar material.

Material for backfill under Gabion mattresses shall be an A-1 soil meeting AASHTO M145 (latest edition).

Backfill shall be carried up evenly in layers not exceeding eight inches (8") in thickness and shall be compacted into place by mechanical tamping to 98% before the next layer is applied. A hydro-hammer shall not be used for compaction. Backfill placed around pipes shall be carefully placed below the pipe haunch, around the sides, and top of pipe by hand shovels and thoroughly compacted to twelve inches (12") above the pipe by tamping or other suitable means.

For backfill in small areas that do not permit any type of tamping, Contractor may use flowable fill to achieve required density. Refer to *Section 306* for more details on flowable fill. Where wet conditions are such that dewatering by normal pumping methods would not be effective, as determined by the Engineer, Contractor may use #57 stone (meeting FDOT's specifications) and hand tamping until backfill has reached an elevation and condition such as to make the use of the mechanical tampers practical. Fully wrap the stones with a layer of Type D filter fabric of *FDOT Index 199* (latest edition). Do not place stones within four feet (4') of the ends of trench or ditch; use normally accepted backfill material at the ends.

Where new cast-in-place concrete work is performed, do not place backfill until the specified twenty-eight (28) days compressive strength occurs.

Heavy construction equipment shall not be permitted to cross over pipes or culverts until placing and compacting backfill material to the finished earthwork grade or to an elevation of at least four feet (4') above the top of the pipe or culvert.

The cost of backfill, flowable fill, alternative approved material for wet conditions, and extra dewatering effort to achieve required density, etc., shall be included in the contract unit price or lump sum price for the item of the work specified.

304-2. TESTING AND INSPECTION

Contractor shall employ and pay for the services of an independent testing laboratory, approved by the Engineer, to perform density testing on backfilled material. All testing shall be witnessed by the Engineer's Representative. The test shall be repeated until satisfactory results are obtained. The Contractor shall be charged for all retests and re-inspection services.

Backfill under all types of pavement areas shall be compacted in layers not to exceed 6" in thickness unless an alternate method is approved by the Engineer. Backfill shall be a minimum of 98% compaction as determined by AASHTO T 180 - Modified Proctor Density Test (latest edition) to the bottom of pavement.

Backfill outside of pavement areas shall be compacted to the full depth to the ground surface to a minimum of 95% compaction as determined by AASHTO T 180 - Modified Proctor Density Test (latest edition).

Backfill under buried structures shall be in accordance with these specifications to prevent future subsidence.

Backfill Testing: The Contractor shall demonstrate the adequacy of backfill compaction by performing density testing. For each test location, density testing shall be performed at six-inch (6") lifts. The character of the backfill material will be observed during the excavation for density testing to determine conformance with the specifications. Density testing shall be performed using nuclear field density equipment or conventional weight-volume methods. If the weight-volume method is used, volume shall be determined by using the sand replacement test (ASTM D1556/ D1556M the latest edition) or liquid displacement methods (ASTM D2167 latest edition). If nuclear methods are used, the trench correction effect shall be accounted for by recalibrating the nuclear gauge on its calibration block at the location of each test prior to taking the density measurement. The Contractor shall furnish all equipment, tools, and labor to prepare the test site for testing.

Normal Testing Frequency: One test shall be performed for each one hundred feet (100') of backfill or fraction thereof or for each single run of pipe/culvert connecting two (2) successive structures whichever is less. The location of the test within each section shall be selected by the Engineer's Representative. Testing shall progress as each one hundred-foot (100') section is completed. Four (4) tests equally spaced around each structure shall be performed on each six-inch (6") lift. Testing which indicates that unacceptable material has been incorporated into the backfill, or that insufficient compaction is being obtained shall be followed by expanded testing to determine the limits of the unacceptable backfill.

Expanded Testing Requirements: If normal testing within a testing section indicates unacceptable backfill, the Engineer's Representative may require additional testing within the same test section to determine the limits of unacceptable backfill. Additional testing required by the Engineer's Representative shall be paid for by the Contractor and shall not exceed testing of four (4) additional locations within the test section. Unacceptable backfill within the limits established by the testing shall be removed and replaced by the Contractor at no additional cost to the city. Additional testing beyond that required may be performed by the Contractor at his expense to further delineate limits of unacceptable backfill.

305. RIPRAP

The work included in this specification includes the construction of riprap as shown on the plans. The riprap shall be constructed per *Section 530 of FDOT's Standard Specifications* (latest edition).

305-1. BASIS OF MEASUREMENT

The basis of measurement for riprap will be weight, in tons, in surface dry natural state. The scales must be calibrated and certified by an independent party and carry a state certification.

305-2. BASIS OF PAYMENT

The pay item for sand-cement riprap shall include: all materials, testing, labor, grout, hauling, equipment, excavation, backfill, dressing and shaping for placement of sand-cement and all incidentals necessary to complete the work.

The pay item for rubble riprap shall include: all materials, required bedding stone, dressing and shaping for placement of bedding stone, filter fabric, testing, hauling, excavating, backfill, dressing and shaping for placement of rubble, and all incidentals necessary to complete the work. No payment will be granted if concrete or stone that exists on-site is used as rubble riprap.

306. FLOWABLE FILL

Flowable fill is used in backfill and to fill all abandoned pipelines that are not removed. Mains that need to be abandoned shall be cut, capped, and filled with flowable fill meeting the requirements specified herein. Flowable fill shall adhere to Section 121 of FDOT specifications (latest edition).

The Contractor shall be responsible for producing a flowable mixture using these guidelines and adjusting his mixture design as called for by circumstances or as may be directed by the Engineer.

General mix requirements are as follows:

Components	Excavatable	Non Excavatable	Cellular Concrete
Cement (lb/yd ³)	75-100	75-150	Min 150
Supplementary Cementitious Materials (lb/yd ³)	None	150-600	
Fine Aggregate	*	*	*
Water	**	**	**
Air	5-35%	5-15%	***
Unit Weight (lb/ft ³)	90-110	100-125	20-80
28 Day Compressive Strength	****	****	****

* Fine aggregate shall be proportioned to yield 1 cubic yard (yd³).

** Mix design shall produce a consistency that will result in a flowable self-leveling product at the time of placement

*** In cellular concrete, preformed foam shall be proportioned at the jobsite to yield 1 cubic yard in accordance with design requirements

**** The requirements for percent air, compressive strength, and unit weight are for laboratory designs only and are not intended for jobsite acceptance requirements

Weights for fine aggregate and water shall be adjusted according to cementitious content. The mix proportions shall be adjusted for removability, pumpability and flowability. If required, strength test data shall be provided prior to batching.

If required by the Engineer, the flowability can be measured by afflux time determined in accordance with ASTM C939/ C939M – 16a (latest edition) and shall be 30 seconds +/- 5 seconds as measured on mortar passing the No. 4 sieve. The equipment required to perform this test shall be provided by the Contractor.

The Contractor shall flush all raw sewage, sludge, debris, and water from the force mains prior to filling pipeline with flowable fill. If not discharged into a sanitary sewer system, the Contractor shall collect all flushing water and dispose of at a wastewater treatment facility. City Public Utilities Department IPP Coordinator and Director and/or Assistant Director must approve of the discharge into the collection system or wastewater treatment plant.

The Contractor must locate and verify all connections of the piping before filling the pipeline with flowable fill to avoid redirection and reconnection and report them to the Engineer. During placement of fill, compensate for irregularities in sewer pipe, such as obstructions, open joints, or broken pipe to ensure no voids remain unfilled.

Clean placement areas of sewer and water lines of debris that may hinder fill placement. Remove excessive amounts of sludge and other substances that may degrade performance of fill. Remove free water prior to starting fill placement.

All proposed new force mains shall be installed, pressure tested, and placed in-service prior to abandoning the existing force mains. All pipes shall be abandoned in a manner which results in the abandoned pipeline not being pressurized.

Flowable fill shall be produced and delivered using concrete construction equipment. Placing flowable fill shall be by chute, pumping or other methods approved by the Engineer.

The flowable fill shall be placed to the designated fill line without vibration or other means of compaction. Placement shall be avoided during inclement weather, e.g. rain or ambient temperatures below 40°F. The Contractor shall take all necessary precautions to prevent any damages caused by the hydraulic pressure of the fill during placement prior to hardening. Also, necessary means to confine the materials within the designated space shall be provided by the Contractor.

During placement of the fill, the Contractor is to avoid construction stoppage that would exceed the working time of the fill. If for any case that the fill would harden, the Contractor is responsible for properly installing fill into the abandoned pipeline from another location and shall meet the requirements specified herein.

A city Engineering Department Representative shall be present to witness the placement of flowable fill in abandoned pipelines. A 48-hour notice shall be given to the city before the placement of fill.

The flowable fill shall be proportioned and placed as specified herein. In general, the strength desired is the maximum hardness that can be excavated at a later date using conventional excavating equipment. No curing protection is required.

The fill shall be left undisturbed until material obtains sufficient strength. Sufficient strength is a minimum of 150 psi penetration resistance as measured using a handheld penetrometer. The penetrometer shall be provided by the Contractor.

All flowable fill areas subjected to traffic loads must have a durable riding surface.

Payment of the applicable lump sum price shall be full compensation for furnishing all labor, materials and equipment necessary and will include, but is not limited to the necessary costs associated with the installation of the flowable fill as shown in the Drawings and as described in the Contract Documents.

307. MATERIAL INDEPENDENT TESTING

The city shall have the right to have an independent testing laboratory select, test, and analyze, at the expense of the city, test specimens of any or all materials to be used. The results of such tests and analyses shall be considered, along with the tests or analyses made by the Contractor, to determine compliance with the applicable specifications for the materials so tested or analyzed. The Contractor hereby understands and accepts that wherever any portion of the work is discovered, as a result of such independent testing or investigation by the city, which fails to meet the requirements of the Contract documents, all costs of such independent inspection and investigation as well as all costs of removal, correction, reconstruction, or repair of any such work shall be borne solely by the Contractor.

400 SERIES: SANITARY SEWER

401. SANITARY MANHOLES

401-1. BUILT UP TYPE

Manholes shall be constructed of brick with cast iron frames and covers as shown on the drawings. Invert channels shall be constructed smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made in a smooth curve of as large a radius as possible. Changes in size and grade of channels shall be made gradually and evenly. Invert channels shall be formed by one of the following methods: formed directly into concrete manhole base, build up with brick and mortar, or lay half tile in concrete. For invert channels formed using the brick and mortar, or the half tile in concrete approaches the entire bench and channel area will be coated with a minimum of one-half inch of Xypex Megamix II or approved equal.

The manhole floor outside of channels shall be made smooth and sloped toward channels. Free drop in manholes from inlet pipe invert to top of floor outside the channels shall not exceed 12 inches (12”).

Standard Drop Manholes shall be constructed wherever free drop exceeds twelve inches (12”). Doghouse manholes and flat top manholes are not permitted. If a drop manhole is needed, only outside drop manholes allowed.

Manhole steps shall not be provided. Joints shall be completely filled with mortar, shall be smoothed from inside of manholes.

The entire interior and exterior of brick manholes shall be plastered with one half inch (1/2”) of Mega Mix II with Bio San as supplied by Xypex or approved equal.

Brick used may be solid only. Brick shall be laid radially with every sixth course being a stretcher course.

Maintenance of Flow Plan:

1. The Contractor shall prepare a Maintenance of Flow Plan that describes in detail the work that will be performed by the Contractor to maintain continuous operation of the city’s existing utility services. Maintenance of Flow Plan shall address the temporary and permanent flow diversion of gravity sewers and service laterals.
2. Temporary diversion of the gravity sewer flows shall be done using bypass pumps (one duty, one standby) to pump from the upstream manhole to the downstream manhole. Bypass pumps shall have hospital grade sound attenuation. The Contractor shall obtain peak wet weather flow rates in the gravity sewer from the city and shall demonstrate in the Maintenance of Flow Plan that adequate pumping capacity is provided to accommodate peak wet weather flow. The Contractor and city personnel that are experienced in the collection system shall determine the float levels in the field, pump on, standby or lag pump on, and high-level alarm. The high-level alarm shall be connected to an auto dialer to notify the Contractor of an alarm condition. The bypass pump suction manhole shall use the collection system for a temporary wet well storage; however, surcharging in the existing sewer system shall be limited. Once the high-level float alarm is triggered, it shall allow enough time for emergency Contractor personnel to arrive on scene and resolve the problem prior to any sanitary sewer overflows. The bypass suction and discharge pipes may require the removal of the manhole tops which will result in excess odor escaping from the manholes. The contractor shall provide a means to seal odors within the bypass manholes to minimize odors during the temporary diversion.
3. The Maintenance of Flow Plan shall include a sequence of construction with projected time, in days, for each step in the sequence.

4. If the work required to maintain utility operation must occur during evening, night or weekend hours, the Contractor shall notify the affected residents in advance of the projected work. The Contractor shall reimburse the city for overtime work, including inspector overtime, in excess of regular working hours. The Contractor must also get permission from city Project Manager before working outside of Noise Ordinance hours.
5. Identify the person(s) responsible for executing the Maintenance of Flow Plan and the systems to be put in place for monitoring the existing utility system's ability to maintain flow.

401-2. PRECAST TYPE

Precast Sanitary Manholes shall conform to this specification unless otherwise approved by the City Engineer.

AASHTO M 85 Type II cement, with Xypex Admix C-1000R or approved equal, shall be used throughout with a minimum wall thickness of five inches (5"). The precast sections shall conform to ASTM C478 (latest edition). Section joints shall be a tongue and groove with "ram neck" gasket, Pro Stik Butyl Sealant or "O" ring to provide a watertight joint. Caulking of joint shall not be allowed. Minimum concrete strength shall be 4000 psi at 28 days. Xypex admixture must be added to the concrete at the time of batching. Under normal conditions, the crystalline powder shall be added to the concrete mix at the following rates:

1. Xypex Admix C-1000R 3.5 % by weight of cement content

Note: For enhanced chemical protection or for meeting specific project requirements or where the concrete mix design contains higher than 25% type F fly ash content or includes a Portland cement/slag cement/type C fly ash blend, consult with manufacturer or its authorized representative to determine appropriate dosage rates.

One set of shop drawings and location inventory shall be submitted to the city Project Manager and Engineer of Record for approval. Approval of shop drawings does not relieve Contractor of responsibility for compliance to these specifications unless letter from Contractor requesting specific variance is approved by the City Engineer.

Location inventory submitted with shop drawing shall detail parts of manhole per manhole as numbered on the construction plans. All manhole parts shall be numbered or lettered before being sent to the job site to permit proper construction placement. A plan or list of the numbering system shall be present on the job site when manhole components are delivered. Precast manhole dimensions, drop entry, grout flow of channel, etc., shall be as shown on city of *Clearwater Engineering Index 302 Sheets*.

Manhole sections shall be rejected if abused during shipping or placement and if pipe openings are not properly aligned. The "break in" to precast manholes for pipe entry will not be allowed. The manhole base shall be set on a pad of A 1 or A 2 Classification compacted soil approximately five inches (5") thick as referenced in *Section 304-2* and twelve inches (12") of # 57 grade stone, wrapped in geotextile to secure proper seating and bearing. Refer to these Technical Specifications, *Section 304* for backfill and compaction requirements.

401-2.1. MANHOLE ADJUSTMENT RINGS (GRADE RINGS)

Between the top of the manhole cone/corbel and the manhole cover frame, a manhole adjustment ring shall be installed. The intent of the manhole adjustment ring is to accommodate future grade changes without disturbing the manhole. See *Section IV, Section 703-7, Asphaltic Concrete – Adjustment of Manholes*. All final grade adjustment of manhole covers, and frame assemblies shall be completed utilizing injection molded high density polyethylene (HDPE) adjustment rings as manufactured by LADTECH, Inc. or an approved equal. The adjustment rings shall be manufactured from polyethylene plastic as identified in ASTM Specification D4976 (Standard Specification for Polyethylene Plastic Molding and Extrusion

Materials) the latest edition. Material properties shall be tested and qualified for usage per the ASTM Test Methods referenced in the above ASTM standard. The adjustment rings shall be molded from 100% recycled material. The plastic rings shall be manufactured utilizing the injection molding process as defined by SPE (Society of Plastic Engineers). The adjustment rings shall be tested to assure compliance with impact and loading requirements per the AASHTO Standard Specification for Highway Bridges latest edition. Installation shall be per manufacture's recommendations for vacuum test installations only. The annular space between the rings and cone basin, the rings, and the rings and cover frame shall be sealed utilizing an approved butyl rope (not caulk) sealant. All adjustment for matching road grade shall be made utilizing a molded and indexed slope ring. All grade rings shall be covered by the LADTECH, Inc. warranty or one of equal terms and duration. Grade rings shall be Traffic Rated AASHTO HS-20 (latest edition).

401-2.2. STAINLESS STEEL MANHOLE STORM WATER INFLOW ABATEMENT INSERTS (DISH/PAN)

401-2.2.1. MATERIALS AND DESIGN

General: The insert, gasket and relief valve shall be manufactured of materials resistant to corrosion from atmospheres containing hydrogen sulfide and dilute sulfuric acid.

Insert: The insert body shall be manufactured of 304 stainless steel with a thickness of not less than 18 gauge. The insert shall have straight sides designed to allow a loose fit into the ring for easy removal. The insert manufacturer must furnish a "load test verification" showing a load test failure in excess of 3000 lbs. For added strength, no less than three (3) ribs shall be stamped in bottom of the insert.

Gasket: The gasket shall be extruded onto the stainless dish with a Synthetic elastomer having the following physical properties:

Tensile Strength: 335 psi - ASTM D412 Elongation 400-600% - ASTM D412 Shore Hardness: 25 Shore A - ASTM D2240 Adhesion to Stainless: 580 psi - ASTM D454 I/D7234 (Use latest edition)

Relief Valve: The gas relief valve shall be designed to release at a pressure of .5 to 1.5 PSI and have a water leak down rate no greater than 5 gallons per 24 hours. The valve shall be installed in the insert by means of a hole tapped in the insert by the manufacturer. The valve shall be made of nitrite for prevention of corrosion from contact with hydrogen sulfide, dilute sulfuric acid and other gases associated with wastewater collections systems.

Handle: The dish shall have a handle of 3/16" plastic-coated stainless-steel cable installed on the body of the dish. The handle shall be attached with a #6 high-grade stainless-steel rivet. The cable shall be braided in a manner which resists cutting with common bolt cutters. The cable terminal and eye shall be stainless steel.

Manhole Frames: Manhole frame sizes vary, and the city will provide the successful bidder with specific dimensions and number of required inserts for each manhole frame size. Maximum insert outside diameter (OD) will not exceed 26.5 inches nor be less than 23 inches. Most frames have an outside diameter of 23.5 inches with a clear opening of 21.5 inches.

401-2.2.2. MEASUREMENT AND PAYMENT

Payment of each inflow abatement insert shall be full compensation for furnishing all labor, materials and equipment necessary but not limited to the costs associated for the installation of the sanitary manholes' pans/dishes.

401-3. DROP MANHOLES

Standard drop inlets to manholes shall be constructed of commercial pipe, fittings, and specials as detailed on the drawings. Only outside drop manholes allowed.

401-4. FRAMES AND COVERS

Manhole frames and covers shall be set in a full bed of mortar with the top of the cover flush with or higher than finished grade as directed. Refer to *Clearwater Standard Detail Index 301*.

401-5. MANHOLE COATINGS

The exterior of all precast manholes shall not require any specific coating. The interior shall be coated with either Spraywall®, Polyurethane or Raven 405 Epoxy at the direction of the city at a thickness not less than 125 mil. For new manholes install geotextile wrap at the joints.

401-6. CONNECTIONS TO MANHOLES

Connections to existing sanitary manholes using approved PVC sewer main shall be made with a manhole adapter coupling by NPC Kor-N-Seal® with stainless steel bands or approved equal water stop coupling.

401-7. MEASUREMENT AND PAYMENT

Payment of each inflow abatement insert shall be full compensation for furnishing all labor, materials, and equipment necessary but not limited to the costs associated for the installation of the sanitary manholes.

402. RAISING OR LOWERING OF SANITARY SEWER STRUCTURES

Sanitary Sewer Structures shall be raised or lowered as indicated on the plans or as indicated by the Engineer.

402-1. BASIS OF PAYMENT

Payment, unless covered by a bid item, shall be included in the cost of the work.

403. SANITARY SEWERS AND FORCE MAINS

403-1. MATERIALS

403-1.1. GRAVITY SEWER PIPE

GRAVITY SEWER PIPE SHALL BE POLYVINYL CHLORIDE OR DUCTILE IRON. All polyvinyl chloride mains (pipe and fittings) shall be at least 6-inch-diameter, SDR 26, and conform to ASTM D3034; laterals can be four-inch (4'') PVC schedule 40. Pipe and fittings shall be plainly marked with the ASTM designation. Strong back stainless steel Fernco is required for all non-mechanical PVC connections. The bell end of joints and fittings shall have a rubber sealing ring to provide a tight flexible seal in conformance with ASTM D3212 (latest edition). The laying length of pipe joints shall be a maximum of twenty feet (20').

Unless otherwise noted in these specifications or the construction plans, ductile iron pipe and fittings for gravity sewer shall conform to *Section 502-2.1* of these Technical Specifications for DIP water main except the pipe interior shall be lined with Protecto 401 ceramic epoxy in accordance with manufacturer's recommendations. Where sanitary sewer main is to be placed between buildings lots in a sideline easement, the sewer main shall, insofar as possible, be constructed without manholes or lateral connections within the side easement. A two-way cleanout shall be installed on each lateral at the property line.

403-1.2. FORCE MAIN PIPE

FORCE MAIN PIPE SHALL BE POLYVINYL CHLORIDE, DUCTILE IRON OR HDPE. Unless otherwise noted in the specifications or construction plans, polyvinyl chloride, ductile iron and HDPE force main pipe and fittings shall conform to *Section 502-2.1* and *502-2.2* of these Technical Specifications for water main pipe except that DIP shall be lined with Protecto 401 ceramic epoxy in accordance with manufacturer's recommendations. All polyvinyl chloride pipe which has become deteriorated due to exposure to ultraviolet radiation shall be rejected.

403-2. INSTALLATION

403-2.1. GRAVITY SEWER PIPE

Installation of Thermoplastic gravity sewer pipe shall be in conformance with recommended practices contained in ASTM D2321 (latest edition).

The bottom trench width in an unsupported trench shall be limited to the minimum practicable width (typically pipe OD plus eight inches (8") to twelve inches (12") on each side) allowing working space to place and compact the haunching material. The use of trench boxes and movable sheeting shall be performed in such a manner that removal, backfill and compaction will not disturb compacted haunching material or pipe alignment.

Dewatering of the trench bottom shall be accomplished using adequate means to allow preparation of bedding, placement of the haunching material and placement of the pipe in the trench without standing water. Dewatering shall continue until sufficient backfill is placed above the pipe to prevent flotation or misalignment.

Where pipe bedding is insufficient to adequately support the pipe, the Contractor will be required to remove unsuitable material and pipe bedding and replace with Class I material (one half inch (1/2") diameter aggregate) to provide firm support of the pipe.

The laterals shown on the plans do not necessarily reflect exact locations. The Contractor is required to locate all existing laterals for reconnection and to coordinate with the construction inspector, the location of all new laterals.

403-2.2. FORCE MAIN PIPE

Installation of force main pipe shall be in conformance with *Section 503* of these Technical Specifications for water main pipe.

403-3. INSPECTIONS OF LINES AND MANHOLES

- A. Inspection of completed lines and manholes shall be scheduled within a reasonable time after construction or when required by the Engineer. Before scheduling an inspection, the Contractor shall prepare the lines by cleaning and flushing. Manholes shall be clean, finished, and free of leaks.
- B. Manholes shall be on a true and uniform grade. The inverts shall have a smooth steel troweled finish. All benches shall be uniformly sloping. The frames shall be tight and properly set in mortar

on solid masonry. The invert, benches and adjacent pipe shall be free of splattered mortar. All required interior lining or paint shall be kept intact. Manhole frames shall be adjusted to grade with the covers and frames cleaned and free of mortar and asphaltic mixtures. All precast manhole seams shall be filled with an approved asphaltic compound.

- C. Pipe between manholes shall be true to line and grade. Dips and sags with one inch or more of trapped water shall be cause for rejection. Air testing may be required also at the Contractor's expense. Contractor shall provide personnel to assist with inspections.
- D. The Contractor shall provide city Public Utilities Department and the Engineer with a Television Inspection of the completed gravity sewers in accordance with the following:
 1. Shall be performed by a National Association of Sewer Service Companies (NASSCO) Pipeline Assessment & Certification Program (PACP) Certified Operator who will use software that is compatible with CUES Granite products latest version software to NASSCO PACP Standards.
 2. Shall be submitted as digital media that includes video and data base file in PACP format and include a printed copy of the PACP television inspection log.
 3. Shall perform a manhole inspection and provide a completed NASSCO Manhole Inspection form (latest version) for each manhole that is inspected
 4. All pertinent data recorded in audio on the media to include:
 - a. Subdivision name and phase number.
 - b. Manhole numbers (these numbers must match manhole numbers on “as built” and record drawings).
 - c. Date of inspection
 - d. Size and material of pipe
 - e. Service connection locations, right or left
 - f. All distances between manholes
 - g. Locations of suspected and obvious pipe deficiencies (i.e., bad joints, breaks or leaks, etc.)
 5. PVC pipe shall have a deflection test using a seven and one-half percent (go-no-go) test mandrel of appropriate size, which shall be visible on video at all times.
 6. The printed NASSCO PACP television report (indicating manhole numbers) which will accompany the media. This written report must include:
 - a. Manhole numbers (these numbers must match manhole numbers on "as-built" and record drawings).
 - b. Service connection locations, right or left.
 - c. Reference to service connection locations out of manholes.
 - d. Locations of suspected and obvious pipe deficiencies (i.e., bad joints, breaks or leaks, etc.).
 - e. Depth of each manhole.
 - f. Actual measured distance (on ground) between manholes.
 7. All visual and television inspections shall be completed by the contractor and approved by city Public Utilities Department and Engineer after the road base has been constructed but prior to the placing of any asphalt.
 8. Television Inspection Media must clearly show details of structural defects, misalignments and infiltration.

403-4. TESTING

403-4.1. TESTING OF GRAVITY SEWERS

The Contractor shall take all precautions to secure a perfectly watertight sewer under all conditions. The water tightness of a sewer which has a crown lying below groundwater level shall be tested by measuring infiltration. The water tightness of sewers having crowns lying above groundwater level shall be tested by filling the pipe with water so as to produce a hydrostatic head of two feet or more above the crown of the sewer at the upper end of the test section or the water table outside of the sewer, whichever is higher, and then measuring the exfiltration. In no case shall the infiltration or exfiltration exceed fifty (50) gallons per inch of diameter per mile per day. The Contractor shall furnish all labor, materials and equipment to test the amount of infiltration or exfiltration under the Engineer's direction. Where the infiltration or exfiltration is excessive, the Contractor at their own expense shall take the necessary steps to remedy such conditions by uncovering the sewer, remaking the joints or by replacing the entire length of sewer as required by the Engineer. No such repaired joints may be backfilled until after they have been tested and found to be acceptable. Care shall be taken to avoid flotation. The Contractor shall TV inspect all mains and provide to the Engineer to verify the true and uniform grade and the absence of bellies or dropped joints prior to acceptance. Any dips or sags of more than five percent (5%) of the pipe inside diameter (ID) dimension from its design alignment shall be cause for rejection. The above tests shall be performed at the discretion of the Engineer on any or all sections of the line.

403-4.2. TESTING OF FORCE MAINS

Force mains shall be tested under a hydrostatic pressure of 150 psi for two (2) hours, as described in Section 504 of these Technical Specifications for the testing of water mains.

403-5. BASIS OF PAYMENT

403-5.1. GRAVITY SEWER PIPE

Payment for in place sanitary sewer gravity main pipe shall be the unit price per linear foot per appropriate range of depth of cut as contained in the contract bid. Measurement for payment shall be along the centerline of the sewer main from center to center of manholes. Payment for laterals shall be the unit price per linear foot of pipe as measured from the centerline of the sewer main pipe to the terminal end of the lateral pipe including a two-way cleanout at the property line.

Payment for sewer pipe shall include all labor, equipment, and materials necessary to complete the installation. This shall include clearing and grubbing, excavation, shoring and dewatering, backfill and grading.

403-5.2. FORCE MAIN PIPE PAYMENT

Payment and measurement of force main pipe shall be the same as described in *Section 506* of these Technical Specifications for water main pipe.

404. CURED-IN-PLACE PIPE SANITARY SEWER REHABILITATION

404-1. GENERAL

It is the intention of this specification to provide for the trenchless restoration of sanitary sewers, mains and service laterals, by the installation and curing of a resin impregnated felt tube/cured-in-place pipe (CIPP) liner. The liner shall be jointless, continuous from manhole to manhole, watertight and chemically resistant to withstand exposure to domestic sewage. Installation and curing shall include all labor, materials and equipment to provide for a complete, fully restored and functioning installation. Any proposed installer/contractor, or liner system, must be pre-approved by the city prior to receiving bids.

The installer must be certified by the liner system manufacturer for installation of the liner system. The city reserves full and complete authority to approve the satisfactory nature of the both the liner system and the installer.

The contractor shall provide trenchless reconstruction of service laterals and mainline sewers. The contractor shall have the capability of performing city's selected services which include televised inspection, data collection, system flow analysis, and pipeline reconstruction.

The contractor shall employ adequate staff to perform the services required, staff should include Project Representative, Project Manager, Field Supervisor and Senior Foreman. Field supervisory personnel employed by the CIPP Contractor will have at least five (5) years of experience in the performance of the work and tasks as stated in the Contract Documents.

Staff shall be proficient and experienced in all phases of services mentioned.

The contractor shall perform all work and shall be a licensed Contractor for these services.

The contractor shall be certified in confined space entry (OSHA) and traffic control.

The contractor shall provide services that include safety measures for both the public and workers, including traffic control, and shall coordinate all scheduling with the city.

The contractor shall work with the city in establishing priorities and in preparing work assignments.

The contractor shall be completely responsible for the control of the environment of the work site during on-site operations. All precautions shall be taken by the selected contractor to protect the workers, public and city staff from the exposure to harmful or hazardous substances with the sewer system.

The contractor shall be responsible for the transport and disposal of all waste materials. The selected contractor shall be responsible for all waste material spills and clean-up in the loading, hauling, and unloading of the contractor's equipment.

The contractor shall be responsible for conforming to any and all requirements regarding hauling and disposal of sewer wastes from each city's work site in accordance with OSHA regulations and those that may be mandated by the Federal or State Governments. The contractor shall ensure that all waste material transporters possess all required local, state and federal transportation permits and that they comply with all local, state and federal regulations, including but without limitation, 40 CFR Part 263, "Standards Applicable to Transporters of Hazardous Wastes" and Chapter 17-730, Part 3, Florida Administrative Code, as may be amended from time to time.

The contractor shall inform the city of its planned work schedules and shall afford the city reasonable opportunity to observe and inspect the contractor's work in process. The city will be advised of all schedule changes and notified when a work site is left for a 24-hour period when work is not complete.

The contractor shall report to city's Inspector their daily progress.

Work hours shall be from 7:00 AM to 3:30 PM Monday through Friday unless authorized in writing by the city's Project Manager.

404-2. MEASUREMENT & PAYMENT

Payment for sanitary sewer rehabilitation using the cured-in-place product shall be made per linear foot including all preparation, installation, curing, flow maintenance, lateral reconnection, submittals, light cleaning (3 passes of cleaning head) of piping, material removal & disposal, CCTV inspection/reporting (pre & post installation) sealing of all leaks, connection to all manholes, traffic control on city streets, testing such as infiltration and/or exfiltration, provision of equipment, labor, materials, operations, restoration, etc., to provide a fully completed and operational sewer.

Payment shall be measured from center of manhole to center of manhole for the sanitary sewer mains and from the connection to the main to the terminus of the liner for service laterals.

404-3. SUBMITTALS

The Contractor shall submit the following information:

1. Manufacturer's certification that the materials to be used meet the referenced standards and these specifications.
2. License or certificate verifying Manufacturer's/Licenser's approval of the installer.
3. Proposed equipment and procedures for accomplishing the work.
4. Lining Manufacturer's product data and instructions for resin and catalyst system.
5. Design Calculations, in accordance with the Appendix of ASTM F1216 or latest edition, for each length of liner to be installed including the thickness of each proposed CIPP. It will be acceptable for the Contractor to submit a design for the most severe line condition and apply that design to all of the line sections. To be completed and certified by a Professional Engineer proficient in the design of pipeline systems. All calculations shall include data that conforms to the requirements of these specifications.
6. A detailed installation plan describing all preparation work, cleaning operation, pre-closed-circuit television (CCTV) inspections, flow maintenance, traffic control, installation procedure, method of curing, service reconnection, quality control, testing to be performed, final CCTV inspection, and all else necessary and appropriate for a complete CIPP liner installation.
7. Tube wet-out and cure method including: a complete description of the proposed wet-out procedure, manufacturer's recommended cure method- for each diameter and thickness of CIPP liner to be installed, and detailed curing procedure detailing the curing medium and the method of application.
8. A detailed installation schedules.
9. All SDS sheets for all materials to be furnished for the project.
10. Weekly work schedules shall be submitted no later than close of business on proceeding Thursdays for the work on the following week. Scope of the schedule shall include the following: cleaning operations, CCTV pre & post operations, lining, and crew leader's information including phone number.

404-4. CURED-IN-PLACE PIPE (CIPP) FOR GRAVITY SEWER MAINS

404-4.1. LINER MATERIAL

The liner material shall be an epoxy, vinyl ester or polyester fiber felt resin-impregnated tubing or city Engineering Department approved equal, sized to tightly fit the internal circumference and length of the designated gravity sewer. The cured liner shall meet the minimum initial structural properties as listed in ASTM F1216. The liner shall be designed in accordance with the Appendices in ASTM F1216. It shall be assumed that a fully deteriorated gravity sewer pipeline having no structural strength will be rehabilitated with H-20 traffic loading, the water table's at the ground surface and the product installed will have a minimum expected lifetime of fifty (50) years. In no case shall the liner thickness be less than six millimeters (6 mm) for pipe sizes six inches (6'') through eight inches (8'') and 7.5 millimeters for pipe sizes ten inches (10'') through twelve inches (12'') in diameter. Minimum liner thickness for pipes greater than twelve inches (12'') shall be as specified by the city. Liner shall be sized by Contractor to provide a tight fit to the inside circumference of the host pipe and shall be a continuous jointless lining from manhole to manhole.

Unless otherwise specified, the Contractor shall use an epoxy vinyl ester or polyester resin and catalyst system, and a fiber felt tube compatible with the inversion or other approved alternate installation process and having the following minimum physical properties for the cured pipe:

PROPERTY VALUE	TEST METHOD	MINIMUM (psi)
Tensile Strength	ASTM D638 or latest edition	3,000
Flexural Strength	Modified ASTM D790 or latest edition	4,500
Flexural Modulus of Elasticity	Modified ASTM D790	250,000
Long-Term (50 year) Modulus of Elasticity	ASTM D7790 or latest edition	125,000

The epoxy vinyl ester or polyester resin and fiber felt tubing system shall be in accordance with the requirements of ASTM F1216 and be fabricated to a size that, when installed, will neatly fit the interior of the host pipe. Allowance shall be made for circumferential stretching during a direct (non-inversion) pull in. The CIPP product shall fit tightly to the host sewer pipe (with minimal shrinkage) in such a way as to minimize water migration (tracking) between the liner and the host pipe. A vacuum impregnation process shall be used in conjunction with a roller system to achieve a uniform distribution of the resin throughout the tube under controlled conditions. The volume shall be adjusted by adding five to ten (10) percent excess resin for the change in resin volume due to polymerization and to allow for any migration of resin into cracks or joints in the host pipe.

The outside of the fabric tube shall be marked every 5 feet with the name of the manufacturer or CIPP system, manufacturing lot and production footage.

404-4.2. CHEMICAL JOINT, CRACK AND ANNULAR SPACE SEALING MATERIALS FOR ACTIVE LEAKS AND SERVICE LATERAL CONNECTIONS

Chemical joint and crack sealing materials shall have the following properties:

1. React quickly to form a permanent watertight seal
2. Resultant seal shall be flexible and immune to the effects of wet/dry cycles
3. Non-biodegradable and immune to the effects of acids, alkalis, and organics in sewage
4. Component packaging and mixing compatible with field conditions and worker safety

5. Extraneous sealant left inside pipe shall be readily removable; and shall be compatible with the repair resin utilized.

Chemical joint sealing material shall be acrylic resin type and shall be furnished with activators, initiators, inhibitors, and any other materials recommended by the manufacturer for a complete grout system. Sealing grout shall be furnished in liquid form in standard manufacturer's containers.

404-4.3. MANHOLE CONNECTIONS

A seal, consisting of a resin mixture or hydrophilic seal compatible with the installed CIPP shall be applied at manhole walls in accordance with the CIPP System manufacturer's recommendation. Cost associated with manhole seals shall be included in the contract price of CIPP installation.

404-4.4. INSTALLATION AND EXECUTION

404-4.4.1. CLEANING/SURFACE PREPARATION

It shall be the responsibility of the Contractor to clean and prepare the existing pipes for rehabilitation. The Contractor shall perform light cleaning (3 passes of the jet head) using a jetting system capable of providing 60 gallons of flow at 3,000 psi. After light cleaning has been completed the Contractor shall attempt a pre-installation CCTV inspection. If the Contractor believes that the piping requires additional cleaning the collected CCTV video will be provided to the Inspector before beginning any heavy cleaning of the piping. Light cleaning is included in the cost of liner installation and heavy cleaning will be measured as a separate pay item. The Contractor will thoroughly clean the interior of the sewers to produce a clean interior surface free of all coatings, sand, rock, roots, sludge, or other deleterious materials prior to liner insertion. Flow maintenance will be provided by the Contractor as required. Bypass operations are to be so arranged as to cause minimum disruptions to local traffic, residents and commercial facilities. During the cleaning and preparation operations all necessary precautions shall be taken to protect the public, all property and the sanitary sewer facilities from damage.

All material removed from the sewers shall be the Contractor's responsibility for prompt disposal in accordance with all regulatory agency requirements. The Contractor may be required to control the rate of sewer cleaning in the sanitary system to avoid heavy pollution loads at the city's treatment plants.

404-4.4.2. TELEVISION INSPECTION

After cleaning, and again after the rehabilitation work on each section of pipe is completed, all pipe sections shall be visually inspected with a digital CCTV camera and recorded in DVD format. Cost of CCTV inspections is included in the cost of pipe lining CCTV data shall be provided to the city designated Project Manager. Asset Management (OWAM) software. This section describes the requirements of the Contractor in providing the following minimum requirements for video capture, photo capture and database structure to the city. The city is currently using CUES Granite video and data collection software. The Contractor shall provide the TV Inspections in the same CUES Granite product database, photo, and video capture format. The Contractor-provided TV inspections, database, DVDs, photos, and related files shall have the ability to direct synchronize to the city's existing CUES Granite product database.

404-4.4.2.1. IMAGE (PHOTOS) CAPTURE FORMAT AND REQUIREMENTS

The Inspection image files (pictures) shall have the ability to export to industry standard formats to include JPEG, BMP, and TIFF formats and be transferable by disk, thumb drive, DVD and/or external hard drive to an external personal computer utilizing standard viewers and printers.

404-4.4.2.2. DIGITAL VIDEO FORMAT AND REQUIREMENTS

Digital video files (Inspection Videos) shall be captured and/or recorded in the MPEG format or as specified by the city. The video capture files shall be in MPEG format with data linking (Inspection Observations) to the database file(s). The “Link” of the video capture file to the database observation file is required. The inspection observation(s) shall link to the video record in real-time.

The accompanying database shall support the following code system: PACP, or current code system being utilized by the city. The Database and Software program (CUES Granite products) shall be able to import asset data from an Esri ArcGIS (v.10.1+) geodatabase utilizing the network features to associate Sewer Mains with corresponding Sewer Nodes.

The database structure shall retain information on the various structures found within a sewer or storm system. It is important that the structures, nodes, manholes and pipe identifiers and related attribute information be retained as separate tables from the inspection allowing import of existing data from multiple sources. The data structure allows different projects to reside within a single database. Information gathered in projects shall be available to view by project or by system. Data gathered during project inspection shall be available to view by the selected structure. Therefore, all inspections can be viewed on a structure even if gathered in different projects.

404-4.4.2.3. SYNCHRONIZATION

The database shall have the ability to synchronize assets and inspections from replicated databases. The synchronization process should have built-in error checking for duplicates, updates and any modifications to the data being synched. This allows for multiple sources of data to be effectively consolidated into a single unitary database for analysis and evaluation.

404-4.4.3. LINER INSTALLATION

Liner shall be sized to field measurements obtained by the Contractor to provide a tight fit to the full interior circumference of the existing sanitary sewer and shall be a continuous, joint-less liner product from inside of manhole to inside of manhole. Contractor shall use installation methods approved by the liner manufacturer including liner placement, reforming to fit existing pipe, pressure and heat requirements and reconnection of laterals. The Contractor shall immediately notify the city of any construction delays taking place during the insertion operation. Contractor shall provide flow maintenance measures as described by the approved Flow Maintenance Plan. Flow Maintenance Plan shall be approved by the city Project Manager prior to 48-hours of mobilization. Flow Maintenance Plan shall include redundancy. Liner entries at manholes shall be smooth, free of irregularities, and watertight. No pinholes, tears, cracks, thin spots, or other defects in the liner shall be permitted. Such defects shall be removed and replaced by the Contractor at their expense. OSHA requirements for installation procedures, in particular, confined spaces are to be met.

404-4.4.4. LATERAL RECONNECTION

Sanitary laterals shall be reconnected as soon as possible to renew service. Laterals are to be reconnected by means of robotics, by internally cutting out the liner to 100% of the area of the original opening. All lateral reconnections are to be grouted, as directed by the city to prevent leakage. Grouting method and material is to be approved by the city. Cost for robotic reconnection shall be included in the cost to install the liner. If the city wishes to reconnect service lateral using a different method the cost to do so will be measured and paid for separately.

Any reconnections to laterals and connections to manholes which are observed to leak shall be resealed by the Contractor. All laterals discovered during the lining process are to be reconnected unless specifically directed otherwise by the city. Contractor shall notify all local system users when the sanitary system will not be available for normal usage by the delivery of door hangers seven days before commencement with

appropriate information regarding the construction project. Contractor shall notify the Senior Public Information Coordinator from the city Public Communications Department prior to distribution.

404-4.4.5. TIME OF CONSTRUCTION

Construction schedules will be submitted by the Contractor and approved by the city. At no time will any sanitary sewer service connection remain inoperative for more than an eight (8) hour period without a service bypass being operated by the Contractor. In the event that sewage backup occurs and enters buildings, the Contractor shall be responsible for cleanup, repair and property damage costs and claims.

404-4.4.6. TESTING AND ACCEPTANCE

Post cleaning and television inspection shall proceed only after all necessary work and preparation has been completed, including the following:

- Placement of traffic control measures in accordance with these specifications
- Implementation of adequate flow control
- Pre-installation cleaning and television inspection
- Installation of CIPP liner in accordance with specifications
- All services re-instated including grout sealing in accordance with these specifications

The Contractor shall clean and televise the assigned gravity sewer in accordance with *Sections 404-4.4.1, 404-4.4.2, 404-4.4.2.1, 404-4.4.2.2 and 404-4.4.2.3*. The interior surface of the pipeline shall be cleaned with high pressure water jet equipment immediately prior to conducting the post television inspection. Jetting equipment will provide a minimum of sixty (60) gallons per minute of water at 3,000 psi. All service locations, gouges, cracks, bumps, bulges and obstructions, such as dropped joints, shall be noted on the inspection. In the case of bellies in the line, the pipe shall be cleared of any standing water to provide continuous visibility during the post inspection. The Contractor shall provide all inspections in digital PACP format including printed inspection logs to the city. Cost associated with post-televising and cleaning shall be included in the contract price of CIPP installation.

The finished liner shall be free of significant visual defects, damage, deflection, holes, leaks and other defects.

Each individual pipe segment contained in a development is to be considered an “individual project” such that all work, including all deliverables shall be reviewed and accepted prior to the city accepting and processing payment for that individual project. No partial payments will be made on individual sewer projects.

404-4.4.7. CLEANUP

Cleanup is an essential part of the work. As the work progresses and is completed, the Contractor shall clean the various sites of all operations and completely restore all work areas to the satisfaction of the city. This cleanup shall be done as promptly as practicable and shall not be left until the end of the construction period. No part of the work shall be considered complete and no payment will be made until cleanup is completed.

404-5. CURED-IN-PLACE PIPE (CIPP) FOR SERVICE LATERALS

404-5.1. LINER MATERIAL

The lining material shall be a fiberglass/polyester needle fleece vacuum epoxy resin -impregnated or equivalent material tube, matching the diameter of the lateral pipe, which is inserted into the service lateral to be rehabilitated and cured-in-place by an acceptable curing method. No Polyester resins will be accepted.

The epoxy shall be suitable for the design conditions as well as the curing process. The cured liner shall provide a service life of 50 years and shall have the minimum structural properties listed below:

PROPERTY VALUE	TEST METHOD	MINIMUM (psi)
Tensile Strength	ASTM D638	3,000
Flexural Strength	Modified ASTM D790	4,500
Modulus of Elasticity	ASTM D790	250,000

The liner system shall consist of a sectional liner in the mainline (full wrap around the circumference of the main line extending 5” on either side of the service) and the continuous lateral liner shall have the capacity to extend to within 10 feet of the building foundation. The liner shall form a continuous, one-piece, tight fitting, corrosion resistant and verifiable non-leaking cured in place pipe. The one-piece section liner shall be manufactured in a factory setting prior to its arrival on site. No component of the liner (i.e. lateral tube to mainline piece) shall be glued or sewn fused in the field prior to installation. The material shall be capable of conforming to offset joints, bells, and disfigured pipe sections.

The liner shall be designed, fabricated, and installed for the actual conditions encountered for this application including the material of the host pipe, in accordance with the applicable provisions of ASTM F1216(latest edition), and shall meet the following minimum design conditions: AASHTO H-20 live load with one truck passing; Soil Weight 120 pounds per cubic foot. Coefficient of friction $Ku'=0.130$; Groundwater: At the ground surface; fully deteriorated pipe with 2 percent (min.) ovality. If ovality of existing pipe is found to be worse, use actual percent up to 5 percent (max.); Soil Modulus 1,000 psi; Factor of Safety = 2; Soil Depth: Depth of Cover will be determined by field measurements.

The liner shall be designed to withstand all imposed loads, including live loads and, if applicable hydrostatic pressure. The liner shall have sufficient wall thickness to withstand all anticipated external pressures and loads that may be imposed after installation. The design shall be performed and certified by a professional engineer licensed by the Florida.

The liner and resin shall be manufactured by Trelleborg Pipe Seals, BLD, Inc., LMK, Inc., or approved equal. The finished liner product shall be chemically resistant to domestic sewage over the expected lifetime of the rehabilitated pipe.

The lateral liner system shall create epoxy resin migration into the defect/joints of the existing lateral. A combination of mechanical and chemical bonding shall be created between the lateral lining system and existing host pipe.

404-5.2. EPOXY RESIN MATERIAL

The epoxy system shall meet the requirements of ASTM F1216 (latest edition), Section 5.2. The epoxy installed liner system shall produce a liner that will comply with the structural requirements specified herein and shall provide chemical resistance for the flow media in the gravity pipe. The epoxy shall be compatible with the rehabilitation process, shall be able to cure in the presence or absence of water, and shall have an initiation temperature for cure as recommended by the epoxy manufacturer. Polyester and Vinylester resins contain styrene and volatile organic compounds which are susceptible to shrinkage and UV Curing will not be accepted.

Submitted documentation from the epoxy manufacturer specifically describing the chemical characteristics of the epoxy system, including allowable mixing, impregnation, and handling time, transportation and storage time, and recommended curing cycle including temperatures, pressures, and times. The epoxy manufacturer's documentation must also include maximum allowable time for handling the impregnated tube prior to insertion and the maximum allowable elapsed time from insertion to exotherm. If remedial measures are available to extend either of the maximum allowable times indicated above, without affecting the physical properties of the epoxy, the epoxy manufacturer should describe these measures and the time limits beyond which even these measures will not prevent alteration of the physical properties of the epoxy.

404-5.3. INSTALLATION AND EXECUTION

The Contractor, when required, shall provide for the flow of sewage around the section(s) of main pipe where the service lateral designated for lining is located. The bypass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow. Contractor must coordinate installation with property owner(s).

Delivery, storage, and handling of approved products are the responsibility of the Contractor. The Contractor shall keep them safe from damage and stored with the proper environmental containment as outlined by the manufacturer. No products should be used that have exceeded the designated shelf life as outlined by the manufacturer. Remove damaged products from site. Promptly replace damaged products with new products at no additional cost to the city.

If the service lateral lining process requires the installation of a cleanout, the city must approve the work before it is done.

404-5.3.1. PRE-LINING INSPECTION

Prior to inspecting each service lateral the piping will be cleaned to allow passage of the camera. A recorded CCTV video survey must be completed on the sewer main and service laterals with a pan and tilt camera. The inspection shall confirm the location and clock reference of the lateral junctions to be lined, any offsets within the mainline or service lateral, any intrusion from the lateral into the main; the angle at which the connection comes in; any changes in angle of approach of the lateral for the length of the repair; the potential flows coming through the lateral pipe; the potential flows going through the sewer main pipe; the diametric size of the connection for the length of the liner; the size of the main pipe at the point of the liner and the presence of active infiltration within the vicinity of the work area. Cost to complete the necessary pipe cleaning and CCTV inspection will be included in the cost to install the lateral liner.

Two copies of the pre-lining inspection shall be submitted to the Public Utilities Dept. The Contractor shall be responsible for having a copy of the pre-lining inspections in the field as well. Immediately prior to liner insertion, the camera shall traverse the lateral to inspect for debris which may have entered the line after the existing condition video recording.

404-5.3.2. LATERAL PREPARATION

It shall be the responsibility of the Contractor to clear the line of obstructions such as solids, roots, or broken pipe that will prevent the insertion of the liner. A high speed rotating hydraulic cutter shall be used to cut roots, grease or other obstructions in the pipe. The cut shall be made flush with the wall of the pipe to be restored, and the debris shall be pushed down the lateral pipe to the main pipe and to the downstream manhole and is to be removed by the contractor. If inspection reveals an obstruction that cannot be removed by conventional cleaning equipment, the Contractor shall notify the city and the cleaning effort shall be abandoned. The Contractor shall confirm that the sewer is clean enough to ensure an effective lining. The line segment shall not be lined until approved by the city.

Built-up deposits on the sewer main and lateral pipe walls shall be removed. The removal shall reach at least one foot beyond the liner product to allow the bladder to inflate tightly against the pipe walls ensuring a smooth transition from the liner product to the existing pipe wall.

Where the sewer main pipe has been lined previously with a CIPP liner, a check should be made to ensure the prior lateral reopening work created a lateral opening that is flush with the lateral pipe. If this is not the case, the mainline CIPP must be trimmed back using a lateral cutter.

Where active infiltration is present and when it is recommended by the liner manufacturer the infiltration must be stopped in advance by grouting.

404-5.3.3. LINER INSTALLATION

Notify all property owners not identified for service flow maintenance that their sewage service will be discontinued while the liner is being installed. Notify each affected property owner at least 7 days in advance of commencement of the work, giving the date, start time and time when service will be completely restored. Also provide a telephone number which property owners can call for information during the work.

If required for flow maintenance for selected services, Contractor shall excavate at the property line down to the service lateral for the installation of a cleanout. The preferred method of excavation shall be vacuum excavation. Although other installation techniques may be accepted, they must be pre-approved by the city. The service lateral shall be thoroughly cleaned prior to attaching the PVC wye connection. The riser pipe shall be sealed with a screw type plug, the excavation backfilled with sand or pea gravel, and the surface restored to preconstruction conditions.

Service lateral liner material shall be vacuum impregnated on site with the epoxy resin immediately prior to installation. Impregnation should be carried out under vacuum using electric impregnation table with pinch rollers set at the correct gap as per the manufacturer's instructions. Impregnation should take place in a clean, temperature-controlled cab in which the materials are protected from direct sunlight, objects which may damage the coating.

Impregnation should not take place using a manual roller in which the material is subject to excessive pressure and that the materials are squeezed resulting in a resin slug. All the calculated resin shall be confined to the liner to ensure the correct mechanical properties can be achieved.

Impregnation should not take place outside in an uncontrolled environment in which the materials are exposed to the elements. The liner should not be placed on the ground where it is susceptible to damage from objects such as stones, grit, glass etc. During and upon completion of the impregnation process the liner should be stored in a container to avoid damage prior to loading the material into the installation device.

The liner product shall be loaded inside a pressure apparatus above ground. The pressure apparatus, with an end attached to a robotic manipulator device, shall be positioned in the mainline pipe at the service connection that is to be rehabilitated. The robotic device together with a television camera will be used to align the repair product with the service connection opening. The robotic device shall hold the collar in place while air pressure, supplied to the pressure apparatus through a hose, shall be used to invert the liner into the lateral pipe. The insertion pressure will be adjusted to fully deploy the liner product into the lateral connection and hold the liner product tight to the main and lateral pipe walls.

After insertion is completed, recommended pressure must be maintained on the impregnated liner product for the duration of the curing process. The Contractor shall apply a heat source and circulation system to affect a cure of the epoxy system. The equipment shall be capable of uniformly raising the temperature of the pressurized fluid above the temperature required to affect a complete curing of the epoxy system. Initial cure shall be deemed to be completed when the temperature gauge on the heat source indicates that the temperature inside the tube is of a magnitude to realize an exotherm. The minimum cure period shall be as recommended by the system manufacturer.

The finished liner product shall be free of dry spots, lifts, delamination, and excess epoxy. The installed liner product should not inhibit the post installation video inspection, using a closed-circuit television camera, of the mainline and service lateral pipes or future pipe cleaning operations. During the warranty period any defects with the liner product that affect the performance or cleaning of the lateral connection shall be repaired at the contractor's expense in a manner acceptable to the city.

The Contractor shall inform the city of service laterals in which a liner product cannot be installed due to pre-existing conditions. These services will be identified, documented, video recorded, and the city will be

informed of the conditions encountered. The Contractor will not attempt to install a liner product in these services unless directed by the city.

Contractor may be permitted, at the direction of the city, to install service liners from inside the existing cleanout location to the main line sewer if conditions allow. Final liner product must include a lateral connection repair brim type liner to seal the connection at the host pipe and overlap the service liner installed from the cleanout.

404-5.3.4. TESTING AND ACCEPTANCE

Following installation of the service lateral liners, conduct a final, video recorded, CCTV/color television inspection of the completed work including the service lateral connections at the sewer main and the full length of all service laterals lined during the progress of the work. Copies of these recordings and those made prior to the liner installation shall be submitted to the city for approval and shall be retained by the city. Field acceptance of the liner shall be based on the city's evaluation of the installation including CCTV inspection video recordings and a review of certified test data for the installed pipe samples. groundwater infiltration of the liner shall be zero. There shall be no evidence of splits, cracks, breaks, lifts, kinks, delamination or crazing in the liner. If any defective liner is discovered after it has been installed, it shall be removed and replaced with either a sound liner or a new pipe at no additional cost to the city. The cost for all necessary testing shall be included in the cost associated with the lining.

The Contractor shall clean up each project area after the work is completed and all testing is accepted. Remove and dispose of all excess materials and debris at each location as directed by the city.

405. SANITARY MANHOLE LINER RESTORATION

405-1. SCOPE AND INTENT

It is the intent of this portion of the specification to provide for the repair, rehabilitation and groundwater infiltration abatement of manhole walls, corbels/cones, pipe connections and bench and channel/trough areas. All manhole rehabilitation products will be installed in accordance with the manufacturer's recommendations and these specifications. The purpose of the rehabilitation work is to eliminate inflow and infiltration, provide corrosion protection, and to restore the structural integrity of the manhole. For any particular system the Contractor will submit manufacturer's technical data and application instructions. All OSHA regulations shall be met in the completion of the work and the contractor shall be responsible for all necessary maintenance of traffic. The contractor shall warrant all work against defects in materials and workmanship for a period of one 1 years, unless otherwise noted, from the date of final acceptance of the project. Contractor shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship which may develop during said one year period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the city.

The following lists all elements of potential rehabilitation activity:

1. REMOVE STEPS
2. STOP ACTIVE INFILTRATION.
3. PATCH VOIDS AND ALL FRAME CONNECTIONS WITH NON-SHRINK GROUT.
4. REMOVE LOOSE COATING MATERIALS.
5. RESURFACE CORBEL/WALLS WITH CEMENTITIOUS MORTAR.
6. REBUILD/REPAIR BENCH & CHANNEL/TROUGH/SEAL PIPE CONNECTIONS.
7. COAT CORBEL/CONE, WALLS, BENCH AND TROUGH WITH AN APPROVED CEMENTITIOUS, EPOXY, OR POLYURATHANE, COATING/LINING SYSTEM.
8. ADJUST FRAME AND COVER HEIGHT.
9. RESET FRAME AND COVER.

10. REMOVE ROOTS.
11. PROVIDE INFLOW INSERT/DISH/PAN.
12. REMOVE DEBRIS.
13. PERFORM STRUCTURAL REPAIR.
14. REPLACE FRAME AND COVER.
15. SEAL FRAME TO CORBEL/CONE CONNECTION WITH AN APPROVED POLYUREA COATING/LINING SYSTEM

It is implicit that many of the repair activities listed above will not be measured and paid for separately as they will be included in the cost of rehabilitating the manhole substrate. These activities include stopping active infiltration, patching voids, removal of loose coating materials, resurfacing of the corbel & wall, removing roots, and removing miscellaneous debris. Repair activities which will have a separate measurement and payment item include: Rebuilding/Repairing Bench & Channel/Trough; Interior Manhole Coating; Adjusting/Resetting Frame & Cover, Replacing Frame & Cover and Sealing Frame to Corbel Connection.

405-2. MEASUREMENT & PAYMENT

405-2.1. MANHOLE LINERS/COATING

Payment for manhole rehabilitation shall be per vertical linear foot of liner/coating which is installed/applied. Lining systems will generally be measured from the manhole bench to the top of existing, or new, corbel/cone. Cementitious, Epoxy and Polyurethane coating systems will be measured from the lowest pipe invert to the bottom of the manhole frame. No separate payment will be made for the following items: Flow Maintenance; Maintenance of Traffic; Debris Disposal; Miscellaneous Excavation, including necessary pavement removal and replacement; Infiltration control in manhole and at all pipe connections; Grout, Brick and mortar placement to fill voids and level surfaces; Brick replacement; Root removal, Installation of pipe extensions and connectors as necessary; Removal and replacement of manhole steps, Replacement of unpaved roadway and grass or shrubbery; Replacement of roadway base (including backfill and compaction) and asphalt surface; and Appurtenant work as required to complete the identified rehabilitation. The cost of such work shall be included in the pay item, per vertical linear foot of liner/coating.

405-2.2. REPLACE FRAME & COVER

Payment for manhole frame and cover replacement will include removal of existing frame and cover and replacement with a new frame and cover which meets the criteria established by *Section 401-4* of the city's specifications. The Contractor will also install and/or replace manhole pans and dishes if it is damaged or missing. Refer to *Section 401-2.2.* from these *Section IV Technical Specifications*. Where manholes fall in paved areas, refer to *Standard Detail Index 104, "Street and Driveway Replacement for Concrete and Asphaltic Concrete Surfaces"*. Payment will be made for each manhole frame and cover replaced. No separate payment will be made for maintenance of traffic, necessary pavement removal and replacement, or replacement of grass or shrubbery.

405-2.3. REBUILD BENCH & CHANNEL/TROUGH

Payment for rebuilding bench and channel/trough will include removal of existing bench and channel (if applicable) and constructing a new bench and channel using the criteria established by *Section 401-1* of the city's specifications. Payment will be made for each bench and channel repaired/installed. No separate payment will be made for the removal of the existing bench and channel, by-pass pumping, and preparation of the manhole invert.

405-2.4. RESET/ADJUST MANHOLE FRAME & COVER

Payment for adjusting, or resetting, manhole frame will include removal of existing frame, removal of existing mortar, preparing top of corbel surface, installation of necessary riser material as described in *Section 401-2.1*, and placement of existing frame. No separate payment will be made for necessary maintenance of traffic, pavement removal and replacement, or replacement of grass or shrubbery. All work will be performed in accordance with *Section 401-4* of the city's specifications. Where manholes fall in paved areas, refer to *Standard Detail Index 104*, "Street and Driveway Replacement for Concrete and Asphaltic Concrete Surfaces". Payment will be made for each manhole frame and cover adjusted. No separate payment will be made for maintenance of traffic, necessary pavement removal and replacement, or replacement of grass or shrubbery.

405-2.5. SEAL MANHOLE FRAME TO CORBEL CONNECTION WITH POLYUREA MATERIAL

Payment for providing a water tight connection between the manhole frame and the manhole corbel /cone will include placement of non-shrink grout in any area between the frame and corbel which is void of mortar, preparing the frame and corbel/cone to accept the polyurea material and testing the thickness of the application. No separate payment will be made for necessary maintenance of traffic. All work will be performed in accordance with *Section 405-7* of the city's specifications.

405-3. CEMENTITIOUS COATING SYSTEM

This specification shall govern all work to spray/apply a monolithic fiber reinforced cementitious liner to the wall, channel, invert and bench surfaces of brick, concrete, or any other construction material; Strong Seal MS 2C product or approved equal.

Described are procedures for manhole cleaning preparation, application of material and testing. The applicator must be approved, trained and certified as having successfully completed factory training. The applicator/contractor shall furnish all labor, equipment and materials for applying the Strong Seal MS 2C product directly to the contour of the manhole to form a structural cementitious liner of a minimum one half inch (1/2") thickness using a machine specially designed for the application. As it is the intention of the city to rehabilitate the entire structure; corbel, walls, bench and channel/trough the contractor will be required to provide by-pass pumping as the necessary cure time exceeds four (4) hours. In no case will flow through plugs be allowed. All aspects of the installation shall be in accordance with the manufacturer's recommendations and with the following specifications:

1. The elimination of active infiltration prior to making the application.
2. The removal of any loose and unsound material.
3. The spray application of a pre-blended cementitious mix to form a monolithic liner in a two (2) coat application.

405-3.1. SUBMITTALS

Submittals shall be made in accordance with the following:

1. Technical data sheet on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.
2. Safety Data Sheets (SDS) for each product used.
3. Project specific guidelines and recommendations.
4. Applicator Qualifications:
 - a. Manufacturer certification that the Applicator has been trained in the handling, mixing and application of the products to be used.

- b. Certification that the equipment to be used for applying the products has been approved by the protective coating manufacturer and Applicator personnel have been trained and certified for proper use of the equipment.
- c. Written document providing three (3) years of experience and five (5) recent references of Applicator indicating successful application of the materials provided
- d. Installed a minimum of 50,000 square feet of plural component spray applied coating the same or similar to that specified within the last two (2) years.
- e. Proof of any necessary federal, state, or local permits or licenses necessary for the project.

405-3.2. MATERIALS

405-3.2.1. PATCHING MIX

A Strong A Seal or approved equal shall be used as a patching mix according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive Strength (ASTM C109)	15 min., 200 psi; 6 hrs., 1,400 psi
2.	Shrinkage (ASTM C596)	28 days, 150 psi
3.	Bond (ASTM C1072)	28 days, 150 psi
4.	Cement Sulfate resistant	
5.	Density, when applied	105 +/- 5 pcf

405-3.2.2. INFILTRATION CONTROL

A Strong A Plug or approved equal shall be used to stop minor water infiltration according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive strength (ASTM C109)	600 psi, 1 hr.; 1000 psi 24 hrs.
2.	Bond (ASTM C1072)	30 psi, 1 hr.; 80 psi, 24 hrs.

405-3.2.3. GROUTING MIX

Strong-Seal Grout or approved equal shall be used for stopping very active infiltration and filling voids according to the manufacturer's recommendations. The grout shall be volume stable and have a minimum twenty-eight (28) day compressive strength of 250 psi and a one (1) day strength of 50 psi.

405-3.2.4. COATING MIX

Strong Seal MS 2C or approved equal shall be used to form the monolithic liner covering all interior manhole surfaces and shall have the following minimum requirements at twenty-eight (28) days: The physical requirements must be verified by an independent, certified, third party testing laboratory within the last five years. The proposed third-party laboratory must be submitted with the bid package; any bid package not including the verifiable, independent third-party testing shall be ruled non-responsive and will be rejected.

1.	Compressive strength (ASTM C109)	3,000 psi
2.	Tensile strength (ASTM C496)	300 psi
3.	Flexural strength (ASTM C78)	600 psi
4.	Shrinkage (ASTM C596)	0% at 90% R.H.
5.	Bond (ASTM C1072)	130 psi
6.	Density, when applied	105 + pcf
7.	Chemical Resistance (ASTM D543/G20) immersion service for:	
	a. Municipal sanitary sewer environment	
	b. Sulfuric Acid, 30%	
	c. Sodium Hydroxide, 10%	
	d. Sodium Hypochlorite, 3%	

Fiberglass rods which are contained in the product shall be alkaline resistant and shall be one-half inch (1/2") to five-eighths inch (5/8") long with a diameter of 635 to 640 microns. Products shall, in the unmixed state, have a lead content not greater than two percent (2%) by weight. Strong Seal MS 2C shall be made with Calcium Aluminate Cement and shall be used according to the manufacturer's recommendations in applications where there is evidence of severe sulfide conditions.

Product must be factory blended requiring only the addition of water at job site. Bag weight shall be 50 to 51 pounds and contents must have a dry bulk density of 50 to 56 pounds per cubic foot. Cement content must be 65% to 75% of total weight of bag. One bag of product when mixed with correct amount of water must have a wet density of 95 to 108 pounds per cubic foot and must yield a minimum of 0.67 cubic foot of volume. Product shall not include any basic ingredient that exceeds maximum allowable EPA limit for any heavy metal.

Manufacturer must provide SDS sheets for product(s) to be used in reconstruction process. A two (2) coat application of liner material will be required (no exceptions) with the first coat rough troweled to force materials into cracks and crevices to set the bond. The second coat to be spray applied to assure a minimum of one-half inch (1/2") thickness after troweling or brush finishing to a relatively smooth finish.

405-3.2.5. WATER

Water shall be clean and potable not to exceed 80°F (Fahrenheit).

405-3.2.6. OTHER MATERIALS

No other material shall be used with the mixes previously described without prior approval or recommendation from the manufacturer.

405-3.3. APPLICATION EQUIPMENT

A specially designed machine consisting of an optimized progressive cavity pump capable of producing a minimum of 250 psi pumping pressure, contra blend mixer with twin ribbon paddles with discharge, and an air system for spray application of product. Equipment must be complete with water storage and metering system. Mixer and pump are to be hydraulically powered. Equipment is to be mounted to heavy duty construction tandem axle road worthy trailer complete with electric brakes and running lights. Internal combustion engine must be included to power the hydraulic system and air compressor.

405-3.4. INSTALLATION AND EXECUTION

405-3.4.1. PREPARATION

1. All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (minimum 1,200 psi). Loose and protruding brick, mortar and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with brick and quick setting patching mix.
2. Active leaks shall be stopped using quick setting specially formulated mixes according to the manufacturer's recommendations. When severe infiltration is present, drilling may be required in order to pressure grout using a cementitious grout. Manufacturer's recommendations shall be followed when pressure grouting is required.
3. Any bench, invert/channel/trough or service line repairs shall be made at this time using the quick setting mix and following the manufacturer's recommendations.
4. Any active flows shall be dammed, plugged, or diverted as required to ensure all liquids are maintained below or away from the surfaces to be coated until final applications are cured as recommended by the manufacturer.

5. Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify city, in writing, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

405-3.4.2. MIXING

For each bag of product, use the amount of water specified by the manufacturer and mix using the Spray Mate Model 35C or 35D equipment for thirty (30) seconds to one (1) minute after all materials have been placed in the mixing hopper. Place the mix into the holding hopper and prepare another batch with timing such that the nozzleman can spray in a continuous manner without interruption until each application is complete.

405-3.4.3. SPRAYING

The surface, prior to spraying, shall be damp without noticeable free water droplets or running water. Materials shall be sprayed, applied to a minimum uniform thickness to ensure that all cracks, crevices and voids are filled, and a somewhat smooth surface remains after light troweling. The light troweling is performed to compact the material into voids and to set the bond. Not before the first application has begun to take an initial set (disappearance of surface sheen which could be fifteen (15) minutes to one (1) hour depending upon ambient conditions) is the second application made to assure a minimum total finished thickness of one-half inch (1/2"). The surface is then troweled to a smooth finish being careful not to over trowel so as to bring additional water to the surface and weaken it. A brush finish may be applied to the finished coat to remove trowel marks. Manufacturer's recommendation shall be followed whenever more than twenty-four (24) hours have elapsed between applications. The bench will be sprayed such that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than one-half inch (1/2"). The invert/channel/trough area shall also be sprayed in a manner that provides a gradual slope through the structure while achieving one-quarter inch (1/4") thickness coverage. The wall/bench and bench/invert/channel/trough intersections shall be rounded to a uniform radius, the full circumference of the intersection. The final application shall have a minimum of four (4) hours cure time before being subjected to active flow. The corbel/cone to manhole frame joint shall be sealed according to *Section 405-7*.

405-3.4.4. PREPARATION OF SAMPLES

At some point during the application, at least four (4) two inch (2") cubes will be prepared for each manhole, or from every fifty (50) bags of product used, identified and submitted, in accordance with the city's or Manufacturer's directions, for compression strength testing as described in ASTM C109.

405-3.4.5. CURING

Ambient manhole conditions are adequate for curing so long as the manhole is covered. It is imperative that the manhole be covered as soon as possible after the application has been completed.

405-3.5. TESTING AND ACCEPTANCE

Manhole will be vacuum tested from the top of manhole frame to the manhole base. All pipes entering the manhole shall be plugged, taking care to securely place the plug from being drawn into the manhole. The test head shall be placed, and the seal inflated in accordance with the manufacturers' recommendations. A vacuum pump of ten inches (10") of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to nine inches (9"). The manhole shall pass if the time is greater than sixty (60) seconds for forty-eight inch (48") diameter, seventy five (75) seconds for sixty inch diameter (60"), and ninety (90) seconds for seventy-two inch (72") diameter manholes. If the manhole fails the initial test, necessary repairs shall be made. Retesting shall proceed until a satisfactory test is obtained. Tests shall be performed by the Contractor under the direction of the city.

405-4. RAVEN 405 EPOXY COATING SYSTEM

This specification shall govern all work to spray/apply a monolithic epoxy material to the wall, channel, invert and bench surfaces of brick, concrete, or any other construction material; Raven 405 product or approved equal.

Described are procedures for manhole cleaning preparation, application of material and testing. The applicator must be approved, trained, and certified as having successfully completed factory training. The applicator/contractor shall furnish all labor, equipment, and materials for applying the Raven 405 product directly to the contour of the manhole to form a structural liner of a minimum 125 mil thickness using a machine specially designed for the application. As it is the intention of the city to rehabilitate the entire structure; corbel, walls, bench, and channel/trough the contractor will be required to provide by-pass pumping as necessary if the cure time exceeds one (1) hour. In no case will flow through plugs be allowed. All aspects of the installation shall be in accordance with the manufacturer's recommendations and with the following specifications:

1. The elimination of active infiltration prior to making the application.
2. The removal of any loose and unsound material.
3. Preparing the manhole to provide a clean, dry, sound and monolithically smooth surface
4. The spray application of a Solvent-free epoxy coating to be applied to specified thickness

405-4.1. SUBMITTALS

Submittals shall be made in accordance with the following:

1. Technical data sheet on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.
2. Safety Data Sheets (SDS) for each product used.
3. Project specific guidelines and recommendations.
4. Applicator Qualifications:
 - a. Manufacturer certification that the Applicator has been trained in the handling, mixing and application of the products to be used.
 - b. Certification that the equipment to be used for applying the products has been approved by the protective coating manufacturer and Applicator personnel have been trained and certified for proper use of the equipment.
 - c. Written document providing three (3) years of experience and five (5) recent references of Applicator indicating successful application of a 100% solids high-build solvent-free coating by spray application.
 - d. Applicator must provide written documentation of having installed a minimum of 50,000 square feet of plural component spray applied epoxy coating the same or similar to that specified within the last two (2) years.
 - e. Proof of any necessary federal, state, or local permits or licenses necessary for the project.

405-4.2. MATERIALS

405-4.2.1. PATCHING MIX

Strong Seal, or approved equal, shall be used as a patching mix according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive Strength (ASTM C-109)	15 min., 200 psi; 6 hrs., 1,400 psi
2.	Shrinkage (ASTM C-596)	28 days, 150 psi
3.	Bond (ASTM C-952)	28 days, 150 psi
4.	Cement Sulfate resistance	

5.	Density, when applied	105 +/- 5 pcf
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405-4.2.2. INFILTRATION CONTROL

Strong Plug, or approved equal, shall be used to stop minor water infiltration according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive strength (ASTM C109)	600 psi, 1 hr.; 1000 psi 24 hrs.
2.	Bond (ASTM C1072)	30 psi, 1 hr.; 80 psi, 24 hrs.

405-4.2.3. GROUTING MIX

Strong-Seal Grout, or approved equal, shall be used for stopping very active infiltration and filling voids according to the manufacturer's recommendations. The grout shall be volume stable and have a minimum twenty-eight (28) day compressive strength of 250 psi and one (1) day strength of 50 psi.

405-4.2.4. COATING MATERIAL

Coating product shall be applied to all interior surfaces to protect the host substrate and repair materials from all forms of chemical or bacteriological attack typically found in municipal sanitary sewer systems and to impart a degree of structural enhancement.

Coating product physical properties shall be substantiated through submittal of accredited third-party testing results and shall be representative of the actual field applied product and cure mechanism(s) to be employed in the field. The physical requirements must be verified by an independent third-party testing shall be ruled non-responsive and will be rejected.

100% Solids, Solvent-Free, Ultra-High Build Epoxy Coating to be spray applied to all interior surfaces of exposed concrete above the spring line or as otherwise detailed:

1. Manufacturer: Raven Lining Systems, Broken Arrow, Oklahoma 800-324-2810 or 918-615-0140 fax.
2. Product: Raven 405, or approved equal – 100% solids, solvent-free ultra-high-build epoxy system exhibiting the following characteristics:
 - a. Product Type: amine cured epoxy
 - b. VOC Content (ASTM D2584): 0%
 - c. Compressive Strength, (ASTM D695): 18,000 psi
 - d. Tensile Strength, (ASTM D638): 7,600 psi
 - e. Flexural Modulus, (ASTM D790): 700,000 psi
 - f. Adhesion to Concrete, (ASTM D4541/7234): >200 psi with substrate (concrete) failure
 - g. Chemical Resistance (ASTM D543/G20) immersion service for:
 - Municipal sanitary sewer environment
 - Sulfuric Acid, 30%
 - Sodium Hydroxide, 10%
 - Sodium Hypochlorite, 3%
 - h. Successful Pass: Sanitation District of L.A. County Coating Evaluation Study and SSPWC 210.2.3.3 (Greenbook “Pickle Jar” Chemical Resistance test) 100% Solids, Solvent-Free, Ultra-High Build Epoxy Coating to be manually or spray applied to interior surfaces of exposed concrete above or below the typical flow line; specifically designed for accelerated cure and suitable for release of flow in less than 45 minutes at normal service temperatures or as otherwise detailed.

405-4.2.5. OTHER MATERIALS

No other material shall be used with the mixes previously described without prior city approval.

405-4.3. INSTALLATION AND EXECUTION

405-4.3.1. PREPARATION

1. All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (minimum 5,000 psi). Loose and protruding brick, mortar and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with brick and quick setting patching mix.
2. Active leaks shall be stopped using quick setting specially formulated mixes according to the manufacturer's recommendations. When severe infiltration is present, drilling may be required in order to pressure grout using a cementitious grout. Manufacturer's recommendations shall be followed when pressure grouting is required.
3. Any bench, invert/channel/trough or service line repairs shall be made at this time using the quick setting mix and following the manufacturer's recommendations.
4. Any active flows shall be dammed, plugged, or diverted as required to ensure all liquids are maintained below or away from the surfaces to be coated until final applications are cured as recommended by the manufacturer.
5. The area between the corbel and the manhole frame and any other area that might exhibit movement or cracking due to expansion and contraction shall be grouted with a flexible grout or gel. A termination groove "key" cut into the substrate between the bottom of the manhole frame and concrete is recommended for placement of the flexible grout or gel. The "key" shall be a minimum ¼" w x ¼" d, cut at a minimum 45° angle (60° maximum).
6. Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify city, in writing, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

405-4.3.2. APPLICATION

Application procedures shall conform to the recommendations of the coating product(s) manufacturer, including environmental controls, product handling, mixing, application equipment, and methods. Spray equipment shall be specifically designed to accurately ratio and apply the coating product(s) and s Prepared surfaces shall be coated via spray application of the coating product(s) described herein unless otherwise recommended by the coating product manufacturer.

In all cases the coating product shall be applied to a minimum dry film thickness of 125 mils to surface profiles. Subsequent top coating or additional coats of the coating product(s) shall occur within the products recoat window. Additional surface preparation procedures will be required if this recoat window is exceeded.

Coating product(s) shall interface with adjoining construction materials/components throughout the manhole structure to effectively seal and protect substrates from attack by corrosive elements and to ensure the effective elimination of infiltration into the sewer system. Termination points of the coating product(s) shall be made at the manhole frame and corbel joint (or other man way as is present), and a minimum of 1" interfacing within each pipe penetrating the structure. The corbel/cone to manhole frame joint shall be sealed according to *Section 405-7*. The entire bench and invert/channel/trough will be thoroughly coated noting that the invert/channel/trough area will be sprayed in a manner that provides a gradual slope through the structure while achieving 125 mils thickness coverage.

405-4.4. TESTING & ACCEPTANCE

Coating system thickness shall be inspected to ensure compliance with the specifications herein.

1. During application a wet film thickness gauge, meeting ASTM D4414 (latest edition) - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be

used. Measurements shall be taken, documented, and attested to by Contractor for submission to the city.

2. After the coating product(s) have cured in accordance with manufacturer recommendations, coating system thickness shall be measured according to SSPC-PA 9 - Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages.

High voltage holiday detection for coating systems installed in corrosive environments, when it can be safely and effectively employed, shall be performed to ensure monolithic protection of the substrate. After the coating product(s) have cured in accordance with manufacturer recommendations, all surfaces shall be inspected for holidays in accordance with NACE RPO 188-99 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates or ASTM D4787 Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates. All detected holidays shall be marked and repaired according to the coating product(s) manufacturer's recommendations.

1. Test voltage shall be a minimum of 100 volts per mil of coating system thickness.
2. Detection of a known or induced holiday in the coating product shall be confirmed to ensure proper operation of the test unit.
3. All areas repaired shall be retested following cure of the repair material(s).
4. In instances where high voltage holiday detection is not feasible a close visual inspection shall be conducted, and all possible holidays shall be marked and repaired as described above.
5. Documentation of areas tested, equipment employed, results, and repairs made shall be submitted to the city by the Contractor.

Adhesion of the coating system to the substrate shall be confirmed in a minimum of 10% of the manholes coated, or for large structures once every 1000 square feet of coated area. After the coating product(s) have cured in accordance with manufacturer recommendations, testing shall be conducted in accordance with ASTM D7234 Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers. city's Project Manager shall select the manholes/areas to be tested.

1. For each test manhole a minimum of three 20 mm dollies shall be affixed to the coated surface; one at the cone/corbel area, one at the midsection and one near the bottom of the structure.
2. For larger structures a minimum of three 20 mm dollies shall be affixed to the coated surface at random locations within each 1000 square foot area or as otherwise agreed upon.
3. The adhesive used to attach the dollies to the coating shall be rapid setting with tensile strengths in excess of at least twice the anticipated failure point (generally 1000 psi) and permitted to cure in accordance with manufacturer recommendations. The coating and dollies shall be adequately cleaned and prepared to receive the adhesive. Failure of the dolly adhesive shall be deemed a non-test and require retesting.
4. Prior to performing the pull test, the coating shall be scored to the substrate, or within 10 mils of the substrate surface, by mechanical means without disturbing the dolly or coating system bond within the test area.
5. Two of the three adhesion pulls in each test area shall exceed 200 psi and shall include substrate adhered to the back of the dolly or no visual signs of the coating product in the test hole. Pulls tests with results between 150 and 200 psi may be acceptable if more than 50 percent of the substrate in the test area is adhered to the dolly.
6. Should a structure, or area, fail to achieve two successful pulls as described above, additional testing shall be performed at the discretion of the Owner or Project Engineer. Any areas detected to have inadequate bond strength shall be evaluated by the city. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Contractor.
7. All adhesion testing shall be performed by qualified personnel using calibrated equipment as specified by the applicable ASTM standard(s).

8. All adhesion testing shall be documented and submitted in a consistent format detailing location, test values, description of the failure point/mode, scoring method employed, adhesive used, cure time of coating and adhesive and other data as deemed necessary by the city.
9. All adhesion test locations shall be repaired by the Contractor at no cost to the city.
10. Visual inspection shall be made by the Project Engineer and/or Inspector. Any deficiencies in the finished coating affecting the performance of the coating system or the operational functionality of the structure shall be marked and repaired according to the recommendations of the coating product(s) manufacturer.

405-5. SPRAYWALL POLYURETHANE COATING SYSTEM

This specification shall govern all work to spray/apply a monolithic polyurethane material to the wall, channel, invert and bench surfaces of brick, concrete, or any other construction material; SprayWall product or approved equal.

Described are procedures for manhole cleaning preparation, application of material and testing. The applicator must be approved, trained and certified as having successfully completed factory training. The applicator/contractor shall furnish all labor, equipment and materials for applying the SprayWall product directly to the contour of the manhole to form a structural liner of a minimum 125 thickness using a machine specially designed for the application. As it is the intention of the city to rehabilitate the entire structure; corbel, walls, bench and channel/trough the contractor will be required to provide by-pass pumping as the necessary if the cure time exceeds one (1) hour. In no case will flow through plugs be allowed. All aspects of the installation shall be in accordance with the manufacturer's recommendations and with the following specifications:

1. The elimination of active infiltration prior to making the application.
2. The removal of any loose and unsound material.
3. Preparing the manhole to provide a clean, dry, sound and monolithically smooth surface
4. The spray application of a Solvent-free polyurethane coating to be applied to specified thickness.

405-5.1. SUBMITTALS

The following items shall be submitted:

1. Technical data sheet on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.
2. Safety Data Sheets (SDS) for each product used.
3. Project specific guidelines and recommendations.
4. Applicator Qualifications:
 - a. Manufacturer certification that the Applicator has been trained in the handling, mixing and application of the products to be used.
 - b. Certification that the equipment to be used for applying the products has been approved by the protective coating manufacturer and Applicator personnel have been trained and certified for proper use of the equipment.
 - c. Written document providing three (3) years of experience and five (5) recent references of Applicator indicating successful application of a 100% solids high-build solvent-free coating by spray application.
 - d. Written document stating that the contractor has installed a minimum of 50,000 square feet of plural component spray applied polyurethane coating the same or similar to that specified within the last two (2) years.
 - e. Proof of any necessary federal, state or local permits or licenses necessary for the project.

405-5.2. MATERIALS

405-5.2.1. PATCHING MIX

Strong Seal, or approved equal, shall be used as a patching mix according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive Strength (ASTM C109)	15 min., 200 psi; 6 hrs., 1,400 psi
2.	Shrinkage (ASTM C596)	28 days, 150 psi
3.	Bond (ASTM C952)	28 days, 150 psi
4.	Cement Sulfate resistant	
5.	Density, when applied	105 +/- 5 pcf

405-5.2.2. INFILTRATION CONTROL

Strong Plug, or approved equal, shall be used to stop minor water infiltration according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive strength (ASTM C109)	600 psi, 1 hr.; 1000 psi 24 hrs.
2.	Bond (ASTM C952)	30 psi, 1 hr.; 80 psi, 24 hrs.

405-5.2.3. GROUTING MIX

Strong-Seal Grout, or approved equal, shall be used for stopping very active infiltration and filling voids according to the manufacturer's recommendations. The grout shall be volume stable and have a minimum twenty-eight (28) day compressive strength of 250 psi and a one (1) day strength of 50 psi.

405-5.2.4. COATING MATERIAL

The resin-based material shall be used to form the sprayed structurally enhanced monolithic liner covering all interior surfaces of the structure, including benches and channels/troughs of manholes. The finished liner shall be SprayWall® as manufactured by Sprayroq, Inc. or approved equal and conform to the minimum physical requirements listed below. A minimum of 125 mil. coating thickness is required.

The physical requirements must be verified by an independent, certified, third party testing laboratory within the last five years and must be submitted with the bid package. Any bid package not including the verifiable, independent third-party testing shall be ruled non-responsive and will be rejected.

1.	VOC Content (ASTM D2584)	0%
2.	Compressive Strength, (ASTM D695)	18,000 psi
3.	Tensile Strength, (ASTM D638)	> 7,450 psi
4.	Flexural Modulus, (ASTM D790)	735,000 psi
5.	Adhesion to Concrete, (ASTM D4541/7234)	>200 psi with substrate (concrete) failure
6.	Chemical Resistance (ASTM D543/G20) immersion service for:	<ul style="list-style-type: none"> • Municipal sanitary sewer environment • Sulfuric Acid, 30% • Sodium Hydroxide, 10% • Sodium Hypochlorite, 3%
7.	Successful Pass:	Sanitation District of L.A. County Coating Evaluation Study and SSPWC 210.2.3.3 (Greenbook "Pickle Jar" Chemical Resistance test)

The initial flexural modulus of elasticity (short term) of the submitted resin material will be utilized with the long-term deformation percentage as determined by ASTM D2990 (see below) in the design equation outlined in ASTM 1216-09, Appendix X1. The value of the long-term flexural modulus of the proposed product will be certified by an independent, certified, third party testing lab, independent of the

Manufacturer and submitted with the bid package. [The definition of long-term value will be identified as initial flexural VER 01 w/Flat Wall 2015 Page 7 of 12 modulus of elasticity less the reduction in value caused by Creep over a fifty (50) year minimum period and verified by third party DMA testing (ASTM D2990).] All design submittals will include this certified third-party DMA testing (ASTM D2990) value in their respective design calculations for each structure being rehabilitated.

Coating product physical properties shall be substantiated through submittal of accredited third-party testing results and shall be representative of the actual field applied product and cure mechanism(s) to be employed in the field.

Polyurethane coating to be manually or spray applied to interior surfaces of exposed concrete above or below the typical flow line; specifically designed for accelerated cure and suitable for release of flow in less than 45 minutes at normal service temperatures or as otherwise detailed.

405-5.2.5. OTHER MATERIALS

No other material shall be used with the mixes previously described without prior approval or recommendation from the manufacturer.

405-5.3. INSTALLATION AND EXECUTION

405-5.3.1. PREPARATION

1. All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (minimum 5,000 psi). Loose and protruding brick, mortar and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with brick and quick setting patching mix.
2. Active leaks shall be stopped using quick setting specially formulated mixes according to the manufacturer's recommendations. When severe infiltration is present, drilling may be required in order to pressure grout using a cementitious grout. Manufacturer's recommendations shall be followed when pressure grouting is required.
3. Any bench, invert/channel/trough or service line repairs shall be made at this time using the quick setting mix and following the manufacturer's recommendations.
4. Any active flows shall be dammed, plugged, or diverted as required to ensure all liquids are maintained below or away from the surfaces to be coated until final applications are cured as recommended by the manufacturer.
5. The area between the corbel and the manhole frame and any other area that might exhibit movement or cracking due to expansion and contraction, shall be grouted with a flexible grout or gel (Sikadur 42 Grout Pak LE, Pro-Stik Butyl Sealant, or equal). A termination groove "key" cut into the substrate between the bottom of the manhole frame and concrete is recommended for placement of the flexible grout or gel. The "key" shall be a minimum ¼" w x ¼" d, cut at a minimum 45° angle (60° maximum).
6. Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify city, in writing, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

405-5.3.2. APPLICATION

Application procedures shall conform to the recommendations of the protective coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment. The spray equipment shall be specifically designed to accurately ratio and apply the specified protective coating materials and shall be regularly maintained and in proper working order.

The protective coating material must be spray applied by a Certified Applicator of the protective coating manufacturer. Specified surfaces shall be coated by spray application of a solvent-free, 100% solids, rigid polyurethane structural lining as further described herein. Airless spray application equipment approved by the coating manufacturer shall be used to apply each coat of the protective coating. The air source is to be filtered to completely remove all oil and water.

If necessary, subsequent top coating or additional coats of the protective coating should occur as soon as the basecoat becomes tack free, no later than the recoat window for the specified products. Additional surface preparation procedures will be required if this recoat window is exceeded.

The roughness of the substrate will dictate the thickness needed to create the monolithic liner and eliminate any opportunity for voids in the coating. The minimum value for coating thickness shall be a minimum 125 mils.

Coating product(s) shall interface with adjoining construction materials/components throughout the manhole structure to effectively seal and protect substrates from attack by corrosive elements and to ensure the effective elimination of infiltration into the sewer system.

Termination points of the coating product(s) shall be made at the manhole frame and corbel joint (or other man way as is present), and a minimum of 1” interfacing within each pipe penetrating the structure. The entire bench and invert/channel/trough will be thoroughly coated noting that the invert/channel/trough area will be sprayed in a manner that provides a gradual slope through the structure while achieving 125 mils. thickness coverage.

405-5.4. TESTING & ACCEPTANCE

Coating system thickness shall be inspected to ensure compliance with the specifications herein.

1. During application a wet film thickness gauge, meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used. Measurements shall be taken, documented, and attested to by Contractor for submission to the city.
2. After the coating product(s) have cured in accordance with manufacturer recommendations, coating system thickness may be measured according to SSPC-PA 9 - Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages.

High voltage holiday detection for coating systems installed in corrosive environments, when it can be safely and effectively employed, shall be performed to ensure monolithic protection of the substrate. After the coating product(s) have cured in accordance with manufacturer recommendations, all surfaces shall be inspected for holidays in accordance with NACE RPO 188-99 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates or ASTM D4787 Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates. All detected holidays shall be marked and repaired according to the coating product(s) manufacturer’s recommendations.

1. Test voltage shall be a minimum of 100 volts per mil of coating system thickness.
2. Detection of a known or induced holiday in the coating product shall be confirmed to ensure proper operation of the test unit.
3. All areas repaired shall be retested following cure of the repair material(s).
4. In instances where high voltage holiday detection is not feasible a close visual inspection shall be conducted, and all possible holidays shall be marked and repaired as described above.
5. Documentation of areas tested, equipment employed, results, and repairs made shall be submitted to the city by the Contractor.

Adhesion of the coating system to the substrate shall be confirmed in a minimum of 10% of the manholes coated, or for large structures once every 1000 square feet of coated area. After the coating product(s) have cured in accordance with manufacturer recommendations, testing shall be conducted in accordance with

ASTM D7234 Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers. City’s Project Manager shall select the manholes/areas to be tested.

1. For each test manhole a minimum of three 20 mm dollies shall be affixed to the coated surface; one at the cone/corbel area, one at the midsection and one near the bottom of the structure.
2. For larger structures a minimum of three 20 mm dollies shall be affixed to the coated surface at random locations within each 1000 square foot area or as otherwise agreed upon.
3. The adhesive used to attach the dollies to the coating shall be rapid setting with tensile strengths in excess of at least twice the anticipated failure point (generally 1000 psi) and permitted to cure in accordance with manufacturer recommendations. The coating and dollies shall be adequately cleaned and prepared to receive the adhesive. Failure of the dolly adhesive shall be deemed a non-test and require retesting.
4. Prior to performing the pull test, the coating shall be scored to the substrate, or within 10 mils of the substrate surface, by mechanical means without disturbing the dolly or coating system bond within the test area.
5. Two of the three adhesion pulls in each test area shall exceed 200 psi and shall include substrate adhered to the back of the dolly or no visual signs of the coating product in the test hole. Pulls tests with results between 150 and 200 psi may be acceptable if more than 50 percent of the substrate in the test area is adhered to the dolly.
6. Should a structure, or area, fail to achieve two successful pulls as described above, additional testing shall be performed at the discretion of the Owner or Project Engineer. Any areas detected to have inadequate bond strength shall be evaluated by the city. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Contractor.
7. All adhesion testing shall be performed by qualified personnel using calibrated equipment as specified by the applicable ASTM standard(s).
8. All adhesion testing shall be documented and submitted in a consistent format detailing location, test values, description of the failure point/mode, scoring method employed, adhesive used, cure time of coating and adhesive and other data as deemed necessary by the city.
9. All adhesion test locations shall be repaired by the Contractor at no cost to the city.
10. Visual inspection shall be made by the city’s agent and/or Inspector. Any deficiencies in the finished coating affecting the performance of the coating system or the operational functionality of the structure shall be marked and repaired according to the recommendations of the coating product(s) manufacturer.

405-6. INTERNAL MANHOLE CORBEL SEALING SYSTEM

This specification shall govern all work to spray/apply a monolithic polyurea material to the frame and adjacent corbel surfaces of brick, concrete or any other construction material.

The work covered by this item includes but is not limited to furnishing all labor, equipment, materials and supervision, and performing all work necessary to seal the manhole as specified herein or equal to the manhole through the frame joint area and the area above the manhole corbel/cone.

Described are procedures for manhole/frame cleaning preparation, application of material and testing. The applicator must be approved, trained and certified as having successfully completed factory training. The applicator/contractor shall furnish all labor, equipment and materials for applying the product directly to the manhole and frame joint with a minimum of 6-inch overlap on each surface and a minimum thickness of 125 mils. All aspects of the installation shall be in accordance with the manufacturer's recommendations and with the following specifications:

1. The removal of any rust or loose and unsound material.

2. Preparing the manhole corbel/cone and frame to provide a clean, dry, sound and monolithically smooth surface
3. The spray application of a Solvent-free polyurea coating to be applied to specified thickness.

405-6.1. SUBMITTALS

The following items shall be submitted:

1. Technical data sheet, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.
2. Safety Data Sheet for the product (SDS).
3. Project specific guidelines and recommendations.
4. Applicator Qualifications:
 - a. Manufacturer certification that the Applicator has been trained in the handling, mixing and application of the products to be used.
 - b. Certification that the equipment to be used for applying the products has been approved by the protective coating manufacturer and Applicator personnel have been trained and certified for proper use of the equipment.
 - c. Written document providing three (3) years of experience and five (5) recent references of Applicator indicating successful application of a 100% solids high-build solvent-free coating by spray application.
 - d. Proof of any necessary federal, state, or local permits or licenses necessary for the project.

405-6.2. MATERIALS

405-6.2.1. PATCHING MIX

Strong Seal, or approved equal, shall be used as a patching mix according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive Strength (ASTM C109)	15 min., 200 psi; 6 hrs.; 1,400 psi
2.	Shrinkage (ASTM C596)	28 days, 150 psi
3.	Bond (ASTM C952)	28 days, 150 psi
4.	Cement Sulfate resistant	
5.	Density, when applied	105 +/- 5 pcf

405-6.2.2. INFILTRATION CONTROL

Strong Plug, or approved equal, shall be used to stop minor water infiltration according to the manufacturer's recommendations and shall have the following minimum requirements:

1.	Compressive strength (ASTM C109)	600 psi, 1 hr.; 1000 psi 24 hrs.
2.	Bond (ASTM C952)	30 psi, 1 hr.; 80 psi, 24 hrs.

405-6.2.3. COATING MATERIAL

Manhole seal shall be designed to prevent leakage of water into the manhole through the frame joint area and the area above the manhole cone including all extensions to the corbel area. The seal shall remain flexible allowing for the repeated vertical or horizontal movements of the frame due to frost lift, ground movement or the thermal movement of pavements. The final coating shall be made no less than 125 mils. of corrosion resistant aromatic or approved equal. The product shall have a minimum elongation of 800%. Final liner shall have a minimum tensile strength of 3250 psi. The manhole sealing system shall conform to the physical requirements of ASTM D412.

The physical requirements must be verified by an independent, certified, third party testing laboratory within the last five years and must be submitted with the bid package. Any bid package not including the verifiable, independent third-party testing shall be ruled non-responsive and will be rejected.

405-6.3. INSTALLATION AND EXECUTION

405-6.3.1. PREPARATION

1. All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (minimum 5,000 psi). Loose and protruding brick, mortar and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with brick and quick setting patching mix.
2. All patching materials shall be cured prior to the installation. Preparation of the frame surface shall include sandblasting (minimum of 70 CFM) and an acetone wet wipe to ensure a clean surface as required by manufacturer on uncoated substrate.
3. If coating is to be on top of SprayWall, or Raven 405, then termination points need to be cut which are ¼" x ¼" cut on 45° angle at top and bottom of application, then sanding of the SprayWall, or Raven 405, with 40 grit paper, cleaned and an application of Lords 7701 is required prior to application to ensure adhesion.
4. Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify city, in writing, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

405-6.3.2. APPLICATION

Application procedures shall conform to the recommendations of the polyurea coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment.

The spray equipment shall be specifically designed to accurately ratio and apply the specified protective coating materials and shall be regularly maintained and in proper working order. The polyuria coating material must be spray applied by a Certified Applicator of the coating manufacturer.

Airless spray application equipment approved by the coating manufacturer shall be used to apply each coat of the protective coating. The air source is to be filtered to completely remove all oil and water.

If necessary, subsequent top coating or additional coats of the polyurea coating should occur as soon as the basecoat becomes tack free, no later than the recoat window for the specified products. Additional surface preparation procedures will be required if this recoat window is exceeded.

405-6.3.3. TESTING & ACCEPTANCE

Coating system thickness shall be inspected to ensure compliance with the specifications herein.

1. During application a wet film thickness gauge, meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used. Measurements shall be taken, documented, and attested to by Contractor for submission to the city.
2. After the coating product(s) have cured in accordance with manufacturer recommendations, coating system thickness may be measured according to SSPC-PA 9 - Measurement of Dry Coating Thickness on Cementitious Substrates Using Ultrasonic Gages.
3. Visual inspection shall be made by the city's agent and/or Inspector. Any deficiencies in the finished coating affecting the performance of the coating system or the operational functionality of the structure shall be marked and repaired according to the recommendations of the coating product(s) manufacturer. The contractor shall warrant proper adhesion of the coating material to the frame and corbel/cone for a minimum of ten (10) years.

406. SMOKE AND DYE TESTING

406-1. GENERAL PROTOCOL

Conduct smoke testing of gravity sewers for defects and identify manholes which could not be located, and all new structures not shown on GIS. Smoke and Dye testing will be completed using the following Protocols:

Smoke testing will provide detailed information on wet weather inflow sources to the sanitary sewer. In order to identify collection system defects and illicit connections, non-toxic smoke will be forced into the sewer by high-capacity blower capable of achieving a minimum of 1,750 cfm of airflow. Any break in the sewer will allow the smoke to escape provided the smoke machine generates sufficient pressure. One line segment will be tested at one time with plugging. The maximum length of sewer to be smoke tested in a single setup shall be 400 linear feet per blower. Dual blower smoke testing shall be performed for pipe sections over 400 linear feet with a maximum of 800 linear feet. Smoke testing shall not be performed during or following weather conditions that may impair detecting escaping smoke (i.e. very windy, rainy, or high groundwater conditions, etc.) Smoke testing will not be performed on surcharged lines. In case of surcharged lines, the selected Contractor will contact the city and identify the issue. Once the surcharge has been eliminated, the city will contact the selected Contractor to re-smoke the test area. Smoke testing will document when smoke does not travel the entire length of piping, or when smoke is not detected at the roof stack of connecting buildings. In these cases, CCTV inspection (by others) will be required of both mainline and lateral piping. When a defect is identified as being a potential significant inflow source it will be recommended for dye testing. The smoke shall be non-toxic, odorless, and non-staining. A Safety Data Sheet shall be submitted and approved by city prior to the commencement of smoke testing.

Prior to testing, the selected Contractor shall submit a schedule outlining test dates and locations to the city, three weeks prior to commencing the smoke testing. The selected Contractor shall prepare Smoke Testing notices (English & Spanish) advising residents and local authorities of the smoke testing program. The notices shall be approved by the city prior to distribution. Extra copies of the notices will be provided to the city for distribution to other city agencies, including the Fire Department, Police Department, Emergency Services and others. The selected Contractor shall distribute smoke testing notices to residences in the project area including the local fire and police precincts, approximately 48-72 hours in advance of the smoke testing. For large facilities such as schools or hospitals, a log will be maintained that documents the property manager's notification of planned smoke testing activities. A local Contractor's telephone number will be provided for those individuals with questions or for anyone requiring special assistance. Field personnel will be uniformed and will conspicuously display identification badges. Private individuals requesting additional identification will be asked to contact the city and crews shall carry a letter from the city authorizing the holder of the letter to perform the work described. Each day the fire department and other affected agencies will be notified of the crew location since smoke may enter homes through defective plumbing.

406-2. REPORTING

Field results shall be documented in an Excel spreadsheet and on printed maps. The Excel spreadsheet shall include the following information:

- a. defect and photo number
- b. address and locations of defects
- c. type of defect found
- d. is defect public or private
- e. address of residences that did not smoke during testing and residents' houses that were smoked with defect description (if possible)

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- f. address of residences that did not have a cleanout plug(s) or lids and or in low-lying areas
- g. manholes ID on those with no manhole inserts, with debris, or in low-lying areas
- h. any defective sewer mains found in the field.

The printed and digital maps shall include the following:

- a. boundary of the test area
- b. sanitary sewer line segments tested
- c. location and boundary of blower setups
- d. locations of defects with defect number and photo of defect
- e. address of residences that did not smoke during testing (plumbing roof vent: negative) and residences that smoke in house
- f. ID numbers for manhole missing water-tight manhole inserts
- g. location of smoking storm sewer catches basins

The field documentation will include:

- a. sketched of the location and nature of each system defect
- b. pertinent information for prioritizing repair of the defects
- c. information needed to assess the best mitigation method
- d. color digital photographs will be taken to document defects during smoke testing
- e. location of defect will be measured from permanent objects (corner of house, light pole, etc.).

In addition to the standard documentation procedure, each smoke testing crew will be equipped with a computer tablet which is ‘blue-toothed’ to a GPS receiver. The crew can see their location on the downloaded ‘cloud-based’ map and as inflow sources are identified photographs will be taken to document each defect and an X, Y coordinate value will be assigned to each image. As each defect image is automatically uploaded to the ‘cloud-based’ map a defect type code will be attached to the image. Each inflow source or defect can then be displayed on the map and each defect type is assigned a different symbol/color/indicator. This form of documentation allows for comprehensive QA/QC of each completed smoke test and assurance that no defect is left unrecorded. The following is an overview of the required smoke testing process and reporting.

1. Field review the area selected area and note on the map all “hundred block” addresses.
2. Distribute smoke notice to all homes, businesses, schools, police and Fire & Rescue, etc. In addition, Fire & Rescue will be notified of any proposed smoke testing activities forty-eight to seventy-two hours prior to initiation.
3. During the initial field review, identify all types of businesses, specifically any doctors’ offices, hospitals, schools, retirement homes (communities), assisted living facilities (ALFs), or any other establishment that may need special consideration and handling during the actual smoke test. Strict consideration and coordination with customers who have sensitive needs must be adhered to, some of whom will not be included on any smoke testing schedule as the nature of their business, such as hospitals, is far too delicate.
4. Twenty-Four hours minimum must expire from the issuance of smoke testing notices to allow all affected to prepare for the testing. For special exceptions, such ALFs and persons with health problems living at home, etc., direct in person of telephone contact shall be made if at all possible.
5. On the day of the testing, the selected portion of the study area will be identified and all street names and related hundred block addresses will be given to the police and fire department/emergency personnel for the area where the testing will occur. UNDER NO CIRCUMSTANCES WILL THE AREA SELECTED FOR THAT DAY’S TESTING BE MODIFIED TO INCLUDE ADDITIONAL WORK UNLESS THE POLICE & FIRE DEPARTMENT/EMERGENCY PERSONNEL HAVE BEEN NOTIFIED FIRST. The name and ID number of the fire department person contacted will be documented on the appropriate form.

The fire department/emergency personnel will be provided the exact locations and specific time frames of where and when the tests will be performed.

6. Multi-day scheduling with one-time reporting to the police and fire department/emergency personnel will not be permitted.
7. The city's Project Manager will be notified on a daily basis with the same information.
8. Should the fire department/emergency personnel respond to the target area during the actual smoke testing, all testing will cease immediately and the Smoke Testing Team's field supervisor in charge will contact the fire unit responding to answer any questions that the fire department officer may have.
9. All testing activity will cease when any resident complains of smoke entering their establishment. Smoke Testing Team's field personnel will then attempt to isolate where the smoke is entering the establishment and make the occupant aware of what the problem may be. All defective plumbing found inside should be documented appropriately for future reference. The occupant will be advised to have the defect repaired by a licensed plumber.
10. During the actual smoke testing, Smoke Testing Team field personnel will scout the area for smoke escaping from ground sources, roof vents, storm drain structures, etc. All sources of Rainfall Dependent Infiltration/Inflow will be photographed, measured, drawn, and documented accordingly with addresses, data, and sketches. The smoke test form will identify which sewer segment is being tested by its component identification in the city's GIS database.
11. All defects encountered will also be recorded using handheld tablets 'blue tooth' to a GPS receiver. The tablet will have access to the city's wastewater collection system GIS which will be overlaid on a digital ortho map and the GPS unit will allow the smoke test team member to see his location on the map in real time and allow for the accurate recording of a defect's type and location. Each defect image taken will be geocoded to a specific location and the information will be stored electronically for future use.

It is understood that the city staff members may accompany the selected Contractor's field staff during the smoke testing initiative to gain a better understanding of how to quantify potential inflow volumes from the smoke defects recorded and how to compare the smoke testing defect results to the previously recorded flow data. It is further understood that the selected Contractor's staff will install cleanout plugs and storm water manhole inflow dishes (provided by the city) concurrently with the smoke testing operations. The selected Contractor will develop a 'Smoke Testing Results' spreadsheet that identifies each pipe section tested and the results of the test, whether positive or negative. A separate spreadsheet: 'Smoke Testing Defects', will be prepared that identifies all defects encountered during the smoke testing activity. This spreadsheet will contain a column which identifies the surface area associated with each defect, and if there is a need to conduct dye water testing/flooding.

406-3. DYE INVESTIGATION

The results of the smoke testing may not always clearly or positively indicate the source of a sanitary sewer interconnection or defect. Further investigation may be required to fully define the I/I sources or defects under the following conditions:

1. Smoke injected into the sanitary sewer is seen in storm sewer catch basins. This may be caused by defective catch basin laterals in the vicinity of the sanitary sewer (if the sanitary sewer has open joints, cracks or breaks). Dye testing may be needed to determine if the catch basin is connected to the sanitary sewer. CCTV (by others) of the sanitary sewer may be needed to identify the point of the smoke exfiltration.
2. Smoke does not freely pass from one manhole to the next, or vent from property's roof stack/ roof plumbing vent, during the sanitary sewer smoke testing. CCTV (by others) of the sanitary sewer/lateral may be needed to identify sewer blockages or pipe sags.

Upon completion of the initial smoke testing within a service area, the selected Contractor will submit a list of locations that require further investigation to the city. Upon approval from the city, the city may request the selected contractor to accompany a city diagnostic crew to further investigate the inconclusive smoke test results. Techniques employed by the city may include dye testing, CCTV inspections (by others) manhole/catch basin inspection, sewer line lamping (by others), and storm sewer cleaning (by others).

Where initial smoke test results warrant further investigation as approved by the city, a non-toxic dye approved by the city will be used to investigate specific potential interconnections. Contractor shall submit the SDS for all dyes used. Storm sewer cross-connections and area drains that are suspected of being connected to the sanitary sewer will be positively identified using the dye tracer procedure. Laterals suspected of having significant leaks or breaks will also be investigated. Field documentation, including sketches showing the location of all tests conducted and digital photographs, where feasible, will be used to record findings. Internal pipeline inspection will determine the exact source of the suspected interconnection and establish the best abatement option. The following identifies the dye water protocols to be implemented.

406-3.1. DYE WATER TRACING

Private/Public sector dye water tracing will be conducted by introducing a small quantity of liquid dye concentrate into suspect sources such as downspouts, area drains, patio drains, window well drains, and driveway drains, and then introducing a sufficient volume of clean water to locate the source's discharge point. During each tracing, sanitary sewers, storm drains, and curb lines located downstream of the sources shall be monitored for signs of dyed water. The quantity of dye concentrate and water used will vary depending on pipe size and the quantity of flow and debris in each line section. A report will be prepared for each location where dye water tracing has been performed. The report will identify where the dye water was introduced and its' susceptibility for entering the wastewater collection system. Photos will be taken of where the dye water is introduced and where it is recorded discharging into the downstream wastewater collection system manhole. CCTV inspection equipment (by others) will be utilized to identify exactly where the dye water is entering the wastewater collection system piping.

406-3.2. DYE WATER FLOODING

Dye water flooding results will be documented for each location where the storm drainage system is flooded. Each dye water flood report will identify the section of wastewater gravity piping being tested, the location(s) where the storm water system piping was isolated and flooded, photographs of each setup and CCTV inspection results (by others) identifying the location(s) where dye water was identified entering the wastewater collection system. The following information will also be documented; evidence of dyed water in manholes downstream from the ponding area, stream crossing, or other suspected sources where the dyed water is placed, and time of travel from contributing source to the manhole sampled, and the concentration of the dyed water observed;

The Field Inspection Procedures for Dyed Water Flooding are as follows:

1. A mixture of water and any approved dye coloring substance will be introduced to the identified source. Dye water team inspectors will be stationed immediately downstream on the local sanitary and storm sewer lines. Observations, whether positive or negative, will be documented appropriately. Whenever possible the dyed water point of exit will be documented by CCTV inspection equipment (by others).
2. Prior to any dye testing, the appropriate city staff shall be notified of the specific location of testing and what adjacent waterways may be affected when the dye water is released into the storm drainage system.

Fire hydrants used to supply the water source needed will be opened slowly and closed in the same manner. A flow restrictive device shall be used on the hydrant to prevent discoloration problems. Should the water be running cloudy or dirty after use, the fire hydrant shall be left open at a slow pace until the water clears. If long term draining is required, the Dye Water Team shall notify the city.

406-4. MEASUREMENT AND PAYMENT

Measurement shall be the number of linear feet smoke tested and each occurrence of dye water tracing and dye water flooding.

406-5. BASIS OF PAYMENT

Payment shall be based upon the unit price per linear foot for smoke testing as measured above and each occurrence of dye water tracing and dye water flooding, which shall be full compensation for all work described in this section of the specifications and shall include all materials, equipment, and labor necessary to perform the smoke and dye testing.

500 SERIES: POTABLE AND RECLAIMED WATER MAINS, FIRE LINES AND APPURTENANCES

501. SCOPE

The Contractor shall furnish all plant, labor, materials, and equipment to perform all operations in connection with the construction of potable water mains, fire lines, reclaimed water mains and appurtenances including clearing, excavation, trenching, backfilling and clean up. All materials identified and specified in this section shall be NSF 61 and ISO 9001 compliant.

502. MATERIALS

502-1. GENERAL

Materials, equipment, and supplies furnished and permanently incorporated into the project shall be of the best quality in every respect and shall be constructed and finished to high standards of workmanship. Materials shall be suitable for service intended, shall reflect modern design and engineering, and shall be fabricated in a first-class workmanlike manner. All materials, equipment and supplies shall be new and shall have not been in service at any time previous to installation, except as required in tests or incident to installation. Machined metal surfaces, exposed bearings and glands shall be protected against grit, dirt, chemical corrosion and other damaging effects during shipment and construction.

All materials shall be tested in accordance with the applicable Federal, ASTM or AWWA Specification and basis of rejection shall be as specified therein. Certified copies of the tests shall be submitted to the Engineer of Record with each shipment of materials.

Engineer of Record shall certify and submit all material test results to the city Project Manager within 10 calendar days of performing test(s).

502-2. PIPE MATERIALS AND FITTINGS

502-2.1. DUCTILE IRON PIPE

Ductile iron pipe shall conform to the requirements of ANSI/AWWA C151/ A21.51, latest revision. The minimum thickness class for underground pipe shall be Thickness Class 51 for 4-inch pipe or greater, 3" ductile iron water mains or service lines are not allowed, Thickness Class 50 for 6-inch through 12-inch pipe and Pressure Class 250 for 16-inch pipe and larger. Flanged pipe shall have a minimum thickness class of Class 53. Pipe thickness class or pressure class, wall thickness and working pressure shall conform to the following table:

Size	Thickness Class (TC) Pressure Class (PC)	Thickness (In.)	Rated Water Working Pressure (PSI)
4"	TC51	0.26	350
6"	TC50	0.25	350
8"	TC50	0.27	350
12"	TC50	0.31	350
16"	PC250	0.31	250
20"	PC250	0.33	250

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24"	PC250	0.37	250
30"	PC250	0.42	250
36"	PC250	0.47	250

Pipe larger than 8-inches in diameter or pipes which are deeper than 10-feet shall be ductile iron only, for open cut installations. The City Engineer reserves the right to require the use of ductile iron in sizes 4-inch through 12-inch when needed due to laying conditions or usage.

Pipe shall have a minimum rated water working pressure of 250 psi and shall be furnished in laying lengths of 20 feet or less, unless specifically shown otherwise on the Drawings. All piping and fittings shall be new and unused, no refurbished piping or fittings shall be accepted.

Ductile iron pipe shall be used for all hydrant installations, large meter sets 3" or larger and for fire line installations from the main to the backflow preventer.

Fittings: Fittings for bends, tees, crosses, etc. from 4-inch through 36-inch in size installed on ductile iron pipe shall be either mechanical joint, restrained joint or flanged joint as indicated on the Drawings and shall have a minimum working pressure of 250 psi. Fittings shall be cast ductile iron and shall conform to ANSI/AWWA C110, ANSI/AWWA C111 and ANSI/AWWA C153, latest revisions for flanged and mechanical joint pipe. Fittings for compact ductile iron cast fittings in accordance with ANSI/AWWA C153/A 21.53, latest revision with mechanical joint bells or ductile iron cast fittings in accordance with ANSI/AWWA C110/A 21.10, latest revision with mechanical joint bells. Fittings shall be coated and lined as indicated on the Drawings, in the manner specified below for ductile iron pipe. The rubber gaskets for flanged, mechanical, and push-on joints shall be as described below.

The working pressure minimum rating shall be 350 psi for 4-inch to 24-inch fittings. Fittings larger than 24-inch shall be pressure rated to 250 psi minimum. Fittings shall be designed to withstand without bursting a hydrostatic test of three times the rated water working pressure. All fittings shall have a date code cast into the fitting in addition to the pressure rating and material code. Ductile iron fittings shall be coated and lined in accordance with requirements of ANSI/AWWA C104/A21.4. Mechanical joint glands shall be ductile iron in accordance with ANSI/AWWA C111/A 21.11. When reference is made to ANSI/AWWA Standards, the latest revisions shall apply. Only those fittings and accessories that are of domestic (USA) manufacture shall be acceptable.

Push-On Joints: Push-on-joints shall be used for straight pipe lengths only. No fittings with push-on-joints shall be allowed. Pipe using push-on joints shall be in strict accordance with AWWA C111 and ANSI A21.11, latest revision. Jointing materials shall be provided by the pipe manufacturer and installation shall be in strict accordance with the manufacturer's recommended practice. The gaskets for push-on pipe joints shall be made of EPDM rubber. Push-on joints shall be as listed in the *City of Clearwater Approved Products List*, or an equal approved by the city.

Mechanical Joints: Jointing materials for mechanical joints shall be provided by the pipe and fitting manufacturer. Materials assembly, bolting and gaskets shall be in strict accordance with ANSI/AWWA C111 and ANSI/AWWA C110/ A 21.10 and ANSI/AWWA C153/ A 21.53, latest revisions. Tee head bolts and nuts for underground mechanical joint ductile iron fittings shall be manufactured of CORTEN, high strength, low alloy, corrosion resistant steel in accordance with ASTM A242, or an equal approved by the Engineer. The gaskets for mechanical joints shall be made of EPDM rubber.

Flanged Joints: Bolt circle and bolt holes for flanges shall be drilled and faced to match ANSI B16.1, Class 125, with any special drilling and tapping as required to insure correct alignment and bolting. All accessory hex-head bolts and nuts and full faced gaskets for each joint size shall be furnished as a flange accessory package.

1. Gaskets: Full face, Toruseal gaskets, or approved equal shall be used for flanged pipe connections. Gaskets shall be suitable for a water pressure of 350 psi at a temperature of 180F. The gaskets for flanged joints shall be made of EPDM rubber.
2. Bolts and Nuts for Flanges: Bolts and nuts for flanges shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts. The nuts shall have a hardness that is lower than that of the bolts and washers by a difference of 50 Brinnell hardness to prevent galling during installation.
3. Flanges shall be long-hub type screwed tightly on pipe by machine at the foundry prior to facing and drilling. Flange machine surfaces shall be coated with rust inhibitor immediately after facing and drilling. Field assembled screwed on flanges are prohibited.

502-2.1.1. MANUFACTURED RESTRAINED JOINTS FOR DUCTILE IRON PIPE

Restrained Pipe Joints and Fittings: Thrust restraint for buried piping shall be provided by restrained joints. Concrete thrust blocks shall not be acceptable. Pipe joints and fittings shall be restrained in accordance with the Drawings and the requirements of this Specification. It is intended that, at a minimum, all fittings shall be restrained. In cases where the calculated required length of restrained pipe is not evenly divisible by nominal laying lengths of pipe, the total required length of restrained pipe shall be rounded up to the next closest nominal length that is evenly divisible by the standard laying length.

- A. Manufactured Restrained Joints: Manufactured restrained joints shall be manufacturer's standard specifically modified push-on type joints with joint restraint provided by ductile iron retainer rings joined together by corrosion-resistant, high strength steel tee head bolts and nuts or with joint restraint provided by a welded-on retainer ring and a split flexible ring assembled behind the retainer ring. Gaskets for manufactured restrained pipe joints shall be made of EPDM rubber. Manufactured restrained joints shall be as listed as an equal approved by the city.
- B. Gripping-Type Gasket Restraint: Gripping-type gaskets may be used for ductile iron pipe 12-inches in size and smaller, when approved by the city. This type of restrained joint shall be the manufacturer's standard push-on type joint with joint restraint provided by a specially designed gasket with high strength stainless steel gripping elements which have sharp teeth on its inner surface for gripping the spigot end of the pipe joint. The gripping type gasket shall be made of EPDM rubber. The gripping type gasket manufacturer's joint restraint shall only be considered for use on pipe sizes from 4-inch to 12-inch. Gripping type gasket restraints shall be as listed in the *City of Clearwater Approved Products List*, or an equal approved by the city.
- C. Manufactured restrained joint pipe and fittings shall be ductile iron only and shall comply with applicable portions of this Specification. Manufactured restrained joints shall be capable of deflection during assembly. Deflection shall not exceed 50 percent of the manufacturer's recommendations.
- D. Tee head bolts and nuts for restrained joints shall be manufactured of CORTEN, high strength, low alloy, corrosion resistant steel in accordance with ASTM A242, or an equal approved by the Engineer.

502-2.1.2. ALTERNATE MECHANICALLY RESTRAINED JOINTS FOR DI PIPE

Thrust restraint for buried piping shall be provided by restrained joints. Concrete thrust blocks shall not be acceptable. When prior approval is obtained from the Engineer, ductile iron pipe and fittings with mechanical joints or ductile iron pipe with push-on joints may be restrained using a follower gland or ring which includes a restraining mechanism. Joint restraints shall have a working pressure rating of 350 psi for 3-inch to 16-inch ductile iron pipe, 250 psi for 18-inch to 36-inch ductile iron pipe, with a minimum pressure

rating safety factor of 2 to 1. The restraint shall be accomplished by multiple gripping wedges incorporated into a follower gland meeting the requirements of ANSI/AWWA C110/A21.10.

502-2.1.2.1. Restraints for Ductile Iron Pipe with Mechanical Joint Fittings

Joint restraints for ductile iron pipe to mechanical joint fittings shall be MEGALUG[®] Series 1100 restraints by EBAA Iron, or an approved equal listed in the *City of Clearwater Approved Products List*. When actuated during installation, the restraining device shall impart a multiple wedging action against the pipe wall, which increases resistance as internal pressure in the pipeline increases.

- A. The restrained joint shall maintain flexibility after installation. Glands shall be manufactured of ductile iron conforming to ASTM A536 and restraining devices shall be of heat-treated ductile iron with a minimum hardness of 370 BHN. The gland shall have standard dimension and bolting patterns for mechanical joints conforming to ANSI/AWWA C111 and C153, latest revisions. The restraining wedges shall have twist-off nuts to insure proper torquing.
- B. Tee head bolts and nuts shall be manufactured of corrosion-resistant, high strength, low alloy CORTEN steel in accordance with ASTM A242.
- C. No other retainer gland type device will be acceptable. After installation prior to backfilling, all parts of the joint restraint system shall be coated with coal tar epoxy equal to Carboline Bitumastic No. 300-M.

502-2.1.2.2. Restraints for Ductile Iron Pipe with Push-on Joints

Joint restraints for ductile iron push-on pipe joints 4-inch to 36-inch shall be constructed of ductile iron conforming to ASTM A536 and shall have a working pressure for 350 psi for 4-inch to 16-inch and 250 psi for 18-inch and larger fittings. Restraint shall be accomplished by a wedge action restraint ring on the spigot joined to a split ductile iron ring behind the bell and the two rings connected by restraint rods and nuts. Torque limiting twist off nuts shall be used to ensure proper actuation of the restraining wedges. The restraints shall be MEGALUG[®] Series 1700 restraint harnesses as manufactured by EBAA Iron or an approved equal.

- A. The restrained joint shall maintain flexibility after installation. Restraint rings shall be manufactured of ductile iron conforming to ASTM A536 and the ring restraining wedge devices shall be of heat-treated ductile iron with a minimum hardness of 370 BHN. The restraining wedges shall have twist-off nuts to insure proper torquing.
- B. Restraint rods and nuts shall be manufactured of corrosion-resistant, high strength, low alloy CORTEN steel in accordance with ASTM A242.
- C. No other restraint harness type device will be acceptable. After installation prior to backfilling, all parts of the joint restraint system shall be coated with coal tar epoxy equal to Carboline Bitumastic No. 300-M.

502-2.1.3. Ductile Iron Pipe Installed with Steel Casings

General: All pipe placed within steel casings shall be push-on joint ductile iron pipe restrained by the use of mechanical bell restraints as specified above in *Section 502-2.1.2.2*. The rods for the bell restraints shall be double nutted to prevent over-belling of the joint during push-in of the carrier pipe into the casing. The carrier pipe shall have properly sized casing spacers installed on the pipe so that the pipe will be centered within the casing. Each end of the casing shall be properly sealed to prevent the intrusion of soil, water, or debris within the casing itself. It shall be double sealed by brick and cement mortar and include a casing end seal with stainless steel bands as shown on in the engineering construction standards.

Cement-Mortar Interior Lining (Potable or Reclaimed Water): Ductile iron pipe, fittings, and specials shall be cement lined in accordance with ANSI/AWWA C104, latest edition, "Cement-Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings for Water". The cement lining shall have standard thickness

and, after curing, the lining shall have a seal coat of bituminous material in accordance with ANSI/AWWA C104/A21.4 80, latest revision and shall be listed by ANSI/NSF Standard 61 for potable water contact.

Pipe Labeling: Pipe manufacturer shall label in large legible lettering on the exterior of the pipe the type of pipe interior lining.

Exterior Coatings for Buried Pipe: Ductile iron pipe, fittings, and specials to be installed underground shall be coated on the exterior at the factory with one coat, 1 mil DFT, of asphaltic coating per AWWA C151, C110 and C153. All clamps, bolts, nuts, studs, and other uncoated parts of joints for underground installation shall be coated with coal tar epoxy prior to backfilling. Coal tar epoxy shall be equal to Carboline Bitumastic No. 300-M.

Exterior Coating for Exposed Pipe: Ductile iron pipe, fittings, and specials to be installed aboveground shall be furnished with a shop applied primer on the exterior. All above ground ductile iron pipe and fitting installations shall be painted in the field with an epoxy-epoxy-urethane system coating from an approved coating manufacturer, color: Safety Blue for potable water, Pantone Purple for reclaimed water or Safety Green for wastewater.

502-2.1.4. POLYETHYLENE ENCASEMENT FOR BURIED DUCTILE IRON PIPE

Polyethylene tube encasement shall be provided and installed for all buried ductile iron pipe segments and fittings for corrosion protection as specified herein. Both material and installation procedures shall be in accordance with ANSI/AWWA C105/ A21.5-10. Polyethylene encasement material shall be manufactured with UV inhibitors. The polyethylene encasement shall be color coded as follows:

- A. Potable Water Service – Blue Polyethylene Encasement.
- B. Reclaimed Water Service – Pantone Purple Polyethylene Encasement.
- C. Wastewater Service – Green Polyethylene Encasement.

The polyethylene encasement shall be a minimum of 8 mils thick and shall be certified by the manufacturer to provide suitable protection of pipe installation in corrosive soil.

All pipe joints shall consist of a minimum of one foot of polyethylene overlap onto the adjacent pipe at both ends. All overlap material shall be secured in place with at least two wraps of 1-inch wide x 8 mils thick polyethylene adhesive tape. Any slack liner material along the pipe barrel shall be taken up by folds secured in-place with adhesive tape. Repair any rips, punctures, or other damage to polyethylene with tape or by patching.

All valves, fittings and specialty items shall be jointed with proper overlaps and fastening as described above. Prepare openings for service taps, air-reliefs, etc., by making a cut in the polyethylene and temporarily folding back the edges. After installation is completed, replace the polyethylene and repair the cut with polyethylene adhesive tape.

Care shall be taken during backfilling so that no damage will occur to the polyethylene encasement. In general, backfilling shall be done in accordance with AWWA Standard C 600.

The Contractor shall install polyethylene encasement in accordance with all liner and pipe manufacturer recommendations.

Polyethylene encasement shall be required for below ground installations of ductile iron pipe and fittings where the installed ductile iron utility pipe will be located less than 10 feet from a gas main.

502-2.2. POLYVINYL CHLORIDE (PVC) PIPE

Each length of PVC pipe shall bear identification that will remain legible during normal handling, storage and installation such as the name or trademark of the manufacturer, the location of the manufacturing plant,

and the class or strength classification of the pipe. All PVC pipe shall bear the NSF-DW seal. Each length of pipe shall also bear and so designate the testing agency that verified the suitability of the pipe material for potable water service. The markings shall be plainly visible on the pipe barrel. This required identification shall be factory applied by the manufacturer. Pipe which is not marked clearly with the required identification is subject to rejection. All rejected pipe shall be promptly removed from the project site by the Contractor. PVC pipe is approved for underground installations only.

Polyvinyl Chloride (PVC) Pipe 4-inch through 8-inch shall be in accordance with ANSI/AWWA C900, DR18, latest revision and the American Society for Testing & Materials for the PVC Resin Compound conforming to ASTM Specification D1784. Pipe shall have gasketed integral bell ends and shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults. Pipe shall be designed for maximum working pressure of not less than 235 psi and with not less than a sustained hydrostatic pressure of 470 psi for a safety factor of 2 to 1 for AWWA C900 pipe.

Polyvinyl Chloride Pipe shall be manufactured to the same outside diameter (O.D.) as Ductile Iron Pipe only. Pipe larger than 8-inches in diameter or pipes which are deeper than 10-feet shall be ductile iron only. The City Engineer reserves the right to require the use of ductile iron in sizes 4-inch through 8-inch when needed due to laying conditions or usage.

Pipe dimension ratio, working pressure and laying length shall conform to the following table:

Size	Dimension Ratio (OD/Thick.)	Rated Water Working Pressure (PSI)	Laying Length (Ft)
4	18	235	20
6	18	235	20
8	18	235	20
12	18	235	20

Bell and Spigot Pipe Joints: Pipe joints shall be gasketed, push-on type made with integral bell and spigot pipe ends in accordance with ASTM D3139, latest revision. The bell shall consist of an integral thickened wall section designed to be at least as strong as the pipe wall. The bell shall be supplied with factory glued rubber ring gasket which conforms to the manufacturer's standard dimensions and tolerances. The gasket shall meet the requirements of ASTM F477 "*Elastomeric Seals (Gaskets) for Joining Plastic Pipe*" and shall be manufactured of EPDM elastomeric material. PVC pipe shall be approved by the Engineer and the Owner or approved equal.

Integral Pipe Color: All PVC pipe for potable water mains, reclaimed water mains and wastewater force mains shall be extruded or fabricated with an integral color in the PVC material. The integral color for the PVC pipe shall be as follows:

- A. Potable Water: PVC pipeline color - Blue.
- B. Reclaimed Water: PVC pipeline color – Pantone Purple
- C. Wastewater: PVC pipeline color – Green

The use of white or any other color pipe for potable water, reclaimed water or wastewater service shall be prohibited.

Fittings: Fittings for PVC pressure pipe shall be ductile iron fittings with restrained mechanical joint ends, linings and coatings as specified in *Section 502-2.1* for ductile iron fittings.

Restrained Joints for PVC Pipe: Thrust restraint for buried piping shall be provided by restrained joints. Concrete thrust blocks shall not be acceptable. Thrust restraints shall be used at all valves, tees, bends, and other fittings for the Restrained Joint PVC pipe and Push-on Joint PVC pipe. Where indicated on the Drawings, to prevent pipe joints and fittings from separating under pressure, pipe joints and fittings for PVC pipe shall be restrained as follows:

- A. PVC pipe bell and spigot push-on joints, adjacent to restrained fittings, shall be restrained using a harness type restraint device. The harness restraint shall be split to enable installation of the restraint after the spigot has been installed into the bell. The restraint unit shall consist of a split ring that fits behind the bell, a split restraint ring that installs on the spigot and a number of clamping bolts to connect the other two parts. The restraining device shall consist of multiple individually activated gripping wedges or a series of serrations to grip the pipe and maximize restraint capability in conjunction with a sufficient number of clamping bolts connecting the retainer on the bell side of the joint pipe to the restraint ring on the other side to hold the spigot. The restraining device and components shall be manufactured of high strength ductile iron meeting ASTM A536, Grade 65-42-10. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy CORTEN steel meeting the requirements of ASTM A242. The restraint device shall be the EBBA Iron MEGALUG[□] Series 1500 TD Restrainer or an equal.
- B. Mechanical joint fittings used with PVC pipe shall be restrained with the EBBA Iron MEGALUG[□] Series 2000 PV Restrainer or an equal approved. The restraining device shall consist of a retainer gland such that it can replace the standard mechanical joint gland and can be used with the standard mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21-53. The restraining device shall have a pressure rating equal to that of the PVC pipe on which it is used. Twist off nuts, sized same as the tee-head bolts shall be used to insure proper actuating of restraining devices. The restraining gland shall be manufactured of high strength ductile iron meeting ASTM A536, Grade 65-42-10. The tee head bolts and nuts, and the clamping bolts and nuts, shall be manufactured of corrosion resistant high strength, low alloy CORTEN steel meeting the requirements of ASTM A242.

502-2.2.1. RESTRAINED JOINT PVC PIPE (DIRECTIONAL BORE)

Restrained Joint PVC pipe and couplings used for directional bores shall be made from un-plasticized PVC compounds having a minimum cell classification of 12454-B, as defined in ASTM D1784 (latest edition). All compounds shall qualify for a Hydrostatic Design Basis (HDB) rating of 4000 psi for water at 73.4°F, in accordance with the requirements of ASTM D2837 (latest edition latest edition). Blue pipe (safety blue paint color) shall be supplied for the potable water system and purple pipe (pantone 522C paint color) shall be supplied for the reclaimed water system as specified in *Section 502-2.2*.

Nominal outside diameters and wall thickness of PVC pipe shall conform to the requirements of AWWA C900 for pipe sizes between 4 and 16-inches. Nominal outside diameters and wall thickness of 4" PVC pipe shall conform to the requirements of ASTM D2241 (latest edition). PVC pipe shall be furnished in sizes 4" (Pressure Rating 250 psi, DR17), 4" (Class 305, DR-14) and 6" and 8" (Class 235, DR-18). Pipe shall be furnished in standard laying lengths of 20 ft. + 1 in.

PVC pipe used for directional bores shall be joined using a restrained-joint coupling system or ring restraint with Rieber Gasket meeting the requirements of ASTM F477, latest edition. Pipe and/or couplings shall be designed as an integral system and shall be provided by a single manufacturer for maximum reliability and interchangeability. Assembled joints shall meet the leakage test requirements of ASTM D3139 (latest edition). No external pipe-to-pipe restraining devices which clamp onto or otherwise damage the pipe surface as a result of point-loading shall be permitted.

Maximum allowable axial jacking loads for the pipe shall be provided by the pipe manufacturer. The Contractor shall provide and utilize appropriate instrumentation that the Engineer shall monitor, to ensure that the jacking loads never exceed 80% of the maximum allowable axial jacking loads allowed by the pipe manufacturer. Only experienced personnel shall be used to install pipe. If used, coupling edges shall be beveled to reduce drag force when pipe is installed by directional bore or Micro tunneling. Assembly of joints shall be in strict accordance with the manufacturer's written instructions.

Manufacturer/Product: Certain Teed Certa-Lok C-900, no approved equal.

502-2.3. HIGH DENSITY POLYETHYLENE (HDPE) PIPE

This Section includes materials and methods of installation of high-density polyethylene pipe (HDPE) and fittings for water, reclaimed water, and wastewater utility use as required and as specified herein. For point repairs only if the flow cannot be stopped the use of stiffeners is allowed.

The high density, very high molecular weight polyethylene pipe shall be made from a HDPE material having a minimum material designation code of PE4710 and shall conform to AWWA C906, latest revision. The material shall meet the requirements of ASTM D3350 and shall have a minimum cell classification of PE445574C/E. In addition, the pipe shall be listed as meeting NSF-61. HDPE pipe shall have outside diameter sizes matching ductile iron pipe (DIPS) and shall have the minimum wall thickness and dimension ratio (DR) as shown on the Drawings for a particular installation. Minimum pressure ratings for HDPE pipe shall be 250 psi DR 9 and 200 psi for DR-11. The DR rating or the minimum pipe wall thickness of the pipe for a particular HDD installation shall be as called out on the Drawings. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by pre-compounding in a concentration of not less than 2 percent.

The pipe manufacturer shall be listed and in good standing with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe. Pipe shall be manufactured by Performance Pipe (Chevron), JM Eagle or an approved equal.

HDPE pipe shall be manufactured and identified by color based on the type of utility service. HDPE pipe and tubing less than 6-inch in size shall be manufactured entirely in the required color. For HDPE pipe 6-inch and greater, color coding shall be accomplished either through an exterior surface entirely of the required color or through striping. The color coding shall be permanently co-extruded on the pipe exterior surface as part of the pipe's manufacturing process. The pipe shall be manufactured as one solid color per the applicable service color or shall be black in color with three (3) permanent solid color stripes, per the applicable service color, extruded into the piping material. The colored stripes shall appear on three (3) sides of the pipe, run the entire length of the pipe, and each stripe shall be no less than 1-inch wide. Painting HDPE pipe to accomplish color coding shall not be permitted. The pipe identification color coding based on the intended Type of Utility Service shall be as follows:

1. Sewer – green (safety green paint color)
2. Water – blue (safety blue paint color)
3. Reclaimed water – purple (pantone 522C paint color)

In addition to the identification color being co-extruded, HDPE Pipe shall have been continuously marked by the manufacturer with permanent printing with the following information at a minimum:

- A. Nominal Size (Inches).
- B. Dimension Ratio (DR).
- C. Pressure Rating (psi).
- D. Trade Name.
- E. Material Classification (PE4710).
- F. Plant, Extruder and Operator Codes.
- G. Resin Supplier Code.
- H. Date Produced; and
- I. HDPE pipe used for potable water mains shall bear the NSF Seal of Approval.

502-2.3.1. MECHANICAL JOINT ADAPTERS (MJ ADPAPTERS)

Mechanical Joint Adapter Fittings shall have a material designation code of PE4710, and a minimum Cell Classification of PE445474C/E. Mechanical Joint Adapters can be made to ASTM D3261 or if machined, must meet the requirements of ASTM F2206. MJ Adapters shall have a pressure rating equal to the pipe

unless otherwise specified on the plans. Markings for molded or machined MJ Adapters shall be per ASTM D3261.

Where shown on the drawings, 4-inch and larger transitions to mechanical joint fittings and valves shall be ductile iron mechanical joint. Connection to the mechanical joint fittings shall be accomplished using a mechanical joint adapter kit. The mechanical joint adapter fitting shall be fused onto the pipe and shall result in a restrained joint with a pressure rating no less than 150 psi. The D.I./HDPE mechanical joint adaptor shall consist of:

1. A molded or fabricated HDPE mechanical joint transition fitting.
2. A mechanical joint rubber gasket fabricated of EPDM.
3. A mechanical joint restraining gland. The restraining gland shall be manufactured of high strength, ductile iron meeting ASTM A536, Grade 65-42-10.
4. The tee head bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy CORTEN steel, meeting the requirements of ASTM A242.

502-2.3.2. BUTT FUSION PROCESS AND INSTALLATION

The pipe shall be joined by the butt fusion procedure outlined in ASTM F2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations and shall be butt-welded flush to the outside diameter of the pipe. Joints shall provide axial pullout resistance. Fusion joints shall be made by qualified fusion technicians per PPI TN-42. A record or certificate of training for the fusion operator must be provided to the Engineer that documents training to the fundamentals of ASTM F 2620.

All HDPE fusion equipment operators shall be qualified to perform pipe joining. Fusion equipment operators shall have current, formal training on all fusion equipment employed on the project and shall be certified by the pipe supplier/manufacturer. Training records for qualified fusion technicians shall be submitted to the Engineer for review. Training received more than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.

When the fusion machine operator is employed by the HDPE pipe and fusion machine supplier, the supplier shall maintain an ISO 9001 Certified Quality Management System.

Sections of HDPE shall be joined into continuous lengths on the job site above ground and butt fused in strict accordance with pipe manufacturer's recommendations. The finished pipe assembly shall be pressure tested prior to insertion underground.

All HDPE pipe shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with high density polyethylene pipe. The pipe supplier shall certify in writing to the Engineer that the Contractor is qualified to join, lay, and pull the pipe or representative of the pipe manufacturer shall be on site to oversee the pipe joining. Expenses for the representative shall be paid for by the Contractor.

The butt fused joint shall have a zero-leak rate under the following conditions:

- A. External pressure up to 60 psi from bentonite injection, slurry system operation, or groundwater head.
- B. Internal hydrostatic pressure testing of 150 psi.

The Contractor shall obtain from the pipe manufacturer a certificate of compliance to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications. The Contractor shall submit these certificates to the Engineer prior to installation of the pipe materials. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid. Joints or fittings that do not conform to these

specifications will be rejected and must be removed immediately by the Contractor. The entire product of any plant may be rejected when, in the opinion of the city, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

Each joint fusion shall be recorded and logged by an electronic monitoring device (data logger) affixed to the fusion machine. Joint data shall be submitted as part of the As-Built record information, in accordance with this Technical Specification.

Butt Fusion Machines: Only appropriately sized, and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following properties, including the following elements:

- A. **Heat Plate:** Heat plates shall be in good condition with no deep gouges or scratches within the pipe circle being fused. Plates shall be clean and free of any contamination. Heater controls shall properly function, and cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's recommendations.
- B. **Carriage:** Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.
- C. **General Machine:** Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.
- D. **Data Logger:** The current version of the pipe supplier's recommended and compatible software shall be used. Protective case shall be utilized for the hand-held wireless portion of the unit. Data Logger operations and maintenance manual shall always be with the unit. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.
- E. **Joint Recording:** Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of thermoplastic pipe. The software shall register and/or record the parameters required by the manufacturer and these Specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

Required Auxiliary Equipment: Other equipment specifically required for the butt fusion process shall include the following:

- A. Pipe rollers shall be used for support of pipe on either side of the fusion machine.
- B. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement and/or windy weather.
- C. Fusion machine operations and maintenance manual shall always be kept with the fusion machine.
- D. Facing blades specifically designed for cutting HDPE pipe.

The pipe shall be installed in a manner that does not exceed 70 percent of the recommended maximum bending radius of the pipe. When the pipe is installed by pulling in tension, 75 percent of the recommended Safe Pulling Force, according to the pipe supplier, shall not be exceeded.

Joint Fusion Bead Removal: Contractor shall trim and remove the butt fusion beads from the inside and the outside of the HDPE pipe at the butt fused joint following joint fusing. without disrupting pipe service. The restraints shall be manufactured by EBAA Iron Series 1500 or 1600 or approved equal.

502-2.4. PIPING IDENTIFICATION SYSTEM

502-2.4.1. EXTERIOR MARKINGS FOR BURIED PIPE

All ductile iron and polyvinyl chloride pressure pipelines installed by open cut shall receive a color-coded continuous self-adhesive vinyl tape, installed by the contractor, with the width and located as indicated below. Pipe tape striping shall be in the color required for the service as specified below.

A. Tape Stripe Marking Locations:

Up to 4-inch diameter pipe	(1 location)	3-inch wide tape placed at center-top of pipe.
6 to 16-inch diameter pipe	(2 locations)	6-inch wide tape placed on both sides, top half of pipe.
20-inch and larger diameter pipe	(3 locations)	6-inch wide tape placed on both sides' top half of pipe with a third stripe centered along top of pipe.

B. Color of Tape Stripe Marking:

Potable Water Marking Stripe Tape	Blue with Black or White Lettering, "POTABLE WATER MAIN" or similar wording.
Reclaimed Water Marking Stripe Tape	Purple with White or Yellow Lettering, "RECLAIMED WATER MAIN" or similar wording
Force Main Marking Stripe Tape	Green with Black or White Lettering, "WASTEWATER FORCE MAIN" or similar wording

502-2.4.2. LOCATION DETECTION WIRE:

- A. **Location Detection Wire for Open-Cut Pipeline Installations:** All ductile iron and polyvinyl chloride pressure pipelines installed by open cut shall be laid with two (2) strands of Location Detection Wire applied to the pipe. The detection wire shall be continuous, high strength copper clad steel (HS-CCS) 10 gauge AWG wire insulated with 30 mil thick high molecular weight – high density polyethylene (HMW-HDPE) insulation with a minimum break load of 684 pounds and specifically designed for use in open cut installations, equal to "1030-HS High Strength Tracer Wire" manufactured by Copperhead Industries, LLC, or an approved equal. Each wire shall be continuous with splices made only by spicing connectors manufactured by the wire manufacturer equal to "LSC1030C Snake Bite™ Locking Connectors" as manufactured by Copperhead Industries, LLC or an approved equal. The 2 wires shall be taped to the top of each joint of pipe with about 5-feet between each piece of tape, with a minimum of 3 taping locations for each 20-foot length of pipe. The tape used shall be 3M Scotch Rap All-Weather Corrosion Protection Tape, polyvinyl chloride backing with rubber adhesive, 4-inches wide or Engineer Approved Equal.

Following installation of the pipeline including backfill and compaction, the Contractor shall perform a second 12-volt DC electrical continuity test on each of the two (2) tracer wires.

- B. **Location Detection Wire for Horizontal Directional Drilling Pipeline Installations:** All polyvinyl chloride or HDPE pressure pipe installed by directional drilling methods shall be installed with three (3) insulated tracer wires. The three (3) tracer wires shall be attached at 120-degree locations around the pipe to help ensure continuity of at least one wire subsequent to the HDD installation. The tracer wire shall be continuous, extra high strength copper clad steel (EHS-CCS) 10 gauge AWG wire insulated with 45 mil thick high molecular weight – high density polyethylene (HMW-HDPE) insulation with a minimum break load of 2,032 pounds and specifically designed for use in directional drilling installations, equal to "1045-EHS Solo Shot EHS, Extra High Strength Tracer Wire" manufactured by Copperhead Industries, LLC, or an approved equal.

Continuity shall be maintained in the wire along the entire length of the pipe installed by HDD. No splices shall be allowed for each wire attached to the HDD pipeline unless approved by the city or the Engineer. If approved, permanent splices shall be made using wire connectors approved for underground applications with splices made only by splicing connectors manufactured by the wire manufacturer equal to “LSC1030C Snake Bite™ Locking Connectors” as manufactured by Copperhead Industries, LLC or an approved equal. If splices are approved by the city or the Engineer, all miscellaneous splicing components shall be furnished, installed, and tested by the Contractor and witnessed by the city or the Engineer.

At a minimum, the location detection wires shall be attached to the pipe with nylon wire ties, with ties located at 5-foot intervals, as shown in the Standard Details. The Contractor may suggest other methods of attachment, with the approval of the city or the Engineer.

Prior to installation of the pipeline into the bore hole, the Contractor shall perform a 12-volt DC electrical continuity test on each of the three (3) wires during the aboveground pressure test.

Following installation of the pipeline into the bore hole, the Contractor shall perform a second 12-volt DC electrical continuity test on each of the three (3) tracer wires. Failure of continuous continuity for at least one of the three tracing wires attached to the HDD pipeline, at the discretion of the city or the Engineer, shall be cause for rejection of the HDD installation, resulting in the abandonment and reinstallation of the directionally drilled pipeline.

The HDD tracer wires shall be spliced twelve (12) inches below grade to three (3) 10-gauge tracer wires, as specified above for open cut installations, and brought up in the valve boxes at the ends of each HDD line segment. The splices shall be made only by methods per the tracer wire manufacturer’s recommendations and by splicing connections manufactured by the tracer wire manufacturer. The splicing connectors shall be the “LSC1030C SnakeBite™ Locking Connector” as manufactured by Copperhead Industries, LLC, the Direct Bury Lug as manufactured by DryConn®, or an approved equal.

- C. **Color of Location Detection Wires:** The insulation color for the wire shall match the color for the pipes intended service as follows:
 1. Potable Water Mains – Blue Insulation.
 2. Reclaimed Water Mains - Pantone Purple Insulation.
 3. Wastewater Force Mains – Green Insulation.
- D. **Termination of the Location Detection Wires:** The tracer wires shall be secured to all valves, tees and elbows. It is to be installed at every valve box through a 2-inch PVC pipe to 18-inches above the top of the concrete slab. The 2-inch PVC pipe shall be the same length as the adjustable valve box, and the 2-inch PVC pipe shall be plugged with a 2-inch removable brass plug with recessed square nut

502-2.4.3. WARNING TAPE:

In addition, all underground pipelines installed by open-cut methods shall be buried with identification tape installed over the centerline of the pipe at a depth of 1.0 foot below finished grade. The identification tape shall be as follows:

- A. Identification tape shall be manufactured of reinforced polyethylene film with a minimum overall thickness of 4 mils and shall have a 0.35 mil thick magnetic metallic foil core. The tape shall be highly resistant to alkalis, acids, and other destructive agents found in soil. Tape width shall be 3-inches and shall have background color specified below, imprinted with black letters. Imprint shall be as specified below and shall repeat itself a minimum of once every 2-feet for entire length of tape. Tape shall be Terra Tape Sentry Line, or an approved equal.
- B. Tape background colors and imprints shall be in accordance with the following table:

Tape Imprint	Background Color	Imprint Color
“Caution – Potable Water Main Buried Below”	Blue	Black

“Caution – Reclaimed Water Main Buried Below”	Purple	White
“Caution – Wastewater Force Main Buried Below”	Green	Black

502-2.5. RESTRAINED JOINT COUPLINGS

Restrained Joint Pipe Couplings: Restrained joint pipe couplings used to join and restrain two pieces of plain end pipe shall be sized to suit the outside diameter of the pipe ends to be jointed with restrained ends. Transition couplings shall be used to join pipes of different outside diameters. Pipe couplings shall be bolted type with ASTM A536 ductile iron middle ring and end followers.

Coatings: All ductile iron parts of the coupling shall be coated on the interior and exterior with a fusion bonded thermosetting epoxy coating, applied electrostatically prior to assembly, and complying with AWWA C550 with a 12-mil nominal coating thickness. The coating shall be equal to Mega-Bond as manufactured by EBBA Iron, Inc., or an approved equal.

Gaskets: Gaskets for the coupling shall be wedge type manufactured of EPDM resilient rubber.

Bolts: Torque limiting nuts and gripping restraint wedges shall be manufactured of corrosion resistant, low alloy, high strength steel. Threaded restraint rods and hexagonal nuts shall be manufactured of high strength, Type 316 stainless steel. Bolts and nuts shall conform dimensionally to ANSI/AWWA C111, latest revision.

Approved Manufacturer: Restrained joint couplings shall be Series 3800 as manufactured by EBBA Iron, Inc., or an approved equal.

502-3. GATE VALVES

General: Gate valves shall open by turning to the left (counterclockwise), when viewed from the stem. When fully open, gate valves shall have a clear, unobstructed waterway equal to the nominal diameter of the pipe. All internal valve components shall be removable from the valve bonnet without removing the valve body from the pressure main. Operating nut or hand wheel shall have an arrow cast in the metal indicating the direction of opening. Each valve shall have the manufacturer's distinctive marking, pressure rating and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by applying to it a hydrostatic pressure equal to twice the specified working pressure. Hydrostatic and leakage tests shall be conducted in strict accordance with ANSI/AWWA C500 or ANSI/AWWA C509, latest revisions, whichever is applicable. Only gate valve sizes 4-inch and larger shall be acceptable.

Large Gate Valves: Gate valves with nominal sizes from 4- to 12-inches shall conform to ANSI/AWWA C509, latest revision, and shall be designed for a minimum working pressure of 250 psi differential pressure with zero leakage. Gate valves with nominal sizes from 16- to 36-inches shall conform to AWWA C515, latest revision, and shall be designed for a working pressure of 250 psi differential pressure with zero leakage. Valves shall be ductile iron body resilient wedge type with Nitrile rubber O-ring stem seals. Stems shall be sealed with three (3) O-rings. The top two O-rings shall be replaceable with the valve fully open and subject to the full rated working pressure. O-rings in a cartridge shall not be allowed.

All cast ferrous components of the gate valve including the valve body, wedge, bonnet and stuffing box shall be constructed of ductile iron in conformance with ASTM A536. The valve stem shall be manufactured of manganese bronze in accordance with ASTM B763 and the wedge nut shall be manufactured of bronze in accordance with ASTM B584. The valve stem shall have an integral thrust collar; two-piece stem collars shall not be acceptable. The valve shall have Delrin thrust washers above and below the thrust collar to assist in the operation of the valve.

Valve wedge shall be symmetrical and constructed to assure uniform seating pressure between the wedge seat circumference and body seating surface, providing a complete seal at the rated pressure with flow from either direction. Resilient wedge of the valve shall be formed by a special corrosion and chloramine

resistant, EPDM synthetic elastomer which is permanently bonded to and completely encapsulates the ductile iron valve disc. The wedge nut shall be independent of the wedge and held in place on three sides by the wedge to prevent possible misalignment.

All bolting materials for buried gate valves shall be Type 304 stainless steel with hexagonal shaped heads with dimensions conforming to ANSI B18.2.1; metric bolting materials shall not be allowed. Gate valves shall be NSF 61 listed.

Resilient wedge type gate valves shall be as listed in the *City of Clearwater Approved Products List*, or an equal approved by the city.

Valve End Joints: All gate valves shall have either mechanical joints per ANSI/AWWA C111/A21.11 or restrained joints as specified above for ductile iron or PVC pipe for underground service, or flanged ends, Class 125 per ANSI B16.1, for above ground service or valves in vaults to fit the pipe run in which they are to be used. Gate valves installed on push-on joint pipe shall have mechanical joint ends unless otherwise specified.

Gate Valve Operators: Unless otherwise shown on the Drawings or specified herein, gate valves shall have non-rising stems. Buried gate valves shall be furnished with a 2-inch square AWWA standard nut operator with a valve box and cover. All buried gate valves shall be installed in the vertical position only. Buried gate valves 16-inches and larger in nominal size installed vertically shall be provided with a spur gear box, valve operator. The spur gear shall be an EXEECO 1S-5 to IS-10 spur gear, depending on the valve size, with a gear ratio not more than 2:1. Gate valves located aboveground or inside structures shall be furnished with a rising stem and a handwheel operator which shall have an arrow cast in the metal indicating the direction of opening. Gate valves used as isolation valves for double check valve backflow preventers for fire lines or reduced pressure back flow preventers shall be of the open screw and yoke (OS&Y) design with rising stems and with a handwheel operator.

Gate valves larger than 16-inches in nominal size shall be provided with a smaller gate valve bypass sized by the gate valve manufacturer.

Interior Valve Lining: Interior of the valve body shall be lined with a fusion bonded or thermo-setting epoxy coating in accordance with AWWA C550, latest revision. Lining shall be holiday-free, NSF 61 approved, with a minimum thickness of 16 mils. Surfaces shall be clean, dry, and free from rust and grease before lining.

Exterior Valve Coatings: All exterior surfaces of iron body gate valves shall be clean, dry, and free from rust and grease before coating. For buried service, the exterior ferrous parts of all valves shall be coated at the factory with coal tar epoxy with a minimum total finish dry film thickness of 20 mils. Prior to back filling, all uncoated nuts, bolts, glands, rods, and other parts of joints shall be coated in the field with coal tar epoxy equal to Carboline Bitumastic No. 300-M. For valves installed above-ground, the exterior ferrous parts of all valves shall be shop primed at the factory with one coat, minimum dry film thickness of 4 mils, of a rust-inhibitive universal epoxy primer. Primer shall be suitable for finish paint specified. Following installation, above-ground valves shall be finish painted in accordance with city Construction Standards.

Two Inch (2") diameter gate valves or smaller are not allowed. These should be approved ball valves.

Three Inch (3") diameter valves are not allowed.

502-4. VALVE BOXES

Furnish, assemble, and place a valve box over the operating nut for each buried valve. The valve box shall be designed to prevent the transmission of surface loads directly to the valve or piping.

Valve boxes shall be of the adjustable screw-type of suitable length with an interior diameter of not less than 5-1/4 inches. The valve boxes shall be manufactured of cast iron and shall be of the three-piece design

including a bottom section, middle section and top section with cover. The bottom section shall have a flange at the bottom having sufficient bearing area to prevent settling. The cast iron cover shall be cast with the applicable service; "WATER", markings for potable water mains, "RECLAIMED" marking for reclaimed water mains or "SEWER", markings for wastewater force mains. The top section shall be adjustable for elevation and shall be set to allow equal movement above and below finished grade.

The castings shall be manufactured of clean, even grain, gray cast iron conforming to ASTM A48, Class 30B for Gray Iron Castings; and shall be smooth, true to pattern, free from blow holes, sand holes, projections, and other harmful defects. The seating surfaces of both the cover and the top section shall be machined so that the cover will not rock after it has been seated.

The valve boxes shall be coated inside and outside with an asphaltic coating prior to machining, so that the machined seating surfaces will be free of any coating. Valve extension stems shall be provided for all buried valves when the valve operating nut is deeper than 3 feet below final grade.

Valve boxes and their installation shall be included in the bid price for valves. Refer to *City Standard Detail Index 402; Sheet 1 of 3 & Sheet 2 of 3* for potable water valve pad detail, and *City Standard Detail Index 502; Sheet 1 of 3 & Sheet 2 of 3* for reclaimed water valve boxes and pad detail.

502-5. HYDRANTS

Fire hydrants shall be dry barrel, break away type with 5-1/4-inch minimum main valve opening and shall comply with AWWA C502, latest revision, for a 150-psi working pressure and shall also be UL/FM listed. All hydrants shall be hydrostatically tested at the factory in accordance with AWWA C502, latest revision. Hydrants shall be the compression type, closing with line pressure. The main valve shall be solid encapsulated EPDM rubber. The main valve stem shall be Type 304 or higher-grade stainless steel and manufactured in two sections with a breakable coupling. The main hydrant valve shall open left (counterclockwise). Hydrants shall be fully bronze mounted with all working parts of bronze. Valve seat ring shall be threaded bronze and shall screw into a bronze retainer insert in the hydrant shoe, with O-rings to seal the barrel from leakage of water in the shoe. All interior working parts of the hydrant, including the seat ring, shall be removable through the top of the hydrant to allow repairs without disturbing the barrel of the hydrant after it has been installed. A dirt shield shall be provided to protect the operating mechanism from grit buildup and corrosion due to moisture. A thrust washer shall be supplied between the operating nut and stem lock nut to facilitate operation. The hydrant operating nut shall be of one-piece bronze or ductile iron construction and open counterclockwise. Operating nut shall be a No. 7, 1-1/2-inch, pentagonal shaped nut. The operating threads shall be totally enclosed in an operating chamber, separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or an oil reservoir.

Fire hydrants shall be the traffic model breakaway type, with the barrel made in at least two sections bolted together, of ample length for 3-1/2 foot depth of bury with necessary extensions to place the safety break flange located approximately 2-inches above finished grade. Breakaway bolts shall not be approved. The fire hydrant shall be provided with a 6-inch mechanical joint epoxy lined elbow. The hydrant shall be provided with two, 2-1/2-inch hose nozzles and one, 4-1/2-inch pumper nozzle, all having National Standard hose threads. All nozzles shall have caps attached by stainless steel chains. Hose nozzle cap nuts shall be 1-1/2-inch AWWA standard pentagonal shape. Nozzles shall be of the tamper resistant, 1/4-turn type with O-ring seals or threaded into upper barrel. Nozzles shall be retained with a stainless-steel locking device.

The hydrant shall be cast with no drain or weep holes or the drain or weep holes shall be permanently plugged by the manufacturer. All bolts, nuts and studs for fire hydrants shall be Type 316 stainless steel. Fire hydrant base, lower barrel and 6-inch elbow shall be epoxy coated inside and outside. Upper barrel shall have an interior epoxy coating with the exterior coated with an epoxy primer and a two-part

polyurethane top coating. Fire hydrant upper barrel exterior colors shall have National Standard Yellow, UV resistant enamel, polyurethane, or fusion bonded epoxy.

Approved Fire Hydrants: Only those fire hydrants listed in the *City of Clearwater Approved Products List*, shall be used in extension to or replacement of the city’s potable water system: Absolutely no substitutions for fire hydrants shall be allowed without the approval of the city Engineering Department.

All shipments of fire hydrants to the project site shall be palletized, securely anchored to the pallet(s) and delivered by delivery trucks with mechanical, motorized tailgates for receipt by the Contractor.

All hydrant assemblies shall be provided with an auxiliary 6-inch resilient seated gate valve for isolation so that the water to the hydrant may be shut off without the necessity of closing any other valve in the distribution system. Gate valves for fire hydrant installations shall be as specified above in *Section 502-2.7*. Piping used from the water main tee to the fire hydrant shall be 6-inch ductile iron pipe only. Ductile iron pipe shall be in accordance with *Section 502-2.1*.

The fire hydrant assembly shall be provided with anchoring hydrant fittings including a locked hydrant tee with split gland to provide the locking together of the entire assembly for joint restraint. Hydrants shall be restrained by using bolted mechanical swivel-type connecting joints from the hydrant tee through to the hydrant. Restraining mechanical joint glands on hydrants shall be used only where hydrant runout length precludes the use of swivel joint connectors. Restrained joints shall absorb all thrust and prevent movement of the hydrant. If used, mechanical restrained joints shall comply with *Section 502-2.1.2* of these Technical Specifications.

All fire hydrants shall be provided with a fiber mesh reinforced concrete shear pad with dimensions as shown in the Drawings.

Fire hydrants shall be located in the general location as shown on the Drawings. Final field location of all hydrants shall be as required by the city. All hydrants shall be located no less than 6-feet and no more than 10-feet from the curb or edge of pavement of the adjacent roadway.

Fire hydrants shall be located in a manner to provide complete accessibility and separated from any and all obstructions such as utility poles, posts, walls, etc., by a distance of at least five feet, measured from the centerline of the fire hydrant to the nearest physical feature, which may obstruct access or view of any fire hydrant, unless otherwise required by the Owner. All fire hydrants located within FDOT rights-of-way shall conform to FDOT clear zone requirements.

In order to minimize any inconvenience to property owners, new fire hydrants shall be installed at or near side property lines. Fire hydrants shall be installed such that the 4-1/2-inch pumper nozzle faces the street or driveway, unless otherwise directed by the Fire Department or the Owner’s representative.

No hydrants shall be installed on the reclaimed water system unless approved by the city Engineering Department.

502-6. SERVICE SADDLES/ POLYETHYLENE SERVICE LINES

Service Saddles: Service saddles shall have ductile iron bodies in accordance with ASTM A536, latest revision, with double stainless-steel straps. Ductile iron body shall have a fusion bonded nylon coating with a minimum thickness of 12 mils. Straps shall be Type 304 stainless steel with premium grade Type 304 L stainless steel bolts and Type 304 stainless steel washers and nuts. The nuts shall be Teflon coated. The gasket material shall be an EPDM elastomeric compound resistant to degradation by oil, natural gas, acids, alkalis, most aliphatic fluids, and chloramines. The outlet of the saddle shall have female NPT threads. Approved service saddles shall be as listed in the *City of Clearwater Approved Products List*, or an equal approved by the city.

Service saddles shall be used on all service taps on water main pipelines 4-inch in size and larger. The largest service connection allowable for a 4-inch main shall be a 1-1/2-inch tapped connection. Service saddles shall be used on all 2-inch service connections on water main pipelines 6-inch and larger. Taps larger than 2-inch in size shall require using a tapping sleeve as specified below in *Section 502-12*.

Corporation Stops: Corporation stops shall be all bronze bodies with an all bronze ball and Teflon seats, in accordance with AWWA C800. Inlet and outlet threads shall have NPT threads. Corporation stops shall be as listed in the *City of Clearwater Approved Products List*, or an equal approved by the city.

Polyethylene Service Lines: All polyethylene service lines require stiffeners must be approved by the city and manufactured by Mars Company, Ocala, FL 34483. 3” service lines are not allowed. Refer to reclaimed water *Standard Detail Index 501 Sheet 2 of 2*.

502-7. BACKFLOW PREVENTERS

The city owns and maintains all backflow prevention devices that are installed within their system. Therefore, any and all devices must be purchased from the city and installed by city work forces.

Backflow prevention devices that are installed on customer's service lines at the point of delivery (service connection) shall be of a type in accordance with AWWA C511, latest edition for Reduced Pressure Principle Backflow Prevention Devices or AWWA C506, latest edition for Double Check Valve Assembly Backflow Prevention Devices.

Two (2) different types of backflow prevention devices are allowed. The type of device, and when required, shall be determined by the degree of hazard presented to the municipal water system from possible backflow of water within the customer's private system, as determined by the city Utility Engineering Department. The two types of backflow prevention devices allowed are:

1. **Double Check Valve Assembly Backflow Prevention Device:** a device composed of two (2) single, independently acting, approved check valves, including tightly closing shutoff valves located at each end of the assembly and suitable connections for testing the water tightness of each check valve.
2. **Reduced pressure principle backflow prevention device:** a device containing a minimum of two (2) independently acting, approved check valves, together with an automatically operated pressure differential relief valve located between the two check valves. The unit must include tightly closing shutoff valves located at each end of the device, and each device shall be fitted with properly located test cocks.
 - a. Reduced-pressure principle back flow preventers shall include an integral sensing system that will automatically open a relief valve whenever the differential pressure between the inlet supply and the reduced pressure zone drops to 2 psi. The relief valve shall remain open until a positive pressure differential of 2 psi is re-established. If pressure upstream of the first check valve drops to atmospheric or below, the relief valve shall remain fully open providing an internal air gap between the first check valve and the water level in the reduced pressure zone. The unit shall also be constructed such that any minor leakage of the second check valve will result in visible flow from the relief valve, even if the first check valve is totally disabled.

502-8. TAPPING SLEEVES AND LINSTOPS

Tapping valves and tapping sleeves shall be installed where shown on the drawings to make "wet" taps into existing potable water, reclaimed water mains or wastewater force mains. Tapping valves shall only be installed in the vertical position.

Tapping Sleeves for Taps 4-inch to 12-inch in Size: Fabricated all stainless steel body tapping sleeves to tap pipelines 4-inch through 30-inch in size with outlet tap sizes ranging from 4-inches through 12-inches, shall have heavy welded ASTM A240, Type 304 stainless steel body; Type 304 stainless steel bolts, Grade 8 per ASTM A194, epoxy coated; Type 304 stainless steel nuts, Grade 8 per ASTM A194, fluoropolymer coated; and a 3/4-inch Type 304 stainless steel test plug. The tapping sleeve, unless otherwise specified shall have a 18-8 Type 304 stainless steel outlet flange which meets the requirements of ANSI/AWWA C228 Class SD, ANSI 150 LB drilling recessed for tapping valve per MSS-SP60. The tapping sleeve gasket shall be EPDM rubber. Stainless steel body tapping sleeves shall be as listed in the *City of Clearwater Approved Products List*, or an equal approved by the city.

Mechanical Tapping Sleeves for Taps Larger Than 12-inch in Size: Mechanical joint split tapping sleeves shall be ductile iron capable of withstanding a 250-psi working pressure or the pipe rated working pressure, whichever is greater. The tapping flange for the sleeve shall have a groove that shall mate to the raised lip on the tapping valve flange. Gaskets shall be vulcanized EPDM resilient rubber material. All tapping connections for “size on size” taps shall utilize mechanical joint tapping sleeves only. The tapping sleeve shall be provided by the same manufacturer as the tapping valve. Bolts and nuts for the tapping sleeve split flange connection shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts. The nuts shall be fluoropolymer coated and have a hardness that is lower than that of the bolts and washers by a difference of 50 Brinnell hardness to prevent galling during installation. All interior and exterior surfaces of the mechanical joint split tapping sleeves shall be clean, dry, and free from rust and grease before coating. The interior and exterior surfaces of all mechanical joint split tapping sleeves shall be coated at the factory with fusion bonded or thermo-setting epoxy coating with a minimum total finish dry film thickness of 16 mils.

Tapping Valves: Tapping valves are special gate valves designed to mate to the flange of a mechanical tapping sleeve with a mechanical joint outlet connection. The tapping flange of the valve shall have a raised lip that will mate with the grooved flange of the tapping sleeve flange. The tapping valve shall have an oversized diameter waterway to allow passage of the tapping machine cutter assembly, without sustaining damage to the valve. Each tapping valve shall have the manufacturer's distinctive marking, pressure rating, the words “Ductile Iron” or “DI”, and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by applying to it a hydrostatic pressure equal to twice the specified working pressure. Hydrostatic and leakage tests shall be conducted in strict accordance with ANSI/AWWA C509, latest revision. Resilient-seated type tapping valves shall be as listed in the *City of Clearwater Approved Products List*, or an equal approved by the city.

- A. Tapping valves with nominal sizes from 4- to 12-inches shall conform to ANSI/AWWA C509, latest revision, and shall be designed for a minimum working pressure of 250 psi. Tapping valves with nominal sizes from 16 inches and larger shall conform to AWWA C515, latest revision, and shall be designed for a working pressure of 250 psi. Valves shall be ductile iron body, resilient wedge type with Nitrile rubber O-ring stem seals. Stems shall be sealed with three (3) O-rings. The top two O-rings shall be replaceable with the valve fully open and subject to the full rated working pressure. O-rings in a cartridge shall not be allowed. All cast ferrous components of the tapping valve including the valve body, wedge, bonnet and stuffing box shall be constructed of ductile iron in conformance with ASTM A536. The valve stem shall be manufactured of manganese bronze in accordance with ASTM B763 and the wedge nut shall be manufactured of bronze in accordance with ASTM B584. The valve stem shall have an integral thrust collar; two-piece stem collars shall not be acceptable. The valve shall have Delrin thrust washers above and below the thrust collar to assist in the operation of the valve. Valve wedge shall be symmetrical and constructed to assure uniform seating pressure between the wedge seat circumference and body seating surface, providing a complete seal at the rated pressure with flow from either direction. Resilient wedge of the valve shall be formed by a special corrosion and chloramine resistant, EPDM synthetic elastomer which is permanently bonded to and completely encapsulates the ductile iron valve disc.

The wedge nut shall be independent of the wedge and held in place on three sides by the wedge to prevent possible misalignment. All bolting materials for buried tapping valves shall be Type 316 stainless steel, as specified below, with hexagonal shaped heads with dimensions conforming to ANSI B18.2.1; metric bolting materials shall not be allowed. Tapping valves shall be NSF 61 listed.

- B. **Tapping Valve Ends:** All tapping valves shall have a special flange with a raised lip to mate with the groove in the tapping sleeve flange and a mechanical joint end on the discharge side of the valve.
- C. **Tapping Valve Connection Bolting:** Bolts and nuts for the tapping valve flange connection shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts. The nuts shall be fluoropolymer coated and have a hardness that is lower than that of the bolts and washers by a difference of 50 Brinnell hardness to prevent galling during installation. Jointing materials for the mechanical joint valve end and the mechanical joint tapping sleeve ends shall be in strict accordance with ANSI/AWWA C111 and ANSI/AWWA C153, latest revisions. Tee head bolts and nuts for the mechanical joint ends shall be manufactured of CORTEN, high strength, low alloy, corrosion resistant steel in accordance with ASTM A242, or an equal approved by the Engineer and the Owner.
- D. **Tapping Valve Operators:** Tapping gate valves shall have non-rising stems and shall open by turning to the left (counterclockwise), when viewed from the stem. Tapping valves shall be furnished with a ductile iron 2-inch square AWWA standard nut operator with an arrow cast into the metal indicating the direction of opening. Tapping valves 16-inches and larger in nominal size shall be provided with a spur gear box, valve operator. The spur gear shall be an EXEECO IS-5 to IS-10 spur gear, depending on valve size, with a gear ratio not more than 2:1.
- E. **Interior Tapping Valve Linings:** The interior of the tapping valve body shall be lined with a fusion bonded or thermo-setting epoxy coating in accordance with AWWA C550, latest revision. Lining shall be holiday-free, NSF approved, with a minimum thickness of 16 mils. Surfaces shall be clean, dry, and free from rust and grease before lining.
- F. **Exterior Tapping Valve Coatings:** All exterior surfaces of tapping valves shall be clean, dry, and free from rust and grease before coating. The exterior ferrous parts of all tapping valves shall be coated at the factory with fusion bonded or thermo-setting epoxy coating with a minimum total finish dry film thickness of 16 mils. Prior to back filling, all uncoated nuts, bolts, glands, rods, and other parts of joints shall be coated in the field with two coats of coal tar epoxy equal to Carboline Bitumastic No. 300-M.

502-9. LINE STOPPING ASSEMBLIES

Specialty line stop fittings shall be used for applications where it is necessary to isolate a section of pipe without interrupting service. The Contractor shall provide a submittal which clearly identifies the materials used for line stop applications.

Sleeves used to line-stop existing mains shall be provided and installed at locations as shown on the Drawings or as required for construction of the new force main tie-in to an existing force main. Line-stopping sleeve shall be steel fusion epoxy coated body with stainless steel bolts, nuts, and washers. Contractor shall determine the outside diameter of the existing main prior to ordering sleeve. The back (bottom) section shall be solid and designed within an outside diameter range specific to the pipe it is being installed on. The front (top) section will also be full encirclement design with a welded installed nozzle and flange outlet.

Line stop fitting sleeves shall be the high strength type having a wide body, made of a minimum material strength of A-283 grade steel, ASTM A-36 Steel or equal, which conforms to and reinforces the pipe. The sleeve shall have as a minimum 7/8-inch wide gasket of Nitrile Butadiene Rubber (NBR, Buna-N) per ASTM D2000 with hydro activated lip, captured in a recessed groove around the outlet. Bolts, nuts and washers shall be 3/4-inch stainless steel 18-8 type 304. A 3/4-inch forged steel test outlet will be placed

into the nozzle branch outlet, at the factory, for the purposes of site pressure testing after the fitting has been installed around the pipe.

Tapping sleeves and line stops shall be installed in accordance with the manufacturer's recommendations for the specified model. The fitting may not be retrofitted in any way after being installed on the pipe. The Contractor shall be responsible for ensuring that the fitting is properly restrained.

The line-stopping equipment shall consist of a resilient sealing element, which shall be attached to and transported by a plug inserted perpendicularly into the pipe. The linear actuator shall extend and retract the Line-Stopper into and out of the pipe. When retracted from the pipe, the element and inserter shall be contained within the stopper housing.

The hollow cylindrical sealing element shall be molded of natural rubber. The lower interior chamber of the element shall be enlarged into a hemispherical cavity to allow symmetrical deformation into sealing conformity with the bore of the pipe. The linear actuator shall be hydraulic and shall have a self-contained hand operated pump. The actuator shall exert a force sufficient to perpendicularly deform the cylindrical element into axially symmetrical sealing contact with the bore of the pipe. Design of actuator shall provide adequate stroke and means to continually align the line-stop bullet stopping assemblies in sizes 4-inch thru 20-inch with pressure rating to 250 psig.

Equalization of pressure across the sealed element shall not be required to retract the element from the pipe. No equalization fittings shall be required downstream of the line-stopper.

Line-stopping equipment must be capable of function and acceptance of multiple stopper heads and shall be compatible with existing system fittings.

502-10. BLOW OFF HYDRANTS

Hydrant Blow offs are not allowed.

503. CONSTRUCTION

503-1. MATERIAL HANDLING

1. Care shall be taken in loading, transporting, and unloading to prevent damage to the pipe or fittings and their respective coatings. Pipe, fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be rolled off the carrier or dropped. Unloading shall be done by lifting with a forklift or crane using straps and a spreader bar. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.
2. Pipe shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes. Pipe shall be stacked no higher than 6-feet high on the project site for safety reasons. Where necessary, due to ground conditions, the pipe shall be stored on wooden sleepers, suitably spaced and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.
3. The interior surfaces of valves and piping shall be kept free of dirt and debris.
4. Pipe and fittings which require the protection from UV, such as PVC or HDPE pipe, shall be covered and protected in accordance with manufacturer instructions.
5. Pipe shall be so handled that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at their expense in a manner satisfactory to the Engineer.

6. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.
7. All materials shall be subject to inspection and approved by the Engineer after delivery; and no broken, cracked, misshapen, imperfectly coated or otherwise damaged, unsatisfactory or defective material shall be used.
8. All material found during the progress of the work to have cracks, flaws, or other defects shall be rejected and promptly removed from the site.
9. If damage occurs to any pipe, fittings, valves, hydrants or water main accessories in handling, the damage shall be immediately brought to the Engineer's attention. The Engineer shall prescribe corrective repairs or rejection of the damaged items.

503-2. PIPE LAYING

503-2.1. INSPECTION PRIOR TO INSTALLATION

All pipe, fittings, valves, and other material shall be subject to inspection and approval by the Engineer and the City after delivery and prior to installation. If damage occurs to any pipe, fittings, valves, hydrants or accessories in handling, the damage shall be immediately brought to the Engineer's attention. The Engineer shall prescribe corrective repairs or rejection of the damaged items. No broken, cracked, imperfectly coated, or otherwise damaged or unsatisfactory material shall be installed. When a defect or crack is discovered, the injured or defective piece shall not be installed and shall be removed from the project site. All homing marks shall be checked for proper length to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked on pipe shall result in rejection of pipe and removal from the site at the Contractor's expense.

503-2.2. GENERAL INSTALLATION REQUIREMENTS

General: Excavation, backfill, and compaction shall conform to the provisions of *Section 201-2. – Excavation, Backfilling and Compaction for Utilities*. Upon satisfactory installation of the pipe bedding material as specified in *Section 201-2. – Excavation, Backfilling and Compaction for Utilities*, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.

Proper implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient performance of the work. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench piece by piece by means of a derrick, ropes, or other suitable tools or equipment in such a manner as to prevent damage to materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped in the trench.

Pipe, fittings, valves, and accessories shall be installed as shown or indicated on the Drawings. All joint lubricant compounds shall be NSF approved.

Water in Excavations: Water shall not be allowed in the trenches while underground pipes are being laid and/or tested. All pipe shall be laid “in the dry”. Installation of potable water pipes, reclaimed water pipes or wastewater force main pipes shall not proceed in the trench until the trench has been properly dewatered and prepared. Refer to *Section 203, Dewatering* for dewatering requirements for the installation of pipelines. No pipe shall be laid when, in the opinion of the Engineer, trench conditions are unsuitable. Water shall not be allowed in the trenches while the pipes are being laid and/or tested. The Contractor shall not open more trench than the available pumping facilities are able to dewater the trench to the satisfaction of the Engineer or the city’s Inspector. The Contractor shall assume responsibility for legally disposing of all water so as not to injure or interfere with the normal drainage of the area in which he is working. In no case

shall the pipelines being installed be used as drains for such water, and the ends of the pipe shall be kept properly and adequately plugged during construction by the use of approved stoppers and not by improvised equipment. All necessary precautions shall be taken by the Contractor to prevent the entrance of mud, sand, or other obstructing matter into the pipelines. If on completion of the work any such materials have entered the pipelines, it must be cleaned as directed by the Engineer and the city's Inspector so that the entire system will be left clean and unobstructed. The Contractor shall not leave trenches open overnight.

Pipe Bedding: The Contractor shall provide pipe bedding material in accordance with the Standard Details on the Drawings and *Section 201-2. – Excavation, Backfilling and Compaction for Utilities*. The Contractor shall hand-grade bedding to proper grade ahead of pipe laying operation. Bedding shall provide a firm, unyielding support along the entire pipe length. If the trench has been excavated below the required depth for pipe bedding material placement, the Contractor shall fill the excess depth with pipe bedding material to the proper grade. The Contractor shall excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.

Pipe Cradle: Upon satisfactory installation of the pipe trench as specified in *Section 201-2. – Excavation, Backfilling and Compaction for Utilities* and the pipe bedding, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging so that when the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints or pipe bell from the trench bottom.

Cleanliness: Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surface. The interior of the pipes shall be thoroughly cleaned of all foreign material before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other methods accepted by the Engineer and the city. During suspension of work for any reason at any time, a suitable watertight plug shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

Connections to Existing Utilities: All connections to existing piping systems shall be made as shown or indicated on the Drawings after consultation and cooperation with the city Utility Department. Some such connections may have to be made during off-peak hours (late night or early morning).

Pipe Joint Deflection: Whenever it is desirable to deflect pipe joints to avoid obstructions or to maintain required alignment, the amount of the joint deflection shall not exceed 50 percent of the maximum limits allowed by the pipe manufacturer for ductile iron pipe. No bending or joint deflection of PVC pipe shall be permitted at any time. Changes in horizontal and vertical alignment of PVC pipe shall be achieved by use of fittings only.

Pipe Installation: In preparation for pipe installation, placement (stringing) of pipe should be as close to the trench as practical on the opposite side of the trench from the excavated material.

All pipe and fittings shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation in final position. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling.

Pipe laying shall proceed with the bell ends of the pipe pointing in the direction of the work progress unless directed otherwise by the Engineer. Where pipe is laid on a grade of 10 percent or greater, the laying shall start at bottom and shall proceed upward with the bell ends of the pipe pointing upgrade. Before pipe is joined, gaskets shall be cleaned of all dirt and stones and other foreign material. The spigot ends of the pipe and/or pipe gaskets shall be lubricated lightly with an NSF approved lubricant as specified by the pipe manufacturer and approved by the Engineer and the city. No sulfur based joint compound shall be used. Sufficient pressure shall be applied to the pipe to properly seat the spigot end into the bell of the previously laid pipe. Any damage to the pipe due to over-exertion shall be repaired at the Contractor's expense. All damaged pipe shall be removed for the Project site.

Pipe and fittings shall be laid accurately to the lines and grades indicated on Drawings or required. The depth of cover over the pipeline shall vary to provide uniform gradient or slope to the pipe, whether grading is completed or proposed at time of pipe installation. Where grades for the pipeline are not indicated on the Drawings, maintain a uniform depth of cover with respect to finish grade.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space.

All pipe laid shall be retained in position to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. Care shall be taken to ensure a good alignment both horizontally and vertically and to give the pipe a firm bearing along its entire length. Any pipe which has its grade or joint disturbed after laying shall be taken up and relayed.

All pipe and fittings shall be cleared of sand, dirt, and debris before laying. All precautions shall be taken to prevent sand, dirt, or other foreign material from entering the pipe during installation. If necessary, a heavy, tightly woven canvas bag of suitable size shall be placed over each end of the pipe before lowering into the trench and left there until the connection is made to the adjacent pipe. Any sand, dirt, or other foreign material that enters the pipe shall be removed from the pipe immediately. During pipe laying operations, no debris, tools, clothing or other materials shall be placed into the pipe interior. Interior of all pipe and fittings shall be kept clean after installation until accepted in the complete Work.

Any time that pipe installation is not in progress, the open ends of pipe shall be closed by a watertight plug or other method approved by the Engineer and the city Inspector. Plugs shall remain in pipe ends until all water is removed from the trench. No pipe shall be installed when trench conditions are unsuitable for such work, including standing water, excess mud, or rain.

Thrust Restraint:

- A. General: Thrust restraint shall be accomplished by piping restrained joints or mechanical restraining devices.
- B. Required Length of Restrained Joints: The length of restrained joints required shall be in accordance with the lengths shown on the Plan and Profile Drawings. The restrained joint lengths listed in the Restrained Joint Pipe Tables in the Drawings are absolute minimum lengths required and may not reflect the actual length of restrained joints required for a particular fitting arrangement or situation.
- C. Concrete Trust Blocks: Concrete thrust blocks shall not under any circumstances be allowed on the Project for thrust restraint at fittings.
- D. Concrete Trust Collars: Concrete thrust collars shall be used under extraordinary circumstances when approved by the Engineer and the city. If thrust collars are used, they shall conform to the details shown on the Drawings and shall be constructed of Class I concrete, which shall have a minimum compressive strength of 3,500 psi at 28 days. No pipeline work shall be accomplished adjacent to a thrust collar until the concrete has reached its full compressive strength and can handle the required thrust restraint.

Initial Backfill:

- A. After pipe has been laid, inspected, and found satisfactory, sufficient backfill shall be placed along the pipe barrel to hold the pipe securely in place while conducting the preliminary hydrostatic test. No backfill shall be placed over the joints until the preliminary test is satisfactorily completed, leaving them exposed to view for the detection of visible leaks.
- B. Upon satisfactory completion of the preliminary hydrostatic test, backfilling and compaction of the trench shall be completed.

Location Detection Wire: Refer to the city Standard Detail Drawings for wire location and installation notes. Location Detection Wires shall be installed for all potable water mains, reclaimed water mains and wastewater force mains. For open cut installation the two (2) detection wires shall be attached generally at the three o'clock and nine o'clock positions on the pipe with nylon pipe straps or tape located at 5-foot intervals for each 20-foot length of pipe. The wire shall be installed through valve boxes, valve vaults, air release valve enclosures, etc., and provide sufficient excess (12-inches minimum) such that a loop in the wire can be raised above ground level. An energy source shall be attached to each of the wires to energize each wire to facilitate location of the wire and pipe using a metal detector. Prior to acceptance, the Contractor shall demonstrate to the Engineer and the city Inspector that each of the wires is continuous and unbroken through the complete run of the pipe by performing a continuity test of the 10 gauge location detection wires for the entire length of the potable water main, the reclaimed water main or the wastewater force main at each valve test station box. The test shall also include energizing each of the wires and locating the entire run of pipe with the Engineer and the city Inspector present.

Underground Identification Tape: Install a continuous underground utility identification tape for all underground potable water mains, reclaimed water mains and wastewater force mains installed by open-cut methods. The identification tape shall be installed over the centerline of the pipe at a depth of 12-inches below finished grade.

Aboveground and Exposed Piping: Piping shall be cut accurately to measurements established at the job site and shall be worked into place without springing or forcing, properly clearing all equipment access areas and openings. Changes in sizes shall be made with appropriate reducing fittings. Pipe connections shall be made in accordance with the details shown and manufacturer's recommendations. Open ends of pipelines shall be properly capped or plugged during installation to keep dirt and other foreign material out of the system. Pipe supports and hangers shall be provided where indicated or as required to ensure adequate support of the piping. All above ground piping shall be painted with the appropriate color.

503-2.3. INSTALLATION OF DUCTILE IRON PIPE

Handling and Cutting Pipe:

- A. Care shall be taken in handling, cutting, and laying ductile iron pipe and fittings to avoid damaging the pipe and interior cement mortar lining, scratching, or marring machined surfaces, and abrasion of the exterior pipe coating. All cracked pipe and fittings shall be removed at once from the Work.
- B. Pipe cutting shall be done by skilled workmen in a neat workmanlike manner without creating damage to the pipe and interior lining and to leave a smooth end at right angles to the axis of the pipe. Cut ends shall be square and rough edges of ductile iron pipe shall be ground smooth. For push-on joint connections, the cut end shall be beveled to prevent gasket damage during joint assembly. Interior lining and exterior coatings of the pipe shall be repaired at cut ends per the manufacturer's instructions prior to joint assembly.

Laying Ductile Iron Pipe and Fittings:

- A. **Bedding for Ductile Iron Pipe:** Minimum bedding requirements shall be Type 3 as defined in ANSI/AWWA C600, latest revision. Provide proper bedding required, in accordance with thickness class of pipe being laid, restrained joints required and depth of cover. At a minimum the pipe shall be bedded in compacted 4-inch thick select fill and backfilled and compacted to the top of the pipe to a minimum of 95% Modified Proctor. Proper pipe laying conditions shall be in accordance with ANSI/AWWA C150 and C151, latest revisions, and ANSI/AWWA C600, latest revision.
- B. All ductile iron pipe and fittings shall be laid in accordance with American Water Works Association Standard *ANSI/AWWA C600*, latest revision, entitled "*Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances*", with the following sections specifically applying:

1. Section 3.3 - Pipe Installation.
 2. Section 3.4 - Joint Assembly.
- C. Polyethylene tube encasement shall be installed for all buried ductile iron pipe segments and fittings for corrosion protection. Installation procedures shall be in accordance with *AWWA C105/ANSI A21.5-10*, latest revision, entitled *Polyethylene Encasement for Ductile Iron Pipe Systems, Section 4.4 - Installation*.

Ductile Iron Pipe Joints:

- A. General: The joints of all pipelines shall be made leak tight. The particular joint used shall be approved by the Engineer and the city Inspector prior to installation. Where shown on the Drawings or where, in the opinion of the Engineer or the city Inspector, settlement or vibration is likely to occur, all pipe joints shall be bolted mechanical joint type with mechanical restraints, push-on joints with mechanical restraints or manufactured restrained joint type as specified above, or as indicated on the Drawings.

All lumps, blisters, and excess coating shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean and dry and free from oil and grease before the pipe is laid. Pipe joints shall be made up in accordance with the manufacturer's recommendations.

- B. Mechanical Restrained Joints: All types of mechanical joint and push-on joint pipes with mechanical restraints shall be laid and jointed in full conformance with manufacturer's recommendations, which shall be submitted to the Engineer and the city Inspector for review and approval before work is begun. Only specially trained and skilled workmen shall be permitted to makeup mechanical restrained joints. Torque wrenches, set as specified in AWWA Standard C111, shall be used; or spanner type wrenches not longer than specified therein may be used with the permission of the Engineer and the city Inspector. The gasket shall be inserted, and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.
- C. Manufactured Restrained Joints: Manufactured restrained joints shall be provided where indicated on the Drawings. Joint assembly shall be made in strict accordance with the manufacturer's instructions, which shall be submitted to the Engineer or the city Inspector for review and approval before commencing work.
- D. Flanged Joints: Flanged joints shall be made up by inserting the gasket between the flanges. The threads of the bolts and the faces of the gaskets shall be coated with suitable lubricant immediately before installation. Joints shall be fitted so that the contact faces bear uniformly on the gasket.
1. Bolt holes of flanges shall straddle the horizontal and vertical centerlines of the pipe. Clean flanges by wire brushing before installing flanged fittings. Clean flange bolts and nuts by wire brushing and lubricate bolts with oil and graphite.
 2. Insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
 3. Execute care when tightening joints to prevent undue strain upon valves, pumps, backflow preventers and other equipment.

If flanges leak under pressure testing, loosen, or remove the nuts and bolts, reset or replace the gasket, re-install or re-tighten the bolts and nuts, and re-test the joints. Joints shall be watertight; no leaks shall be allowed.

503-2.4. INSTALLATION OF POLYVINYL CHLORIDE (PVC) PIPE

Storage and Handling of PVC Pipe: PVC pipe shall be delivered to the site in unbroken bundles packaged in such manner as to provide protection against damage. When possible, pipe should be stored at the job site in the unit packages until ready for use. Packaged units shall be handled using a forklift or a spreader bar with fabric straps. Packaged units shall not be stacked at the job site higher than two units high.

When it is necessary to store PVC pipe for long periods of time, exposure to direct sunlight shall be prevented by covering the pipe with an opaque material. Adequate air circulation above and around the pipe shall be provided as required to prevent excessive heat accumulation. PVC pipe shall not be stored close to heat sources of hot objects such as heaters, fires, boilers, or engine exhaust. Pipe gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil, and grease. The interior and all sealing surfaces of pipe, fittings, and other appurtenances shall be kept clean and free of dirt and foreign matter.

Care shall be taken in handling and laying pipe and fittings to avoid severe impact blows, crushing, abrasion damage, gouging, or cutting. Pipe shall be lowered, not dropped, from trucks or into trenches. All cracked, damaged, or defective pipe and fittings, or any length of PVC pipe having a gouge, scratch, or other permanent indentation of more than 10 percent of the wall thickness in depth, shall be rejected and removed at once from the Work and replaced with new acceptable pipe.

Field Cutting PVC Pipe: Field cutting of pipe shall be done in a neat workmanlike manner without creating damage to the pipe. The pipe shall be cut square with a fine-toothed hand or power saw or other cutter or knife designed for use with plastic pipe. Prior to cutting, the pipe shall be marked around its entire circumference or a square-in vise shall be used to ensure the pipe end is cut square. Remove burrs by smoothing edges with a knife, file, or sandpaper.

Field Cutting Bell and Spigot PVC Pipe: Bevel the cut end of the pipe using a pipe beveling tool, wood rasp, or portable sander to prevent damage to the gasket during joint assembly. A factory-finished beveled end should be used as a guide to ensure proper beveling angle and correct depth of bevel. Round off any sharp edges on the leading edge of the bevel with a knife or file. The Contractor shall provide a seat homing mark on the field cut pipe in accordance with the pipe manufacturer's written instructions.

Laying PVC Bell and Spigot Pipe:

- A. **Pipe Bedding:** Bedding for PVC pipe shall be as specified in *Section 201-2. – Excavation, Backfilling and Compaction for Utilities* using granular pipe bedding material.
- B. All PVC pipe shall be laid in accordance with the pipe manufacturer's published installation guide, the *AWWA Manual of Practice No. M23 "PVC Pipe - Design and Installation"* and the Uni-Bell Plastic Pipe Association installation recommendations.

PVC Pipe Joint Assembly for Rubber Gasketed Bell and Spigot Pipe:

- A. The PVC bell and spigot joint shall be assembled in accordance with the pipe manufacturer's installation instructions, ASTM D2774, and AWWA Manual M23. Clean the interior of the bell, the gasket, and the spigot of the pipe to be jointed with a rag to remove any dirt or foreign material before assembling. Inspect the gasket, pipe spigot bevel, gasket groove, and sealing surfaces for damage or deformation.
- B. Lubricate the spigot end of the pipe with an NSF approved lubricant supplied or specified by the pipe manufacturer for use with gasketed PVC pipe in potable water systems. The lubricant should be supplied as specified by the pipe manufacturer and shall be NSF approved. After the spigot end is lubricated, it must be kept clean and free of dirt and sand. If dirt and sand adhere to the lubricated end, the spigot must be wiped clean and re-lubricated.
- C. Insert the spigot into the bell so that it contacts the gasket uniformly. Align the pipe sections and push the spigot end into the bell until the manufacturer's reference mark on the spigot is flush with the end of the bell. The pipe should be pushed into the bell using a bar and wood block. The joint shall not be assembled by "stabbing" or swinging the pipe into the bell, nor shall construction machinery be used to push the pipe into the bell. After joining the pipe, a metal feeler gauge shall be used to verify that the joint gasket is properly located.
- D. If undue resistance to insertion of the spigot end is encountered or if the reference mark does not reach the flush position, disassemble the joint and check the position of the gasket. If the gasket is twisted or pushed out of its seat, inspect the components, repair, or replace damaged items, clean

the components, and repeat the assembly steps. Be sure the pipe is in proper alignment during assembly. If the gasket was not out of position, check the distance between the spigot end and the reference mark and relocate the mark if it is out of position.

- E. Restrained joints for PVC pipe shall be provided where indicated on the Drawings. Joint assembly shall be made in strict accordance with the joint restraint manufacturer's instructions, which shall be submitted to the Engineer and the city for review and approval before commencing work.

503-2.5. DIRECTIONAL BORING INSTALLATION

The work of this Section includes all labor, machinery, construction equipment and appliances required for installation of high-density polyethylene (HDPE) pipe or Certa-Loc PVC pipe below the ground using directionally controlled horizontal drilling equipment and methods. All directional boring methods and equipment shall be approved by the Engineer and the city before any work shall be permitted. All directional boring and pipe installation methods shall be performed in a good workmanlike and safe manner.

Horizontal Directional Drilling (HDD) is a construction method consisting of drilling a small diameter pilot hole within the designed tolerances for radius requirements, followed by enlargement of the hole by back reaming to accommodate the utility pipeline.

503-2.5.1. GENERAL REQUIREMENTS

The overall work scope shall include, but not be limited to steerable directional boring equipment, boring pits and equipment, sheeting, location signs as required, maintenance of traffic and miscellaneous appurtenances to complete the entire Work as shown on the Contract Drawings, and restoration. Directional boring operations shall be performed within the right-of-way and/or easements shown on the Drawings.

The HDD Contractor shall assume full responsibility for his methods of construction, the stability and accuracy of the drilled and reamed hole and pits constructed by him, and all costs for damages resulting from any failure thereof and be solely responsible for the safety of the pits and related structures, and personnel engaged in underground construction throughout the duration of the work.

The general dimensions, arrangement and details for the drilled pilot hole and entry and exit pits to be constructed shall be as indicated on the approved Shop Drawings.

Methods of excavation, equipment and procedures for the HDD operation and pits shall be selected to provide adequate working space and clearances for the work to be performed.

Utility Protection: Utility lines and structures indicated on the Drawings, which are to remain in service, shall be protected from any damage. Where utility lines or structures not shown on the Drawings are encountered, Contractor shall report them to the city and the Engineer before proceeding with the Work.

All utilities within 10 feet of the drill pilot bore, back ream or utility carrier pipe installation will be exposed through a soft-dig "pot-hole" or other opening, in accordance with appropriate utility locate laws and regulations, to ensure, through visual inspection, that the drill, reamer or utility carrier pipe has caused no damage to the utility and maintains adequate clearance. All potholes to locate existing utilities shall be sealed with an excavatable grout to avoid a possible flow path for the HDD drilling mud.

Prior to commencing drilling operations, positively locate and stake all existing utility pipelines, cables, storm sewers, or other underground facilities which are located within 10 feet of the designed drilled path.

All work covered by these Technical Specifications shall be performed in accordance with the applicable local, state and federal codes and laws which pertain to such work and supplemental regulations which are contained in these Technical Specifications.

At all times when construction is not in progress, watertight plugs shall be installed in all pipe ends and openings, either following aboveground pipe fusing and storage before pipe pulling or following underground installation after pipe pull back.

503-2.5.2. SUBMITTALS

The Contractor shall prepare a detailed schedule for the work and submit it to the Engineer and the city for approval. The schedule shall include all major tasks to be performed, including but not limited to the following: pipe delivery; rig mobilization and setup; pipe assembly; pilot hole drilling; reaming; pressure testing the pipe before installation; pipe pulling; pressure testing and pigging/flushing the pipe after installation; disinfection of potable water pipelines; anticipated work hours for each task, daily work hours and dates anticipated for each task.

At least 10 days prior to mobilization of equipment, the Contractor shall submit a detailed installation plan to the city and the Engineer for review and approval. The plan shall also include a detailed Plan and Profile of the bore plotted at a scale no smaller than 1-inch equals 20 feet horizontally and 1-inch equals 4 feet vertically. The Contractor shall include a site plan of the entrance and exit pits, the pipe lay down area and equipment staging. Traffic control plans for entry pit, exit pit, and pipe lay down area if different than what is indicated on the Roadway Traffic Control Plan Drawings.

Submit pipe, fittings, specials, joint restraint systems, adapters and couplings shop drawings including complete dimensions including length, internal diameter, pressure rating and wall thickness; maximum allowable deflection of the pipe; detailing; mechanical connections; and necessary accessories for manufacture, transportation, storage, handling, and installation.

Submit pipe assembly procedures including:

1. Descriptions of procedures means and methods for storing, fabricating, handling, transporting, and protecting pipe segments.
2. Calculations of stresses and longitudinal strains developed in pipe during handling and installation.
3. Description of controls to safeguard that the allowable pulling forces will not be exceeded during the installation.
4. Description of procedures for lifting pipe.
5. Calculations showing allowable lifting configurations so allowable stresses will not be exceeded.
6. Welding procedures for high density polyethylene pipe.

Submit a description of procedures, methods and materials that will be used to repair pipe or pipe joints damaged during installation.

Submit a description of methods and materials that will be used to correct leaks in pipe or pipe joints.

Equipment Submittal: Contractor shall submit manufacturer and specifications of directional drilling equipment to be used to ensure that the equipment will be adequate to complete the project. Submittal shall demonstrate that anticipated pullback forces do not exceed the tensile strength of the HDPE pipe with a minimum factor of safety of 2.0. Include calculations prepared by a Professional Engineer licensed in the State of Florida demonstrating maximum allowable pullback forces for this installation / material combination.

Drilling Plan Submittal: Contractor shall submit a Drilling Plan including: Drilling Operations, Reaming Operations, Estimated Pullback Loads, Drilling Fluids Management, Safety Plan, and a Contingency Plan.

A. Drilling Operations submittal shall include:

1. The number and size of construction crew, hours to be worked, pilot hole drilling procedure, reaming procedure, method of tracking and controlling the drilling head, method of verifying pipe location for as-built drawing and schedule for completing major activities.

2. Provide a 2-inch x 34-inch layout drawing(s), scale 1-inch = 20 feet, indicating location of the entry, exit pits, and fluid storage pits, location of fused pipe before pulling (shall not block access to private property), location and type of fusion equipment, storage of waste fluid, and fluid recycling plan (if used).
 3. Spoil handling, separation and disposal.
 4. Provide a detail of the planned bore path and the method of monitoring and controlling the speed, line, grade, and rate of fluids delivery.
 5. Include the sequence, size and description of each reamer and the capabilities of each through the type of soils anticipated to be encountered in the project area.
 6. The Contractor shall maintain the alignment and minimum radii as detailed on the plan sheets and as specified herein.
 7. The drill plan should include a final swabbing of the bore path prior to pipe pullback.
 8. Contractor shall not proceed with work until Drilling Plan is approved by the Engineer and the city.
- B. Reaming Operations submittal shall include the required bore hole size for pullback of the pipeline. The Reaming Operation Plan shall be submitted for review prior to initiation of construction.
- C. Estimated Pullback Loads submittal shall include:
1. The Contractor shall submit to the Engineer an estimate of the anticipated pullback loads that will be required to install the pipe.
 2. Contractor shall include the calculated buoyant force or buoyant weight of the pipe and proposed method for counterweighting or ballasting the pipe during pullback.
 - a. Calculation shall be based on anticipated density of the drilling fluid(s) to be used.
 - b. Any counterweight or ballast pipe placed inside the pipe shall be free from any dirt, grease, oil, or other contaminants that may prevent proper disinfection.
- D. Drilling Fluids Management submittal shall include:
1. Submit MSDS sheets for drilling fluid additives proposed, demonstrating they are non-hazardous.
 2. Proposed mix design for each specific geological strata or formation anticipated during drilling of the bore path.
 3. Estimate of drilling fluids and quantities to be utilized during each reaming pass.
 4. Delivery volume and pressure for each reaming pass and the proposed method for monitoring.
 5. Details of the drilling fluid/soil slurry solids separation, recycling or disposal plan that will describe the equipment and capacities for separation and recirculation.
 - a. If direct vacuum excavation of the slurry is selected, the disposal site shall be identified, and copies of all required permits shall be presented to the Engineer.
 - b. The Contractor shall submit a written plan that details the estimated quantity of slurry to be vacuum excavated and provide substantiation that there is sufficient equipment to adequately pump or shuttle the slurry to and from the disposal site(s) as required to maintain a near continuous drilling and pipe pull-back.
 6. The Contractor shall submit to the Engineer a contingency plan for a quick response team to address inadvertent fluid discharges to the surface (frac-outs). In the event that a drilling fluid fracture, inadvertent returns or loss of returns occurs during pilot hole drilling operations, Contractor shall cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a March funnel and then wait another 30 minutes. If mud fractures or returns loss continues, Contractor will cease operations and notify the Engineer and the city.

The Engineer, the city and the Contractor will discuss additional options and the Work will then proceed accordingly. Repair and clean-up of damages associated with frac-outs will be resolved in a timely fashion as directed by the city at the Contractor's expense.

- E. Safety Plan submittal: The Contractor shall be responsible for securing a safe worksite that meets all Federal, State, and Local government codes. A project safety and contingency plan which shall include but shall not be limited to drilling fluid containment and cleanup procedures, equipment and plan for compromised utility installations including electrical and power lines, potable water, reclaimed water, wastewater, storm water and any other subsurface utility.
- F. Contingency Plan submittal: Contractor shall submit contingency plans to address procedures to be employed in the event the following may occur:
 1. Obstruction encountered during drilling or reaming.
 2. Broken drill pipe.
 3. Collapsed or buckled carrier pipe or casing pipe.
 4. HDD fails to advance or fails to respond to steering actions.
 5. Alignment deviation is outside allowable limits.
 6. Installation (pull back) forces reach 75% of the max allowable forces.
 7. Ground settlement/heaving exceed allowable limits set by the Engineer and the city.

Project Records and As-Built Drawings submittals shall include the following:

- A. Fusion joint data and fusion technician data indicating conformance with this Technical Specification and applicable standards. This will include fusion joint warranty information and recommended project specific fusion parameters, including criteria logged and recorded by data logger.
- B. Certified copies of test reports of factory tests for the pipe to be inserted into the bore hole prepared by HDD methods required by the applicable standards and this Technical Special Provision. Report shall include at minimum include following information:
 1. Dimensional Checks
 2. Pipe Burst
 3. Flattening
 4. Extrusion Quality (Acetone Immersion)
- C. Project Records: Maintain a complete set of project records. Maintain a daily activity log during Horizontal Directional Drilling operations. Log shall accurately record entire workday. These documents shall include but not be limited to:
 1. Start and finish time of each section of drill pipe for pilot hole drilling and reaming.
 2. For pilot hole drilling, drill bit location at least every 10 ft. along the drill path. Mark the as-built drawings on a daily basis with drilling progress.
 3. General description of ground condition drilled.
 4. Details and perceived reasons for delays greater than one hour other than normal breaks and shift changes.
 5. Details of any unusual conditions or events.

As-built Drawings: Maintain at the construction site a set of field drawings for recording the pilot hole as-built conditions. Plot as-built conditions on the field drawings, including the location in plan and elevation of the pilot hole.

503-2.5.3. QUALITY ASSURANCE AND COORDINATION OF WORK

HDD Contractor's Experience: Any horizontal directional drilling operations 16'' or larger diameter installation shall be conducted by an experienced HDD Contractor. The HDD Contractor shall have minimum of five years of experience constructing horizontal directional drills for pipelines of the same or larger diameter and the same or greater lengths. A responsible representative of the HDD Contractor and the city must be present at all times during a directional drilling operation. A responsible representative as specified herein is defined as a person experienced in the type of Work being performed and who has authority to represent the Contractor in a routine decision making capacity concerning the manner and method of carrying out the Work.

Qualifications and Experience of Contractor Personnel: The Contractor shall employ skilled, experienced superintendent(s), drill rig operators, and key personnel. A competent and experienced superintendent representing the HDD Contractor, that is thoroughly familiar with the equipment and type work to be performed, must always be in direct charge and control of their operation. In all cases the superintendent shall be continually present at the job site during the actual directional drilling.

The superintendent(s) and drill rig operators shall each have at least three years of successful experience using the HDD process, on at least five (5) projects with similar or greater diameters, pull back length and ground conditions. The superintendent(s), drill rig operator, and key personnel shall demonstrate successful completion of at least five (5) projects where pipe was installed with horizontal directional drilling techniques. The Contractor shall furnish resumes of the superintendent(s), drill rig operator(s) and other key personnel. Personnel experience records should include project names, locations, pull back lengths, ground conditions, pipe materials, project description, city project number, Engineer, and references with names, addresses and telephone numbers. The superintendent, drill rig operator(s) and other key personnel listed in the submittal shall be on-site during all construction related activities required for HDD installation.

A responsible representative of the HDD Contractor and the city shall be present at all times during the directional drilling operation. A responsible representative as specified herein is defined as a person experienced in the type of Work being performed and who has authority to represent the Contractor in a routine decision making capacity concerning the manner and method of carrying out the Work.

The HDD Contractor shall always have a sufficient number of competent workers on the job to ensure the directional bore is made in a timely and satisfactory manner. Adequate personnel for carrying out all phases of the actual drilling operation must be on the job site from the beginning through the completion of the work.

The Contractor shall use certified HDPE pipe welding and fusion operators. The certifications of these individuals shall be made available prior to construction. HDPE pipe welding and fusion operators shall be certified by the pipe manufacturer prior to commencement of pipe welding and fusing operations.

The equipment used in directional boring, also known as horizontal directional drilling, shall be of adequate commercial size and satisfactory working condition for safe operation, and may be subject to approval by the city or at the discretion of the Engineer. Such approval, however, shall not relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein. Only workmen experienced in directional boring operations shall be used in performing the Work.

The Contractor shall provide all structures, safety equipment, and professional services required to provide for the health and safety of the general public and of personnel involved in directional boring work in accordance with the requirements of the regulatory agencies having jurisdiction. The Contractor shall take all measures necessary to protect surrounding public and private property, adjacent buildings, roads, drives, sidewalks, and appurtenances from damage due to directional boring work. Responsibility and payment for correction of such damage shall be the sole responsibility of the Contractor and at no additional cost to the city.

The HDD operation is to be operated in a manner to eliminate the discharge of water, drilling mud, and cuttings to nearby water bodies or to the land areas involved during the construction process. If inadvertent spills to nearby water bodies occur, the Contractor shall immediately provide environmental controls and cleanup to the satisfaction of, and at no additional expense to the city.

Best Management Practices (BMP's) for erosion control within the Contractor's work area shall be implemented and maintained at all times during drilling and back-reaming operations to prevent siltation and turbid discharges in excess of State Water quality Standards pursuant to Rule 62-302, F.A.C. Methods shall include but are not limited to the immediate placement of turbidity containment devices such as turbidity screen, silt containment fence, hay bales, and earthen berms, etc. to contain the drilling mud.

503-2.5.4. HDD PIPE PRODUCTS

The horizontal directional drilling shall only use Certa-Loc PVC or butt-welded

HDPE pipe which meets the requirements specified in *Section 502*. Refer to *Section 502-2.4* for the HDPE Butt Fusion Process and installation procedures for HDD installations.

503-2.5.5. GENERAL HDD INSTALLATION CONSIDERATION

The Contractor shall furnish all equipment and materials required, including but not limited to the following:

1. Drilling equipment (Drilling rig, drill head, drill pipe, drilling control system, pipe pull heads, pipe rollers).
2. Water pumps, hoses, fittings, storage tanks, vacuum truck(s), filters, hay bales, and silt fences, as required.
3. Drilling fluids containment, collection, cleaning and disposal equipment, and materials.
4. Fuel and lubricants.
5. Bentonite and related mixing equipment.
6. All hydrostatic testing equipment and materials.
7. Side booms, cranes, backhoes, trucks and other equipment and materials necessary to load and unload pipe, and to support and smoothly transition the pipe while being pulled into the reamed hole.

All equipment used in the horizontal directional drilling operation shall have the built-in capacity, stability and necessary safety features required to fully comply with the Technical Specifications and requirements of this section without showing evidence of undue stress or failure, and shall otherwise be in sound operating condition.

Backup equipment, sufficient spares and replacement items shall be required where job site conditions indicate that severe damage to the roadway or a hazardous condition may result in the event of an equipment breakdown and where the condition of the equipment to be used indicates that routine component replacement or repair will likely be necessary during the drilling operation.

If equipment breakdowns or other unforeseen stoppages occur and forward motion of the directional cutting head is halted at any time other than for reasons planned in advance (addition of drill stems, etc.), the bore hole shall remain filled with Bentonite slurry and the slurry shall be recirculated periodically.

If an existing utility is damaged, pavement cutting for inspection may be approved by the roadway authority (state, county or city) and the city representative after consideration of all pertinent facts indicates that such action would offer the most practical solution to the problem for all parties concerned.

Any such authorized pavement opening shall be repaired according to appropriate regulatory agency's specifications and requirements. No cutting of the pavement will be allowed on interstate or other limited access roadways unless approved by FDOT.

The boring tool shall have a steering capability and have an electronic tool detection system. The position of the tool during operation shall be capable of being determined accurately both horizontally and vertically.

503-2.5.6. HDD DRILLING EQUIPMENT AND DRILLING FLUID

General: The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore(s) and pullback of the pipe(s), a drilling fluid mixing and delivery system of sufficient capacity to successfully complete the crossing, a drilling guidance system to accurately guide boring operations, a vacuum truck or mud separation plant of sufficient capacity to handle the drilling fluid volume, and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working

order for the duration of this project. All required equipment shall be included per the emergency and contingency plan as submitted per these Technical Specifications.

Drilling Rig:

- A. The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull drill pipe while delivering a pressurized fluid mixture to a steerable drill head. The machine shall be anchored to withstand the pulling, pushing and rotating forces required to complete the project.
- B. The drilling rig hydraulic system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks.
- C. The drilling rig shall have a system to monitor and record maximum pull-back forces during pull-back operations.
- D. The drilling rig shall be grounded during drilling and pullback operations. There shall be a system to detect electrical current from the drilling string and an audible alarm that automatically sounds when an electrical current is detected.

Drill Head:

- A. The horizontal directional drilling equipment shall produce a stable fluid filled bore hole with the use of a steerable drill head.
- B. The system shall be able to control the depth and direction of the pipe.
- C. Drill head shall contain all necessary cutters and fluid jets for the operation and shall be of the appropriate design for the soil or rock being drilled.

Drill Pipe: Drill pipe shall be constructed of high quality 4130 seamless tubing, Grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC. Drill pipe shall be capable of drilling the design drill path and of pulling back the HDPE pipe.

Drilling Fluid System:

- A. Drilling Fluid (Mud):
 1. Drilling Fluid shall be a high-quality bentonite drilling fluid or equivalent to ensure hole stabilization, cuttings transport, bit and electronics cooling and hole lubrication to reduce drag on the drill pipe and the product pipe. Oil based drilling fluids or fluids containing additives that can contaminate the soil or ground water shall not be considered acceptable substitutes. Composition of the fluid must comply with all applicable local, state and federal environmental regulations.
 2. Drilling fluid shall be composed of clean potable water and the appropriate additive(s) for the fluid to be used. Water shall be from a clean potable source and shall meet the mixing requirements of the manufacturer. Reclaimed water shall not be considered an acceptable alternative to potable water.
 3. Potable water shall be obtained from a metered city Water Utility construction service connection paid for by the Contractor. The contractor shall follow all city Water Utility Department requirements regarding backflow prevention, service water metering, and cross connection control.
 4. The water and additives shall be mixed thoroughly to assure the absence of any clumps or clods. No hazardous additives may be used.
 5. Drilling fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall(s).
 6. Drilling fluid shall be disposed of off-site in accordance with local, state and federal requirements and/or permit conditions. Disposal of drilling fluids shall be in compliance with environmental regulations, right-of-way and workspace agreements and permit requirements.

7. No additional chemicals or polymer surfactants shall be allowed to be added to the drilling fluid as submitted for this project without written consent of the city and the Engineer.
- B. Drilling Fluid Mixing System:
1. A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid for the project.
 2. The drilling fluid reservoir tank shall be a minimum of 1,000 gallons.
 3. The mixing system shall be able to ensure thorough mixing of the drilling fluid. The drilling fluid reservoir tank shall be sized for adequate storage of the fluid.
 4. The mixing system shall continually agitate the drilling fluid during drilling operations.
- C. Drilling Fluid Delivery and Recovery System:
1. The mud pumping system shall have a minimum variable capacity of 35 to 500 gpm and the capability of delivering the drilling fluid at a constant minimum pressure of 1200 psi.
 2. The delivery system shall have filters or other appropriate in-line equipment to prevent solids from being pumped into the drill pipe.
 3. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and disposed of in a legal manner at approved solid waste landfills. The use of spill containment measures shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps, vacuum truck(s), and/or storage of sufficient size shall be in place to contain excess drilling fluid.
 4. A closed-loop drilling fluid system and a drilling fluid cleaning system should be used to the extent practical, depending upon project size and conditions. Under no circumstances shall drilling fluid that has escaped containment (i.e. inadvertent returns) be reused in the drilling system.

Pipe Pull Heads:

- A. Pipe pull heads shall be utilized that employ a positive through-bolt design assuring a smooth wall against the pipe cross-section at all times.
- B. Pipe pull heads shall be specifically designed for use with high density polyethylene (HDPE) pipe or PVC fusible pipe as appropriate and shall be as recommended by the pipe supplier.

Drilling Control System:

- A. Calibration of the electronic detection and control system shall be verified prior to the start of the bore.
- B. The drilling head shall be remotely steerable by means of an electronic or magnetic detection system. The drilling head location shall be monitored in three dimensions, X, Y and Z:
 1. Distance along the baseline, X.
 2. Offset from the baseline, Y, and.
 3. Depth of bore, Z.
- C. The guidance system shall be capable of tracking at all depths up to 50 feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system shall be accurate and calibrated to the manufacturer 's specifications of the vertical depth of the borehole at sensing position at depths up to 50 feet and accurate to 2-feet horizontally.
- D. Point of rotation of the head shall also be monitored.

Pipe Rollers:

Pipe rollers shall be used for pipe assembly and during final product pull back.

503-2.5.7. PREPARATION AND MOBILIZATION FOR HDD OPERATIONS

Do not commence directional drilling until all required submittals have been approved by the Engineer and the city.

Do not begin drilling until all pipe and special items for drilling have been delivered.

All drilling operations shall be accomplished during daylight hours and shall not begin after the hour pre-established as the latest starting time that will allow completion during daylight hours. Planned nighttime work will generally not be allowed unless stipulated in the special conditions of the city's Agreement. In emergency situations, or where delay would increase the likelihood of a failure, nighttime work may be allowed to complete the drilling operations.

Mobilize all necessary personnel, equipment, and materials to construct an entry area for drilling operations. Provide appropriate supports to maintain safe working conditions; ensure stability of the entry, exit, settlement, and containment pits; minimize loosening, deterioration and disturbance of the surrounding ground.

The drilling site shall contain the horizontal directional drilling rig, drill pipe storage racks, water and slurry pumps, slurry mixing tank, cuttings separation equipment, primary settlement and containment pits, dry storage area for bentonite, crane or lifting equipment, and site office.

The pipe launcher/roller system (or equal) shall be constructed in the specified area. The pipe lay down area shall be as determined in conjunction with the Engineer and the city and shall be used to facilitate the installation of the pipeline.

503-2.5.8. ENVIRONMENTAL REQUIREMENTS

Provide equipment and procedures to maximize the recirculation of drilling mud and to minimize waste. Provide solids control and fluid cleaning equipment of a configuration and capacity that can process surface returns and produce drilling fluid suitable for reuse.

Inadvertent surface returns or "frac-outs" of drilling fluid that is accessible on land must be cleaned up immediately and the surface area washed and returned to original condition. All drilling fluids, spoils and separated material will be disposed of in compliance of state and local environmental regulations. If the amount of surface returns exceeds that which can be contained and collected using small sumps, drilling operations shall be discontinued until surface return volumes can be brought under control. Equipment and materials for cleanup and contingencies must be provided and stored at all HDD sites.

Construction related activities involving fuels and lubricants such as vehicle refueling and equipment maintenance, including the draining and pumping of lubricants shall be conducted at a minimum distance of 50 feet from surface water bodies, drainage ditches or swales, drainage pathways and storm water collection structures to eliminate contamination in case of a spill. Any fuels, drilling fluids, or lubricants spilled shall be cleaned up immediately and comply with all FDEP requirements.

Contractor shall provide sanitation and garbage facilities on both sides of the HDD operation. Wastes shall be transported offsite for disposal.

Immediately upon completion of work, all rubbish and debris shall be removed from the job site. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean, and acceptable condition approved by the city.

503-2.5.9. DRILLING OPERATIONS

Supply all necessary drilling equipment for completing the HDD installation as shown on the approved Shop Drawings.

The plan and profile for the horizontal directional drilling operation shall be in accordance with the approved Shop Drawings.

Drill entrance and exit angles shall be as shown on the approved Shop Drawings.

Drilling Tolerances: A smoothly curved pilot hole shall follow the designated centerline of the pipe profiles as shown on the Drawings. The directional tolerance of the holes will be as follows:

- A. Deviations from, and corrections to, the design centerline of the HDD pipeline construction shall not exceed 2 percent in depth per 100 feet horizontal or a lesser rate determined by the structural characteristics of the selected pipe and jointing system.
- B. The as-built variance from the designed bore path shall not exceed plus or minus 1-foot in the vertical plane and plus or minus 2-feet in the horizontal plane.

503-2.5.10. HDD INSTALLATION

General: The Contractor shall install the HDPE pipe by the horizontally drilled, directionally controlled method of construction.

Instrumentation: The Contractor shall always provide and maintain instrumentation which shall accurately locate the pilot hole position in the X, Y and Z axes relative to the ground surface and measure drill string axial and torsional loads. Drilling fluid flow rate and pressure shall also be monitored. The Contractor shall maintain and provide to the city Inspector and the Engineer access to the data generated by the downhole survey tools.

Drilling Guidance and Pullback:

- A. Pipe installed by horizontal directional drilling shall be located as shown on the Drawings. The Contractor shall plot the actual horizontal and vertical alignment and the depth of the pilot bore at intervals not exceeding 10 feet. Deviations between the recorded position of the drill string and the specified position of the drill string shall be documented and immediately brought to the attention of the Engineer. This “as-built” plan and profile shall be updated as the pilot bore is advanced. At the completion of the pilot hole, the Contractor shall provide the coordinates of the pilot hole as specified.
- B. The Contractor shall provide and use on land, a separate steering system employing a ground survey grid system, equal to “Tru-Tracker”.
- C. The Contractor shall have accurate working gauges which register tensile force being used to pull the pipeline back through the reamed borehole. If, during the pipeline pulling process, this force reaches 75 percent of the allowable load for the pipeline, the Engineer shall be notified immediately, and the Contractor shall prepare to initiate the contingency plan provided within the approved Project submittals. Logs shall be kept referencing all forces exerted on the pipeline during the installation.
- D. The Contractor shall provide adequate pipe supports/rollers along the stringing area (for both entry and exit pits) to support the required length of pipe for each location. The rollers shall be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback.
- E. The pipe entry area shall be graded to provide support for the pipe to allow free movement into the borehole. The pipe shall be guided in the borehole to avoid deformation of, or damage to the pipe. The pipe shall be installed in a manner which will not cause upheaval, settlement, cracking, movement, or distortion of surface features.
- F. During pullback operations, the Contractor shall monitor roller operation and use side booms if required to assist movement of the pipe and to avoid damage to the pipe.
- G. Cease installation operations if damage to the pipe occurs. Damage to the pipe shall be repaired immediately. Pulling operations shall not resume until the pipe has been repaired.

- H. Pipe pullback shall be planned to occur continuously until complete, except for stoppages planned in the course of the operation such as drill rod removal or if damage to the pipe is observed during pullback that needs to be repaired before continuing. Contractor shall implement necessary buoyancy control as stated in the approved HDD Method and Work Plan.

Location Detection Wire for HDD Pipeline Installations: Refer to *Section 502-2.5.2. B.* for specifications regarding material and installation of Location Detection Wires for HDD installations.

503-2.5.11. DRILLING MUD AND CUTTINGS

The horizontal directional drilling operation shall be conducted in a manner to eliminate the discharge of water, drilling mud, and cuttings to areas not involved in the construction process. The Contractor shall immediately contain and clean-up any inadvertent drilling fluid returns. The Contractor shall also provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste disposal.

Disposal of water, drilling fluids, drilling mud, cuttings, and muck shall be the Contractor's responsibility. Disposal of waste materials shall be in a legal manner at approved solid waste landfills.

503-2.5.12. REAMING AND PULLBACK

Reaming: Reaming operations shall be conducted at the discretion of the Contractor. Choosing to simultaneously ream and pull back the pipe is at the discretion and the sole risk of the Contractor. All provisions herein relating to simultaneous reaming and pulling back operations shall also pertain to reaming operations.

- A. Prior to pulling pipe, enlarge pilot hole to the diameter identified in the reaming procedure submittal. The Contractor shall ream the borehole to a minimum of 12-inches larger than the outside diameter of the pipe or 1.5 times the outside diameter of the pipe, whichever is less, using the appropriate tools. Complete a swab pass if necessary.
- B. Ream at rates consistent with the drilling equipment and mud system selected.
- C. Continue to monitor the drilling fluid viscosity and density to reduce the potential for frac-out.

Pulling Loads: The Contractor shall be responsible for determining safe pulling loads required for proper installation. Such loads shall be minimized to prevent failure of the pipeline during installation. Once pullback operations have commenced, operations shall continue without interruption until the pipe is completely pulled into the borehole. During pullback operations, the Contractor shall not apply more than the maximum safe pipe pull pressure at any time. A break away head rated at the maximum safe pull pressure shall be utilized.

Torsional Stress: A properly sized and fully operational swivel shall be installed between the reaming assembly at the end of the drilling pipe and the pipeline to restrict torsional stress from being transmitted to the pipeline.

Ballast: The pipeline must be filled with water (ballasting) as installation proceeds, to prevent buckling and reduce buoyancy.

Pull Section Support: The pipe section shall be supported as it proceeds during pull back so that it moves freely.

503-2.5.13. PIPELINE PROTECTION

Protect the interior of the pipe from entry of foreign matter until the installation is complete and accepted.

Contractor shall video record the inside of the pipe after it has been installed and verify that no cracks, breaches, gouges, holes, etc. have occurred during pullback that would decrease the integrity of the pipe.

503-2.5.14. PIPELINE CLEANING

Following installation of the pipeline installed by HDD, the pipeline shall be hydraulically cleaned and flushed as specified in *Section 504* of these Technical Specifications.

503-2.5.15. PIPELINE TESTING

Pressure Testing: Hydrostatically test pipe before and after installation in accordance with *ASTM F2164-Field Leak Testing of Polyethylene Pressure Piping Using Hydrostatic Pressure* and *Section 505*. of these Technical Specifications.

- A. **Test Duration:** The total test time including initial pressurization, initial expansion, and time at test pressure, must not exceed a total of 8 hours. If the test is not completed due to leakage, equipment failure, etc., the test section shall be depressurized and allowed to “relax” for a minimum of 8 hours before it is brought back up to test pressure. The test procedure consists of initial expansion phase and leakage test phase.
- B. **Initial Expansion Phase:** During the initial expansion phase, the test section is pressured to the test pressure and enough make-up water is added each hour for a total of three hours to return to test pressure.
- C. **Leakage Test Phase:** The leakage test phase immediately follows the initial expansion phase. The test section shall be brought back up to the test pressure and remain at that pressure for 4-hours in duration. At the end of the 4-hour test time period, the test section shall be within +/-2 psig of the test pressure with zero leakage (no water added).
- D. **Zero Leakage:** The portion of the HDD pipeline to be hydrostatically tested with HDPE butt fused joints shall have zero leakage for the entire 4-hour leakage test duration for the HDD pipe section to have passed the leakage test.

Test Pressure: The test pressure for the HDD pipeline shall be 150 psi for potable water and reclaimed water or 100 psi for wastewater.

The Contractor shall furnish all materials, equipment, and labor required for making pressure and leakage tests. Tests shall be performed in the presence of the Engineer and the city Inspector.

503-2.5.16. DISINFECTION FOR HDD POTABLE WATER PIPELINES

Final disinfection for potable water pipelines installed by HDD, following cleaning, flushing and pipeline testing, shall be in accordance with *Section 506*. of these Technical Specifications.

503-2.5.17. CITY ACCEPTANCE

If the finished installation of the HDD is not satisfactory to the city, the Engineer or other jurisdictional entity, due to any of the following: the pipe alignment being outside of the specified limits of ± 1.0 foot of the coordinates for the entry or exit points stated on the Drawings; failure to pass the leakage or pressure tests; or internal damage to the pipeline; the pipeline shall be abandoned, fully pressure grouted in place, in accordance with the jurisdictional authority, and an alternate installation shall be constructed. The abandoned pipeline shall be properly shown on Record Drawings to be submitted following conclusion of the construction work.

If the HDD pipeline construction is to provide an HDPE casing pipe for a carrier utility pipe, casing spacers shall not be permitted inside the HDPE casing pipe.

If the HDD installation is for a casing pipe, the Contractor shall end-seal the annular space between the casing pipe and the carrier pipe using concrete brick and mortar which shall extend at least 8-inches into the casing pipe. To secure the ends of the casing and to preclude the entrance of water and soil into the casing, the casing ends shall be completely sealed to be watertight with a neoprene rubber seal specifically manufactured for that purpose. The neoprene end seal shall be attached to the casing and the carrier pipe

with Type 304 stainless steel bands. The casing end seals shall be constructed to be basically watertight to preclude the intrusion of groundwater into the casing. Casing end seals shall be equal to Cascade Water Works Model CCES or an approved equal listed in the *City of Clearwater Approved Products List*.

The Engineer shall inspect the installed pipe ends for roundness and/or damage. Evidence of significant surface scratching shall be brought to the attention of the Engineer. Gouges or excessive surface damage of more than 10 percent of the wall thickness will be grounds to abandon the bore and have the Contractor re-drill another pipeline at no cost to the city.

The city shall be provided with test logs from the Contractor indicating the actual maximum pull loads, maximum deflection angle encountered during the pulling operation and the actual X, Y and Z coordinates of the pipe centerline at a maximum of every 10 feet horizontally of the HDD pipe for review as part of final acceptance.

Contractor shall review the internal video of the HDD installation and report any deficiencies to the Engineer and the city. A copy of the video shall be provided to the city as part of the Record Documents submittal for the completed and accepted Work.

503-2.5.18. REPAIR

Pipes damaged during handling or installation shall be pushed or pulled out or repaired in-place using replacement sections and butt fusion welds recommended by the pipe manufacturer following methods described in the approved submittal.

503-2.5.19. CLEANUP AND REPAIR

Following the installation, remove all equipment, material, drilling mud and waste from both work area ends of the HDD installation. The project site shall be returned to a condition equal to or better than the pre-construction condition of the site. All excavations will be backfilled and compacted to 98% maximum dry density under roadways and hardscape, or to 95% maximum dry density for all other areas and shall be graded to original contours. Compaction Testing shall be performed in accordance with *Section 201-2.9 – Backfill and Compaction* of these Technical Specifications. All pavement and hardscape shall be repaired per applicable jurisdictional standards, excess materials shall be removed from the site, and disturbed areas shall be re-landscaped. All drilling fluid shall be properly disposed of per these Technical Specifications and all applicable jurisdictional laws.

Areas or facilities disturbed or damaged during construction shall be restored to original or better condition with new materials prior to the completion of construction unless specifically identified on the Drawings to be modified. This includes areas or facilities outside or inside the roadway rights-of-way, previous construction activities being done as part of this Project, and ancillary roadways, retention ponds, landscaping, signage, billboards, utility boxes and equipment, utility poles, and utility lines.

503-3. SETTING OF VALVES, HYDRANTS AND FITTINGS

503-3.1. GENERAL

Valves, hydrants, fittings, plugs and caps shall be set and joined to pipe in the manner specified above for installation of pipe.

503-3.2. Fittings

The weight of ductile iron fittings shall not be carried by the pipe on which they are installed. The fitting shall be supported by a concrete cradle as shown on the standard details. Concrete used for supports shall

have a minimum compressive strength of 3,500 psi at 28 days. Concrete for the support cradle shall be poured against undisturbed soil.

All glands, clamps, bolts, nuts, studs, and other uncoated parts of fitting joints for underground installation shall be coated with two coats, 10 mils DFT per coat, of coal tar epoxy equal to Carboline Bitumastic No. 300-M.

503-3.3. VALVES

Valves for potable water mains and reclaimed water mains shall be located within the street rights-of-way lines unless shown otherwise on the plans. All valves shall be installed adjacent to the tee in all cases, not to exceed 18-inches from the main line.

Valves of the size and type shown on the Drawings shall be set plumb and installed at the locations indicated on the Drawings. Valves shall be installed in accordance with the manufacturer's written installation and operation instructions; with the approved shop drawing submittals; and with the details shown on the Drawings.

Buried valves shall be installed such that they are supported properly in their respective positions, free from distortion and strain with a concrete cradle as shown on the Standard Details. Concrete used for supports shall have a minimum compressive strength of 3,500 psi at 28 days. Concrete for the support cradle shall be poured against undisturbed soil. Valves shall be installed such that their weight is not borne by piping or equipment that are not designed to support the weight of the valve. Exposed aboveground valves shall be supported with fabricated piping supports so that the weight of the valve is not carried by the pipeline.

Install gate valves with the operating stem in the vertical position. Valves shall be carefully inspected during installation; they shall be opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign material from becoming lodged in the valve seat. Check and adjust all valves for smooth operation.

Aboveground Valves: For aboveground flanged valves, clean iron flanges by wire brushing before installing the valves. Clean stainless-steel flange bolts and nuts lubricate threads with a fluoropolymer coating to prevent galling and tighten nuts uniformly and progressively. Flanged joints shall be watertight; no leaks shall be allowed.

Buried Valves: For buried valves, a valve box shall be centered accurately over the operating nut and the entire assembly shall be plumb. Extensions or risers for valve boxes shall be an integral part of the box. No cut sections of ductile iron or PVC pipe shall be used to extend the valve box to its proper height. The tops of valve boxes shall be adjusted to the proper elevation as specified below and as shown on the Drawings. Care shall be taken while constructing valve boxes to ensure that valve stems are vertical and the cast iron valve box has been placed centered and plumb over the valve stem nut of the valve with base bearing on compacted fill and the top flush or above final grade, as specified below. Valve boxes shall have sufficient bracing to maintain alignment during backfilling. When installation is complete, no pressure shall be exerted by the valve box on either the valve or the pipe. The Contractor shall remove any sand or undesirable trash or debris from valve box interior prior to final inspection.

- A. In paved areas, tops of valve box covers shall be set 1/4-inch below pavement. Following paving operations, a 24-inch square shall be neatly cut in the pavement around the box and the paving removed. The top of the box shall then be adjusted to the proper elevation and a 24-inch square by 6-inch thick concrete pad poured around the box cover. Concrete pads in traffic areas shall be reinforced with No. 4 reinforcement bars as shown on the Drawings. Concrete for the pad shall be 3,500 psi compressive strength at 28 days.
- B. In unpaved areas, tops of valve box covers shall be set 2 inches above finished grade. After the top of the box is set to the proper elevation, a 24-inch square by 6-inch thick concrete pad shall be

poured around the box cover. Concrete for the pad shall be 3,500 psi compressive strength at 28 days.

- C. The concrete pad for the valve box cover shall have a 3-inch diameter, brass identification disc embedded in the concrete surface as shown on the Drawings. The brass identification disc shall have the information as shown on the Drawings neatly engraved, not stamped, on it.

Refer to City Standard Detail Index No. 402; Sheet 1 of 3 & Sheet 2 of 3 for potable water valve pad detail, and City Standard Detail Index No. 502; Sheet 1 of 3 & Sheet 2 of 3 for reclaimed water valve box and pad detail.

Hydrostatic Testing: Valves shall be tested hydrostatically, concurrently with the pipeline in which they are installed. Protect or isolate any parts of valves, operators, or control and instrumentation systems whose pressure rating is less than the pressure used for the pressure test(s). If valve joints leak during pressure testing, loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts, and hydrostatically retest the joints.

Coating Repair: Following installation of buried valves, repair any scratches, marks and other types of surface damage, etc., with a coating equal to the original coating supplied by the manufacturer. Prior to backfilling, all nuts, bolts, and other parts of the valve joints shall be coated with two coats, 10 mils DFT per coat, of coal tar epoxy equal to Carboline Bitumastic No. 300-M.

503-3.4. FIRE HYDRANTS

Hydrants shall be located as shown or as directed so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians.

Each hydrant shall be connected to the potable water main with a 6-inch ductile iron branch tee with flow controlled by an independent 6-inch mechanical joint gate valve for isolation at the branch of the water main tee. If the fire hydrant is placed greater than 20-feet from the main, an additional 6-inch mechanical joint valve shall be installed at the hydrant location and shall be included in the hydrant assembly cost. The fire hydrant valve cannot be located anywhere within the hydrant ductile iron pipe branch line to circumvent the requirement of using two valves. Refer to *City Standard Detail Index 409*, for potable water hydrants.

All fire hydrants shall stand plumb and shall have their nozzles parallel with, or at right angles to, the curb, with the pumper nozzle facing the curb. Fire hydrants shall be set to the established grade, with nozzles as shown or as directed by the Engineer.

Hydrostatic Testing: Fire hydrants shall be tested hydrostatically, concurrently with the pipeline in which they are installed. If the hydrant mechanical joints leak during pressure testing, loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts, and hydrostatically retest the joints.

Coating Repair: Following installation of buried portions of the hydrants, repair any scratches, marks and other types of surface damage, etc., with a coating equal to the original coating supplied by the manufacturer. Prior to backfilling, all buried nuts, bolts, and other parts of the hydrant mechanical joints shall be coated with two coats, 10 mils DFT per coat, of coal tar epoxy equal to Carboline Bitumastic No. 300-M.

Reclaimed Water System: No hydrants shall be installed on the reclaimed water system unless approved by the city's Engineering Department.

503-3.5. ANCHORAGE

Movement of all plugs, caps, tees, bends, etc., unless otherwise specified shall be prevented by attaching approved mechanical restraining rings or glands and installed per manufacturer's recommendations.

Hydrants shall be held in place with restrained swivel joints. Restraining mechanical joint glands on hydrants may be used where hydrant run out length precludes the use of hydrant connecting swivel joints.

Where special anchorage is required, such anchorage shall be in accordance with details shown on the plans.

503-4. CONNECTIONS TO EXISTING POTABLE WATER OR RECLAIMED WATER LINES

The Contractor shall coordinate making connection of the new mains to mains which are in service at the time of construction with the city. All potable water or reclaimed water main connections, regardless of new or existing pipe size, to existing potable water or reclaimed water mains shall be made by the Contractor only after the connection procedure and his Work scheduling has been reviewed and approved by the Engineer and the city Engineering Department. The Contractor shall submit a written request to the Engineer and the city Engineering Department a minimum of 5 working days prior to scheduling said connections. The request shall outline the following.

- A. Location of points of connection, fittings to be used, and method of flushing and disinfection, if applicable.
- B. Estimated construction time for said connections.

The Engineer and the city Engineering Department shall review the Contractor's submittal within 3 working days after receiving it and inform the Contractor regarding approval or denial of his request. If this request is rejected by the city, the Contractor shall resubmit his request modifying it in a manner acceptable to the city.

Connections to existing potable water or reclaimed water mains shall only be made following completion of new potable water or reclaimed water main cleaning operations and successful completion of pressure and leakage testing and disinfection clearance of the new potable water main.

The Contractor shall not connect to existing facilities unless the Engineer and a representative of the city are present. All connections shall only be made on the agreed upon date and time. If the Contractor does not initiate and complete the connection work in the agreed upon manner, the Contractor shall be required to reschedule the said connection by following the procedure outlined above.

Operation of all existing potable water or reclaimed water system valves shall be the responsibility of the city's personnel only. At no time shall the Contractor operate any existing system valves. System valves shall be defined as any valve which has main pressure against either side of the valve. The Contractor shall notify the city to request that a valve be operated, at least 5 days prior to the time operation is required.

Upon satisfactory completion of all hydrostatic testing of the new potable water or reclaimed water pipeline, and disinfection of the new potable water pipeline, remove restrained joint caps from both ends of the new pipeline, close main line isolation valves on the existing main, cut and drain the existing main and swab all pipe and fittings for the connection to be installed on the new main with 10 percent hypochlorite solution. The connection of the new main to the existing main shall be made as swiftly as possible and any water collected in the ditch shall be pumped out and kept below the level of the pipe bottom. Following connection and make-up of all fittings, the new pipeline shall then be placed into service by the city's operating personnel.

In the event any existing customers will be without potable water while a connection is being made, the Contractor shall notify the city's Inspector 72 hours prior to disconnection. The city Utility Department shall notify the affected customer(s) when the water will be turned off and when the service is estimated to be resumed. In some instances, these connections may have to be made at late night or early morning hours. No user shall be without potable water service for more than three hours, unless approved otherwise by the city.

504. PIPELINE CLEANING

Following installation of the potable water or reclaimed water pipelines, the pipelines shall be cleaned using a combination of hydraulic cleaning using poly-pig swabbing devices and full bore flushing as specified below.

504-1. PIPELINE PIGGING

All pipelines shall be hydraulically cleaned utilizing multiple pass operations with a polypropylene swabbing device, also referred to as “pigging” operations, of the piping system. Between successive operations, the pig diameter shall increase, and the pig material shall stiffen. Poly pigs shall be blown elastomer polyurethane with open cell-type construction having a material density suitable for use within the system to be cleaned. Pipe cleaning poly pigs shall have a parabolic nose, crisscross coated with a resilient peripheral surface that engages the inner cylindrical wall of the pipe to maintain a sliding seal. Pipe cleaning poly pigs shall be able to pass through a reduction of a minimum of sixty-five percent (65%) of the original cross-sectional area of the pipe and shall be bi-directional. Cleaning procedures shall conform to the Poly Pig manufacturer’s recommendations.

The Contractor shall provide pig launching and retrieval points for the pipeline cleaning, as required. The poly pig cleaning operation shall be completed prior to connection of the new potable water main or reclaimed water main to an existing potable water main or reclaimed water main.

Passage of cleaning poly pigs through the system shall be constantly monitored, controlled, and all poly pigs entered into the system shall be individually marked and identified so that the exiting of the poly pigs from the system can be confirmed.

Cleaning of the pipeline system shall be done in conjunction with the initial filling of the system for the hydrostatic testing.

The line to be cleaned shall only be connected to an existing potable water or reclaimed water distribution system at a single connection point. Only the city’s operating personnel shall operate the supply valve from the existing potable water or reclaimed water distribution system.

The Contractor shall locate and open all new in-line valves beyond the point of connection on the pipeline to be cleaned during the swabbing operation.

At the receiving or exit point for the poly pig, the Contractor is responsible for creating a safe environment for collection of debris, water, and the swab. The Contractor shall provide for the protection of surrounding personnel and property and the safe retrieval of the poly pig.

Temporary blowoffs may be required for the purpose of flushing mains. Temporary blowoffs shall be installed as close as possible to the ends of the main being flushed. Blowoffs installed on the main shall be the same diameter as the main. Temporary blowoffs shall be removed and plugged after the main is flushed.

The city Utility Department shall be notified at least 72 hours prior to pigging and flushing mains.

Cleaning and flushing shall be accomplished by propelling the poly pig down the pipeline to the exit point with potable or reclaimed water, depending on the type of main being cleaned. Flushing shall continue until the water is completely clear and poly pig is retrieved.

- A. Re-apply a series of individual poly pigs in varying diameters and/or densities as required, to attain proper cleanliness of pipeline.
- B. Pigging speed shall range between two and five feet per second.

504-2. FINAL PIPELINE FLUSHING

Following the pigging process for cleaning the pipeline, the length of new water main shall be final flushed with a full-bore clean water flush with a flushing velocity of at least 2.5 fps. The time required for the final full bore flush shall be based on the time needed at the required flushing velocity to provide one complete turnover of the quantity of water in the pipeline based on the length and diameter of water main being flushed.

Blowoffs and temporary drainage piping used for flushing shall not be discharged into any gravity sewer or pumping station wet well. The Contractor shall obtain prior approvals from the Engineer and the city as to the methods and locations of flushing water discharge.

At the discretion of the city, full bore water flushing may not be required for a particular water main based on the size of the main being cleaned and the quantity of water usage required for a full bore water flush.

Following the pigging and flushing process, pressure testing of the pipeline shall be completed in accordance with *Section 505* below.

505. TESTS

505-1. HYDROSTATIC PIPELINE TESTING

General: The Contractor shall perform hydrostatic pressure and leakage tests on all newly laid pressure pipes, fittings and valves for potable water mains and reclaimed water mains. After installation of the water mains, complete with all associated appurtenances including service taps, all sections of newly laid water main shall be subject to a hydrostatic pressure test as described below.

Standard: AWWA C600, Section 4, with the exceptions required herein. The Contractor shall furnish all closure pieces in the pipe as required. All equipment required for the hydrostatic pressure test shall be furnished by the Contractor and shall include, but not be limited to, graduated containers, pressure gauges, meters, testing taps and valves, hydraulic pressure pumps, suitable hoses and piping and any other equipment needed to hydrostatically test the pipelines. Hydrostatic tests shall be conducted on all newly laid potable water main or reclaimed water main pipes, fittings, and valves including any branch lines to the curb. Tests shall be made between valves not exceeding 2,000 feet.

The Contractor may conduct a preliminary hydrostatic test after the trench has been partially backfilled with the joints left exposed for an initial leakage test for his inspection and informational purposes only. The hydrostatic testing for acceptance shall only be conducted after the trenches have been completely backfilled and compacted as specified.

Test new pipelines which are to be connected to existing pipelines by isolating the new line from the existing line by means of pipe caps, special flanges, or blind flanges. After the new line has been successfully tested, remove temporary caps or blind flanges and connect to the existing piping.

The Engineer and the city's Inspector shall be present during all inspection, pressure, and leakage testing for the results to be considered acceptable for the city's acceptance of the new potable water main or reclaimed water main system. Successful passage of both the pressure test and the leakage test is required before acceptance by the city.

The hydrostatic pressure and leakage testing described herein is intended for non-butt-welded jointed pipe with gasketed joints.

Where any section of the piping contains concrete thrust collars, do not proceed with the pressure test until at least 10 days after the concrete has been poured. If high-early cement is used for the concrete thrust collars, the time may be reduced to three (3) days, if the Engineer and the city Engineering Department

both concur that the concrete has cured and reached adequate strength. When testing cement mortar-lined piping, fill the pipe to be tested with water and allow it to soak for at least 48 hours to absorb water before conducting the pressure test.

Each section of pipe to be tested shall be slowly filled with water and the specified test pressure shall be applied by means of a pressure pump connected to the pipe in a satisfactory manner. Before applying the specified test pressure, all air shall be expelled from the pipe as described below. If defective pipes, fittings or valves are discovered in consequence of this pressure test, all such items shall be removed and replaced by the Contractor with sound new material, the pipe shall be re-cleaned and the pressure test shall be repeated until satisfactory results are obtained. Provisions of AWWA C-600, where applicable, shall apply.

Hydrostatic Pressure Test:

- A. **Test Pressure:** Potable Water Mains - 150 psi; Reclaimed Water Mains – 150 psi; Wastewater Force Mains – 150 psi. Apply and maintain the test pressure by means of a hydraulic pressure pump. The test pressure shall be maintained ± 2 psig throughout the entire test period.
- B. **Test Duration:** 2-hours. If during the test, the integrity of the tested line is in question, the Engineer or the city's Inspector may require an additional pressure test.
- C. **Air Release Requirements:** Tapping saddles and corporation cocks at least 3/4-inch in diameter, pipe riser and angle globe valves shall be installed by the Contractor at each dead-end and at all high points in the main to bleed all air from the water main to be tested.
- D. Zero leakage and no pressure loss shall be allowed for the pressure pipe being tested.

Visible Leakage: All visible leaks evident at the ground surface shall be repaired and leakage eliminated.

Leakage Repair: Repairs to leaks shall be completed in strict accordance with the pipe manufacturer's written recommendations. Repair and retest any pipes showing leakage.

Damage or Defects: Any exposed pipe, fittings, valves, hydrants, and joints shall be examined during the test. Any damage or defects that are discovered shall be replaced with new material at no additional cost to the city. The test shall be repeated until no damage or defects are discovered.

505-2. NOTICE OF TEST

The Contractor shall give the city's Project Manager and/or Representative forty-eight (48) hours advance notice of the time when the installation is ready for hydrostatic testing.

City inspector/CEI shall certify and submit all hydrostatic pressure and leakage testing results to the city Project Manager within 10 days of performing test(s).

506. DISINFECTION AND TESTING

Before the new potable water system is put into operation, all new potable water mains and appurtenances and any item of new construction with which the water comes into contact, shall be thoroughly disinfected in accordance with AWWA C651. This section includes materials and procedures for disinfection of water mains by the continuous feed method.

506-1. DISINFECTION MATERIALS

Dry Calcium Hypochlorite: High test granular calcium hypochlorite (HTH) used as the chlorinating agent shall contain between 65 to 70 percent of available chlorine by weight. The dry calcium hypochlorite shall be stored in a cool, dry, and dark environment, prior to its use, to minimize deterioration.

Sodium Hypochlorite Solution: Sodium hypochlorite solution used as the chlorinating agent shall be obtained fresh and shall have a minimum concentration of 10 percent by weight available chlorine. To

minimize degradation, sodium hypochlorite solution shall be stored in opaque, closed polypropylene containers, isolated from contact with any metals and out of direct sunlight. The solution shall be stored in covered (as dark as possible) areas and as cool as possible, prior to use on the jobsite. Sodium hypochlorite solution is highly corrosive. Therefore, the Contractor shall use this chlorinating agent with caution and per the recommendations of the sodium hypochlorite solution manufacturer.

Chlorine Residual Test Kit: To measure chlorine concentration, provide and use a mid-range total chlorine test kit with a digital titrator, using sodium thiosulfate as the titrant. Maintain fresh reagents for the test kit and maintain all components of the kit in good working order available for immediate testing of chlorine residuals at the point of sampling.

506-2. FLUSHING SYSTEM

Prior to pressure testing and application of the disinfection agent for disinfection, all pipelines shall be hydraulically cleaned utilizing multiple pass operations with a polypropylene swabbing device, also referred to as “pigging” operations, of the piping system, followed by full bore flushing. Flushing shall continue until a clean, clear stream of water flows from the hydrants. Where hydrants are not available for flushing, such flushing shall be accomplished at the installed blow off devices generally at the ends of the lines. Cleaning and flushing prior to pressure testing and disinfection shall be in accordance with *Section 504* of these Technical Specifications.

506-3. FINAL DISINFECTION PROCEDURE FOR POTABLE WATER MAINS

Before any portion of a new potable water piping system is to be placed into service, it shall be disinfected; and proper disinfection shall be demonstrated by bacteriological testing conducted in accordance with "Standard Methods for Examination of Water and Sewage" for the coli-aerogenes group, by a commercial laboratory approved by the FDEP, and acceptable to the Engineer and the city, or may be completed by the Pinellas County Health Department.

All pipe, fittings, valves, and all other appurtenances installed for use in potable water pipelines shall be disinfected prior to being placed in service. Disinfection procedures shall be approved by the Engineer and the city and shall be in conformance with ANSI/AWWA C651, latest revision. Contractor shall comply with all General Notes on the Drawings and special requirements that are included with the FDEP permit related to disinfection and clearance of new potable water mains.

Pipe subjected to contaminating materials shall be treated in a manner approved by the Engineer and the city. Should such treatment fail to remove contaminants from the pipe, contaminated sections of pipe shall be replaced with new uncontaminated pipe.

Only potable water from an existing city water main shall be used for disinfection and final flushing of new potable water pipelines. The potable water shall be obtained as described below in *Section 508* of these Technical Specifications.

Disinfection Procedure: Disinfection of a completed potable water pipeline shall be accomplished using the following procedure:

- A. All water piping, fittings, valves, and appurtenances shall be disinfected with a chlorine solution with a sufficient concentration such that the initial chlorine concentration in the water line shall be a minimum of 75 mg/l available chlorine, at any point in the line, and that a chlorine residual of not less than 30 mg/l remains in the water, at any point in the line, after standing 24 hours in the pipeline. The contact period may be longer than 24-hours, if required by the city or the Engineer

before it is flushed out. All valves in the lines being disinfection shall be opened and closed several times during the contact period.

- B. Chlorine may be applied to the water pipeline as a liquid 10% sodium hypochlorite solution, or as a mixture of water and high-test calcium hypochlorite. The Contractor shall assume responsibility for safe handling of chlorinating agents and shall meet requirements of OSHA and other regulatory agencies for safe handling of chlorinating agents.
- C. The dry high-test calcium hypochlorite (HTH) may be used to make up a high concentration chlorine solution which will be used for disinfection. The hypochlorite solution to be used for disinfection should be mixed based on the HTH manufacturer's recommendations. Under no circumstances will undiluted, dry calcium hypochlorite be placed in the pipeline to be disinfected.
- D. The chlorine solution, either 10% sodium hypochlorite or a calcium hypochlorite mixed solution, shall be metered into the pipeline with a small metering pump.
- E. Disinfection of Valves, Blind Flanges and Appurtenances: Swab exposed interior surfaces of valves and blind flanges with a 10% sodium hypochlorite solution prior to installation and bolting in place.
- F. Disinfection of Tapping Sleeves, Tapping Valves and Line Stops: Flush exterior of pipe with potable water after removal of existing coating. Swab exterior of pipe and interior of tapping, sleeve, tapping valve and line stop valve with a 10% sodium hypochlorite solution. Disinfect per AWWA C651, Section 4.8. After completion of tapping and line stopping, swab interior of pipe, valves, and faces of flanges to be connected to bypass piping with a 10% sodium hypochlorite solution.
- G. Disinfection of Connections to Existing Pipelines: Disinfect isolation valves, pipe, and appurtenances per AWWA C651, Section 4.7. Flush with potable water until discolored water, mud, and debris are eliminated. Swab interior of pipe and fittings with a 10% sodium hypochlorite solution. Following disinfection procedures, flush with potable water again until water is free of chlorine odor.
- H. Water from the existing, in-service water line shall be made to flow at a constant, slow rate into the water line to be disinfected. A jumper connection from the existing potable water main to the new water main, utilizing a reduced pressure principle backflow preventer approved by the city, shall be used to obtain water for disinfection. Chlorine solution shall be injected or pumped at a regulated rate into the new main, at a point not more than 10 feet downstream from the beginning of the new water main. The method of tapping the water main for the chlorine injection point and the location of the tap shall be approved by the Engineer and the city.
- I. Proportion the two rates so that the chlorine concentration in the pipeline is maintained at a minimum concentration of 75 mg/L. Check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added.
- J. Chlorine solution shall be circulated in the water main by opening the water control valve and systematically manipulating valves, fire hydrants and blowoffs.
- K. Water service lines, if applicable, shall be disinfected in a similar manner as that for water mains, including corrective measures, by methods acceptable to the Engineer and the city.
- L. Chlorine solution shall remain in the water lines for not less than 24-hours, but longer than 24-hours, if directed by the Engineer or the city.
- M. Extreme care shall be exercised at all times to prevent concentrated chlorine solution from entering existing water mains.

If methods of disinfection used by the Contractor differ materially from those outlined above, such methods shall be in accordance with directives of the Florida State Board of Health and all methods employed shall have the approval of that agency.

506-4. FLUSHING AND RESIDUAL CHLORINE TESTS

After 24-hours, or when approved by the Engineer and the city, the free residual chlorine concentration in the water line at the pipe extremity sample points shall be checked to make sure the free residual chlorine concentration is at least 30 mg/l; if not, the water lines shall be re-disinfected as described above.

Final flushing of lines with potable water may proceed after 24 hours, or when approved by the Engineer and the city, provided the free residual chlorine analysis is satisfactory at 30 mg/L or above. Flushing shall be continued until a chlorine residual test shows that the pipelines contain only the normal chlorine residual in the feed potable water, not less than 0.2 ppm nor more than 3.0 ppm. Residual chlorine test shall be in accordance with standard methods using a standard DPD test kit. Prior to flushing water with high chlorine concentrations, obtain approvals from the Engineer and the Owner as to the methods and locations of discharge.

City inspector/CEI must certify and submit all residual chlorine test results to the city Project Manager within 10 days of performing test(s).

506-5. BACTERIOLOGICAL TESTS

Following disinfection and thorough flushing of the water lines, as specified herein, the Contractor, and/or the city Public Utilities Department Water Division (or the Engineering Department), shall furnish all labor and materials required to obtain samples of water from the potable water line, at established remote sampling points approved by the FDEP, properly collected in suitable sterilized containers obtained from the Pinellas County Health Department or an analytical laboratory approved by the city and certified by the Florida State Board of Health for bacterial examination in accordance with AWWA C651. Proper techniques and procedures shall be used to collect the water samples to avoid outside contamination resulting in a false positive coliform result. Definite instructions as to the collection and shipment of bacteriological samples shall be secured from the laboratory prior to sample collection and shall be followed in all respects.

Two (2) series of successive samples shall be obtained at each established sampling point in accordance with AWWA C651, Section 5.1, to obtain a bacteriological quality test result to demonstrate the absence of coliform bacteria in each separate section of the pipeline being tested after chlorination, flushing and refilling. Each test series will require two samples at each sampling point. The period between each series of samples shall be a minimum of 24-hours. Samples shall be delivered by the Contractor to the County Health Department or the approved analytical laboratory for bacteriological examination within 6 hours of obtaining the samples. Samples shall be collected in conformance with the County Health Department standards and lab testing schedule. Prior to collecting samples, the Contractor shall notify the Engineer and the city, who will have representatives present during bacteriological sample collection.

Collect at least one set of samples from every 1,000 feet of the new water main and line stopping insertion point, plus one set from the end of the line and at least one set from each branch. At each connection to an existing pipeline, take two additional samples.

Bacteriological test results will be available approximately 48- to 72-hours after samples have been submitted to the testing laboratory. If test results are unsatisfactory, the Contractor shall immediately re-chlorinate and retest the water lines as described above and proceed with such corrective measures as are necessary to secure disinfected lines. All services shall be re-chlorinated if the lines are re-chlorinated. The water lines shall be re-disinfected and re-tested, at the Contractor's expense, until approved by the Engineer, the city, and the Pinellas County Health Department or FDEP, as applicable.

At satisfactory completion of the bacteriological test requirements, potable water pipelines shall be placed into service in a manner approved by the Engineer and the city Engineering Department. Complete the pipeline where temporary disinfection or test facilities were installed. Potable water mains shall not be

placed into service until all requirements of the State and Pinellas County Public Health Departments are met, and the Letter of Clearance is obtained from the Florida Department of Environmental Protection (FDEP). The Contractor shall notify the Engineer and the city at least 72 hours prior to placing potable water pipelines into service.

The city Inspector/CEI shall certify and submit all bacteriological test results to the city Project Manager within 10 days of performing the test(s) as required by the Florida Department of Environmental Protection.

507. CORRECTION OF NON-CONFORMING WORK

All non-conforming work shall be repaired or replaced by the Contractor at no additional expense to the city. Non-conforming work shall be defined as failure to adhere to any specific or implied directive of this Project Manual and/or the drawings, including but not limited to paid not laid straight, true to the lines and grades as shown on the drawings, damaged or unacceptable materials, misalignment or diameter ring deflection in pipe due to bedding or backfilling, visible or detectable leakage and failure to pass any specified test or inspection.

508. OBTAINING WATER FOR FLUSHING AND TESTING

The potable water supply shall be protected with an air gap or a reduced pressure principle backflow preventer approved by the city if potable water is used for flushing and testing. Only potable water shall be use for flushing and pressure testing of potable water pipelines. Reclaimed water may be used for flushing and pressure testing of reclaimed water lines or wastewater force mains.

The city will provide the water required for city Projects. The Contractor shall coordinate with the city for a temporary construction water service connection, intended for usage during flushing and testing.

For private development projects the Contractor will need to obtain temporary potable water service during construction, the Contractor shall be required to pay for the installation and for the water used. The piping, fittings, backflow preventer, and appurtenances required for the temporary construction water service shall be supplied by the city of Clearwater.

509. MEASUREMENT AND PAYMENT

509-1. GENERAL

Bids must include all sections and items as specified herein and as listed on the Bid Form. Payment for the work of constructing the project will be made at the unit price or lump sum payment for the items of work as set forth in the Bid, which payment will constitute full compensation for all labor, equipment, and materials required to complete the work. No separate payment will be made for the following items and the cost of such work shall be included in the applicable pay items of work unless otherwise specified:

- Clearing and grubbing
- Excavation, including necessary pavement removal
- Shoring and/or dewatering
- Structural fill
- Backfill
- Grading
- Tracer wire
- Refill materials
- Joint materials

- Tests and sterilization
- Appurtenant work as required for a complete and operable system.

509-2. FURNISH AND INSTALL WATER MAINS

509-2.1. MEASUREMENT

The quantity for payment shall be the actual number of feet of pipe of each size and type satisfactorily furnished and laid, as measured along the centerline of the completed pipeline, including the length of valves and fittings.

509-2.2. PAYMENT

Payment of the applicable unit price shall be full compensation for furnishing all plant, labor, materials and equipment, and constructing the water mains completely and ready for operation.

509-3. FURNISH AND INSTALL FITTINGS

509-3.1. MEASUREMENT

The quantity for payment will be the actual number of size and type of ductile iron fittings satisfactorily furnished and installed.

509-3.2. PAYMENT

Payment of the applicable unit price shall be full compensation for furnishing all plant, labor, materials, and equipment required to furnish and install ductile iron fittings.

509-4. FURNISH AND INSTALL GATE VALVES COMPLETE WITH BOXES AND COVERS

509-4.1. MEASUREMENT

The quantity for payment shall be the number of gate valves of each size satisfactorily furnished and installed.

509-4.2. PAYMENT

Payment of the applicable unit price for each size shall be full compensation for furnishing all labor, materials, and equipment and installing the gate valve complete with valve box and cover, concrete pad and valve disc, including any jointing materials and any restraint devices required.

509-5. FURNISH AND INSTALL FIRE HYDRANTS

509-5.1. MEASUREMENT

The quantity for payment shall be the number of fire hydrants satisfactorily furnished and installed. The only hydrants allowed to be installed in the city utilities system are listed in *Section 502-5* of these Technical Specifications. No exceptions.

509-5.2. PAYMENT

Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing the fire hydrant assembly complete including all necessary anchor tees, swivel-type thrust anchorage, 6-inch ductile iron pipe between the main and the fire hydrant and gate valve(s) and valve boxes and covers, concrete pad(s) and valve disc(s) on the hydrant branch line and , including any jointing materials and any restraint devices required.

600 SERIES: STORMWATER

601. RAISING OR LOWERING OF STORM DRAINAGE STRUCTURES

Storm Drainage Structures shall be raised or lowered as indicated on the plans or as indicated by the Engineer.

601-1. BASIS OF PAYMENT

Payment, unless covered by a bid item, shall be included in the cost of the work.

602. UNDERDRAINS

The Contractor shall construct sub-surface drainage pipe as directed in the Scope of Work and detail drawings contained in the Project construction plans. In general, underdrain pipe shall be embedded in a bed of #6 FDOT aggregate, located behind the back of curb and aggregate surface covered with a non-degradable fibrous type filter material. A #57 aggregate may be used in lieu of #6 if it is washed and screened to remove fines. The aggregate may be stone, slag, or crushed gravel. Unless otherwise noted on the plans, underdrain pipe shall be eight inches (8") in diameter, polyvinyl chloride pipe, in conformance with ASTM F758 "Standard Specification For Smooth Wall PVC Underdrain Systems for Highways" latest revision, minimum stiffness of 46 in conformance with ASTM D2412, perforations in conformance with AASHTO M-189 described in *FDOT Section 948-1.5* or latest revision and in conformance with ASTM D3034 - SDR 35.

Alternate acceptable underdrain pipe material is Contech A-2000 which is a rigid PVC pipe that exceeds ASTM Specifications D1784, minimum cell classification of 12454B or 12454C, manufactured per ASTM F949-93a, minimum pipe stiffness of 50 psi, with no evidence of splitting, cracking or breaking when pipe is tested in accordance with ASTM D2412 at 60% flattening and with a double gasket joint.

Underdrain pipe placed beneath existing driveways and roadways shall be non-perforated pipe with compacted backfill. All poly-chloride pipe which has become deteriorated due to exposure to ultraviolet radiation shall be rejected. Where ductile iron pipe is specified, pipe material shall be the same as specified for potable water pipe in these technical specifications. All underdrain aggregate shall be fully encased in a polyester filter fabric "sock" (Mirafi® 140-N or approved equal) per the construction detail drawings.

Filter aggregate for underdrains shall be as specified in the *FDOT Standard Specifications, Section 901 – Coarse Aggregate*, and shall be either #6 or #57. If #57 is used, it must be washed and screened to remove fines. The aggregate may be stone, slag, or crushed gravel.

602-1. BASIS OF MEASUREMENT

Measurement shall be the number of linear feet of eight inch (8") Sub-drain in place and accepted.

602-2. BASIS OF PAYMENT

Payment shall be based upon the unit price per linear foot for underdrain as measured above, which shall be full compensation for all work described in this section of the specifications and shall include all materials, equipment, and labor necessary to construct the underdrain (specifically underdrain pipe,

aggregate and filter fabric). Underdrain clean-outs, sod, driveway, road and sidewalk restoration shall be paid by a separate bid item.

603. STORM SEWERS

All storm drainpipe installed within the city shall be steel reinforced concrete unless otherwise approved by the City Engineer. Said pipe shall comply with *Section 430 of FDOT Standard Specifications*.

All reinforced concrete pipe joints shall be wrapped with Mirafi® 140N filter fabric or equivalent (as approved by the City Engineer). The cost for all pipe joint wraps shall be included in the unit price for the pipe.

All pipe, just before being lowered into a trench, is to be inspected and cleaned. If any difficulty is found in fitting the pieces together, this fitting is to be done on the surface of the street before laying the pipe, and the tops plainly marked in the order in which they are to be laid. No pipe is to be trimmed or chipped to fit. Each piece of pipe is to be solidly and evenly bedded, and not simply wedged up. Before finishing each joint, some suitable device is to be used to find that the inverts coincide, and pipe is clear throughout.

603-1. TESTING AND INSPECTION

The Contractor shall take all precautions to secure a watertight sewer under all conditions.

The work under this Section shall include the internal video recording of new stormwater drainage pipes and drainage structures. The Contractor shall provide the city with a video of the completed stormwater drainage system, and a written report. The Contractor shall pump down and clean the pipes and drainage structures, to the satisfaction of the city, prior to video recording. The video shall be of the standard DVD format, in color, with all the pertinent data and observations recorded as audio on the DVD. The data should include:

1. An accurate recorded footage of the pipe lengths.
2. The drainage structure number and pipe size.
3. The run of the pipe and direction of flow (i.e. from S-1 to S-2).
4. Details of structural defects, broken pipes, sags, dips, misalignments, obstructions, and infiltration.

The written report shall include the four (4) items listed previously.

All visual and video recording inspections shall be completed by the Contractor and be in accordance with *Section 430-4.8 of FDOT Standard Specifications*. Any deficient or damaged pipe discovered during the video recording process shall be the responsibility of the Contractor to repair or replace at their own expense within the contractual duration.

As a complement to the video report, the Contractor shall also provide digital photos of areas of concern in electronic (computer CD/DVD) and hard copy form (in color).

All known pipe breaks or those breaks discovered after the video inspection shall be repaired by the Contractor regardless of the test allowances. Faulty sections of drainage pipes or drainage structures rejected by the Engineer shall be removed and re-laid by the Contractor. Sections of pipe that are repaired, re-laid or replaced shall be accompanied with a corresponding post construction video inspection at the Contractor's expense. In all cases that a leak is found, re-inspection shall be required at the Contractor's expense, to confirm that the problem has been resolved.

603-2. BASIS OF PAYMENT

Payment shall be the unit price per linear foot for storm sewer pipe in place and accepted, measured along the centerline of the storm sewer pipe to the inside face of exterior walls of storm manholes or drainage

structures and to the outside face of endwalls. Said unit price includes all work required to install the pipe (i.e. all materials, equipment, filter fabric wrap, gravel bedding if needed for stabilization, labor, and incidentals, etc.).

604. STORM MANHOLES, INLETS, CATCH BASINS OR OTHER STORM STRUCTURES

For details on specific design of a type of storm structure refer to city of *Clearwater Standards Details Index Numbers 201 to 236*.

When required, inlets, catch basins or other structures shall be constructed according to the plans and applicable parts of these Technical Specifications, *Sections 301, 302, 303 and 202*, and as approved by the Engineer. Said structures shall be protected from damage by the elements or other causes until acceptance of the work.

604-1. BUILT UP TYPE STRUCTURES

Built up type manholes shall be constructed of brick with cast iron frames and covers as shown on city of *Clearwater Standard Details Index Numbers 201*. Invert channels shall be constructed smooth and semicircular in shape conforming to inside of adjacent sewer section. Changes in direction of flow shall be made in a smooth curve of as large a radius as possible. Changes in size and grade of channels shall be made gradually and evenly. Invert channels shall be built up with grout.

The storm structure floor outside of channels shall be made smooth and sloped toward channels.

Manhole steps shall not be provided. Joints shall be completely filled, and the mortar shall be smoothed from inside of the manholes.

The entire exterior of brick manholes shall be plastered with a skim coat of one-half inch (1/2") of mortar.

Brick shall be laid radially with every sixth course being a stretcher course.

In cases where a storm pipe extends inside a structure, the excess pipe will be cut off with a concrete saw and shall not be removed with a sledgehammer.

604-2. PRECAST TYPE

Precast manholes shall be constructed as shown on city of *Clearwater Standards Details Index 202*. The manhole base shall be set on a pad of dry native sand approximately five inches (5") thick to secure proper seating and bearing.

Precast Manholes and Junction Boxes: The Contractor may substitute precast manholes and junction boxes in lieu of cast in place units unless otherwise shown on the plans. Precast Inlets will not be acceptable. When precast units are substituted, the construction of such units must be in accordance with ASTM C478, or the standard specifications at the manufacturer's option.

Precast structures must also meet the requirement that on the lateral faces, either inside or outside, the distance between precast openings for pipe or precast opening and top edge of precast structure be no less than wall thickness. A minimum of four courses of brick will be provided under manhole ring so that future adjustment of manhole lid can be accommodated. Manhole steps shall not be provided.

604-3. BASIS OF PAYMENT

Payment for Junction Boxes, Manholes or other structures shall be on a unit basis.

605. GABIONS AND MATTRESSES

605-1. MATERIAL

605-1.1. PVC COATED WIRE MESH GABIONS & MATTRESSES

605-1.1.1. GABION & MATTRESS BASKETS

Gabion and mattress baskets units shall conform to ASTM A975, be of non-raveling construction and fabricated from a double twist by twisting each pair of wires through three half turns developing the appearance of a triple twist. The galvanized wire core shall have a diameter of 0.106 inches.

605-1.1.2. PVC (POLYVINYL CHLORIDE) COATING

The coating shall be gray in color and shall have a nominal thickness of 0.0216 inches but not less than 0.015 inches in thickness. The protective PVC plastic shall be suitable to resist deleterious effects from exposure to light, immersion in salt or polluted water and shall not show any material difference in its initial compound properties. The PVC compound is also resistant to attack from acids and resistant to abrasion.

The PVC coating shall be extruded and adhere to the wire core prior to weaving. The PVC coated wire shall be woven into a double twisted hexagonal mesh having uniform openings of 3 1/4 inches by 4 1/2 inches. The overall diameter of the mesh wire (galvanized wire core plus PVC coating) shall be 0.146 inches. Selvedge and reinforcing wire shall be of heavily galvanized wire core, 0.134 inches in diameter, coated with PVC and having an overall diameter (galvanized wire core plus PVC coating) of 0.174 inches. Lacing and connecting wire shall be of soft tensile strength (75,000 PSI max), heavily galvanized wire core, 0.087 inches in diameter, coated with PVC and having an overall diameter (galvanized wire core plus PVC coating) of 0.127 inches. The use of alternate wire fasteners shall be permitted in lieu of tie wire providing the alternate fastener produces a four (4) wire selvedge joint with a strength of 1200 lbs. per linear foot while remaining in a locked and closed condition. Properly formed interlocking fasteners shall be spaced from 4 to 6 inches and have a minimum 3/4 square inch inside area to properly confine the required selvedge wires.

605-1.1.3. GABION AND MATTRESS FILLER MATERIAL

The filler stone shall be from a source approved by the Engineer before delivery is started. Representative preliminary samples of the stone shall be submitted by the contractor or supplier for examination and testing by the Engineer. The stone shall have a minimum specific gravity of 2.3 and be of a quality and durability sufficient to insure permanency in the structure. The individual stones shall be free of cracks, seams, and other defects that would tend to promote deterioration from natural causes, or which might reduce the stones to sizes that could not be retained in the gabion or mattress baskets.

All filler material shall be uniformly graded between 4 inch and 8 inch (equivalent spherical diameter) and shall be angular in form. Rounded stones shall not exceed 10% of the stone, by weight and 70% of the stone, by weight, shall exceed the largest dimension of the mesh opening. Crushed concrete shall not be used for filler material.

605-1.1.4. GEOTEXTILE FABRIC

Fabric shall conform to the latest edition of *FDOT Standard Specifications, Section 985*.

605-2. PERFORMANCE

Gabions and Reno Mattresses shall be installed according to the manufacturer's recommendations and as shown on the Drawings. Fabrication of gabion baskets shall be in such a manner that the sides, ends, lid and diaphragms can be assembled at the construction site into rectangular baskets of the sizes specified and shown on the Drawings. Gabions and mattresses shall be of single unit construction; the base, lid ends and sides shall be either woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that the strength and flexibility at the connecting point is at least equal to that of the mesh. Where the length of the gabion and mattress exceeds one and one-half its horizontal width, they shall be equally divided by diaphragms of the same mesh and gauge as the mattresses shall be furnished with the necessary diaphragms secured in proper position on the base so that no additional tying is required at this juncture. The wire mesh is to be fabricated so that it will not ravel. This is defined as the ability to resist pulling apart at any of the twists or connections forming the mesh when a single wire strand in a section of mesh is cut.

Each gabion or mattress shall be assembled by tying all untied edges with binding wire. The binding wire shall be tightly looped around every other mesh opening along seams so that single and double loops are alternated.

A line of empty gabions shall be placed into position according to the contract drawings and binding wire shall be used to securely tie each unit to the adjoining one along the vertical reinforced edges and the top selvages. The base of the empty gabions placed on top of a filled line of gabions shall be tightly wire to the latter at front and back.

To achieve better alignment and finish in retaining walls, gabion stretching is recommended.

Connecting wires shall be inserted during the filling operation in the following manner: Gabions shall be filled to one third full and one connecting wire in each direction shall be tightly tied to opposite faces of each cell at one third height. The gabion shall then be filled to two thirds full and one connecting wire in each direction shall be tightly tied to opposite face of each cell at one two third height. The cell shall then be filled to the top.

Filler stone shall not be dropped more than twelve inches (12") into the gabions and mattresses.

Geotextile fabric shall be installed at locations shown in the Drawings. The surface to receive the cloth shall be prepared to a relatively smooth condition free of obstructions which may tear or cut the cloth. The panel shall be overlapped a minimum of 30 inches and secured against movement. Cloth damaged or displaced during installation, gabion work, or backfill shall be replaced or repaired to the satisfaction of the Engineer at the contractor's expense. The work shall be scheduled so that the fabric is not exposed to ultraviolet light more than the manufacturer's recommendations or five days, whichever is less.

In wet conditions, a base shall be established by spreading and compacting #57 stone prior to placement of geotextile fabric and gabions or mattresses.

700 SERIES: STREETS AND SIDEWALKS

701. RESTORATION OR REPLACEMENT OF DRIVEWAYS, CURBS, SIDEWALKS AND STREET PAVEMENT

Driveways, sidewalks, and curbs destroyed or damaged during construction shall be replaced with the same type of material that was destroyed or damaged, or to existing city Standards, whichever provides the stronger repair. All street pavement destroyed or damaged shall be replaced with the same type of material, to existing city Standards, unless the existing base is unsuitable as determined by the Engineer, then the base shall be replaced with city approved material. All replaced base shall be at least eight inches (8") compacted thickness, or same compacted thickness as the base destroyed plus two inches (2") and compacted to 98% of maximum density per AASHTO T-180. Refer to *Standard Detail Index 104*.

Unless called for in the proposal as separate bid items, cost of the above work including labor, materials and equipment required shall be included in the bid price per linear foot of main or square yard of base.

The bid price for street pavement, restoration or replacement when called for in the proposals, shall include all materials, labor and equipment required to complete the work, and shall be paid for on a square yard basis. When replacement is over a trench for utilities, the area of replacement shall be limited to twice the depth of the cut plus twice the inside diameter of the pipe. All necessary restoration exceeding this footprint will be at the Contractor's expense.

The bid price for restoration or placement of driveways, curbs and sidewalks, when called for in the proposals, shall include all materials, labor and equipment required to complete the work and shall be paid for on the basis of the following units: Driveways, plant mix - per square yard; concrete - per square foot; curbs - per linear foot; sidewalk four inches (4") or six inches (6") thick - per square foot. Concrete walks at drives shall be a minimum of six inches (6") thick and be reinforced with 6/6 X 10/10 welded wire mesh. The Contractor shall notify the Construction Inspector a minimum of twenty-four (24) hours in advance of all driveway, curb, sidewalk and street restoration and replacement work.

702. ROADWAY BASE AND SUBGRADE

702-1. BASE

This specification describes the construction of roadway base and subgrade. The Contractor shall refer to *Section IV, Section 101 "Scope of Work"* of the city's Contract Specifications for additional roadway base and subgrade items.

Roadway base shall be eight inches (8") compacted minimum thickness unless otherwise noted on the plans or directed by the Engineer. The subgrade shall be twelve inches (12") compacted minimum thickness with a minimum Limerock Bearing Ratio (LBR) of 40 unless otherwise noted on the plans or directed by the Engineer. The Contractor shall obtain from an independent testing laboratory a Proctor and an LBR for each type material. The Contractor shall also have an independent testing laboratory perform all required density testing. Where unsuitable material is found within the limits of the base, *Section IV, Section 204 - Unsuitable Material Removal* of the city's Technical Specifications will apply.

Once the roadway base is completed, it shall be primed that same day (unless otherwise directed by the Engineer) per *Section 300 of FDOT's Standard Specifications*. Repairs required to the base that result from a failure to place the prime in a timely manner shall be done to the city's satisfaction, and at the Contractor's expense. No paving of the exposed base can commence until the city approves the repaired base. The cost for placement of prime material shall be included in the bid item for base.

The Contractor shall notify the Project Inspector a minimum of twenty-four (24) hours in advance of all base and subgrade placement or reworking.

The following base materials are acceptable:

1. **Shell Base:** Shell base shall be constructed in accordance with the latest edition of *Sections 200 and 913 of FDOT's Standard Specifications* and shall have a minimum compacted thickness as shown on the plans. The shell shall be FDOT approved. The cost of the prime coat shall be included in the bid item price for base.
2. **Limerock Base:** Limerock base shall be constructed in accordance with *Sections 200 and 911 of FDOT's Standard Specifications* and shall have a minimum compacted thickness as shown on the plans. The limerock shall be from a FDOT approved certified pit. The cost of the prime coat shall be included in the bid item price for base. When used, Contractor is required to submit documentation certifying the materials were obtained from a FDOT certified pit.
3. **Crushed Concrete Base:** Crushed concrete base shall be constructed in accordance with the latest edition of *Sections 204 and 901 of FDOT's Standard Specifications* and shall have a minimum compacted thickness as shown on the plans. The crushed concrete material shall be FDOT approved. The Contractor shall provide certified laboratory tests on gradation to confirm that the crushed concrete base material conforms to the above specifications. The LBR shall be a minimum of 100. LBR and gradation tests shall be provided to the city by the Contractor once a week for continuous operations, or every 1000 tons of material, unless requested more frequently by the City Engineer or designee. The cost of the prime coat shall be included in the bid item price for base.
4. **Superpave Asphalt Base:** Full depth asphalt base shall be constructed in accordance with the latest edition of *Section 234 of FDOT's Standard Specifications* and shall have a minimum compacted thickness as shown on the plans. The cost for preparation, placement, and compaction shall be included in the per ton unit cost for asphalt unless otherwise noted in the project scope and plans. The cost of the tack coat shall be included in the bid item price for asphalt or base.
5. **Reclaimed Asphalt Pavement Base:** Reclaimed asphalt pavement (RAP) base shall be constructed in accordance with the latest edition of *Section 283 of FDOT's Standard Specifications* and shall have a minimum compacted thickness as shown on the plans. As per *FDOT Section 283*, RAP material shall be used as a base course only on non-limited access paved shoulders, shared use paths, or other non-traffic bearing applications. The cost for preparation, placement, and compaction shall be included in the per ton unit cost for asphalt unless otherwise noted in the project scope and plans. The cost of the tack coat shall be included in the bid item price for asphalt or base.

702-1.1. BASIS OF MEASUREMENT FOR BASE AND REWORKED BASE

The basis of measurement shall be the number of cubic yards of base in place and accepted as called for on the plans. The maximum allowable deficiency shall be a half-inch (1/2"). Areas deficient in thickness shall either be fixed by the Contractor to within acceptable tolerance, or if so, approved in writing by the City Engineer, may be left in place. No payment, however, will be made for such deficient areas that are left in place.

702-1.2. BASIS OF PAYMENT FOR BASE AND REWORKED BASE

The unit price for base shall include: all materials, roadbed preparation, placement, spreading, compaction, finishing, prime, base, subgrade (unless the plans specify a separate pay item), stabilization, mixing, testing, equipment, tools, hauling, labor, and all incidentals necessary to complete the work. Payment for asphalt base shall be included in the per ton unit cost for asphalt unless otherwise noted in the project scope and plans.

702-2. SUBGRADE

All subgrade shall be stabilized and constructed in accordance with the latest edition of *Sections 160 and 914 of FDOT's Standard Specifications* unless otherwise noted herein. All subgrade shall have a minimum compacted thickness of 12" unless otherwise shown on the plans or directed by the Engineer. If limerock is used, it shall also meet the requirements of *Section 911 of FDOT's Standard Specifications*. Where unsuitable material is found within the limits of the subgrade, *Section IV, Section 204 - Unsuitable Material Removal* of the city's Contract Specifications will apply. The extent of said removal shall be determined by the Engineer in accordance with accepted construction practices. The Contractor is responsible for clearing, grading, filling, and removing any trees or vegetation in the roadbed below the subgrade to prepare it per the plans. The cost of this work shall be included in the unit price for base or subgrade. The Contractor shall obtain from an independent testing laboratory the bearing value of the subgrade after the materials are mixed for the stabilized subgrade and provide the results to the Engineer.

702-2.1. BASIS OF MEASUREMENT

The basis of measurement shall be the number of cubic yards of stabilized subgrade in place and accepted as called for on the plans. The maximum allowable deficiency for mixing depth shall be per the latest edition of *Section 161-6.4 of FDOT's Standard Specifications*. Acceptable bearing values shall be per the latest edition of *Section 160-7.2 of FDOT's Standard Specifications*. Areas deficient in thickness or bearing values shall either be corrected by the Contractor to within acceptable tolerance, or if so, approved in writing by the City Engineer, may be left in place. No payment, however, will be made for such deficient areas that are left in place.

702-2.2. BASIS OF PAYMENT

The unit price for subgrade shall include roadbed preparation, placement, spreading, compaction, finishing, testing, stabilizing, mixing, materials, hauling, labor, equipment and all incidentals necessary to complete the work. If no pay item is given, subgrade shall be included in the bid item for base.

703. ASPHALTIC CONCRETE MATERIALS

This specification is for the preparation and application of all asphaltic concrete materials on roadway surfaces unless otherwise noted.

703-1. ASPHALTIC CONCRETE

703-1.1. AGGREGATE

All aggregates shall be obtained from an approved FDOT source and shall conform to the latest edition of *Sections 901 through 915 of FDOT's Standard Specifications*.

703-1.2. BITUMINOUS MATERIALS

All bituminous materials shall conform to the latest edition of *Section 916 of FDOT's Standard Specifications*.

703-2. HOT BITUMINOUS MIXTURES – PLANT, METHODS, EQUIPMENT & QUALITY ASSURANCE

The plant and methods of operation used to prepare all asphaltic concrete and bituminous materials shall conform to the requirements of *Section 320 of FDOT's Standard Specifications*. Unless otherwise noted, all acceptance procedures and quality control/assurance procedures shall conform to the requirements of *Section 330 of FDOT's Standard Specifications*.

The city shall have the right to have an independent testing laboratory select, test, and analyze, at the expense of the city, test specimens of any or all materials to be used. The results of such tests and analyses shall be considered, along with the tests or analyses made by the Contractor, to determine compliance with the applicable specifications for the materials so tested or analyzed. The Contractor hereby understands and accepts that wherever any portion of the work is discovered, as a result of such independent testing or investigation by the city, which fails to meet the requirements of the Contract documents, all costs of such independent inspection and investigation as well as all costs of removal, correction, reconstruction, or repair of any such work shall be borne solely by the Contractor.

Payment reductions for asphalt related items shall be determined by the following:

1. Density per FDOT's Standard Specifications.
2. Final surface or friction course tolerances per FDOT's Standard Specifications.
3. Thickness will be determined from core borings. Deficiencies of 1/4" or greater shall be corrected by the Contractor, without compensation, by either replacing the full thickness for a length extending at least twenty-five feet (25') from each end of the deficient area, or when the Engineer allows for an overlay per FDOT's Standard Specifications. In addition, for excesses of one-quarter inch (1/4") or greater, the Engineer will determine if the excess area shall be removed and replaced at no compensation, or if the pavement in question can remain with payment to be made based on the thickness specified in the contract.

The Contractor shall notify the Project Inspector a minimum of twenty-four (24) hours in advance of the placement of all asphalt.

703-3. ASPHALT MIX DESIGNS AND TYPES

All asphalt mix designs, acceptance procedures and quality control/assurance procedures shall conform to the requirements of the latest edition of *Sections 330 and 334 of FDOT Standard Specifications*. All asphalt mix designs shall be approved by the Engineer prior to the commencement of the paving operation. Reclaimed asphalt pavement (RAP) material may be substituted for aggregate in the asphaltic concrete mixes up to 25% by weight.

703-4. ASPHALT PAVEMENT DESIGNS AND LAYER THICKNESS

All asphalt pavement designs shall conform to the following FDOT requirements:

- Type SP/Spec 334-1
- Type FC/Spec 337-8
- Type B/Spec 234-8
- ATPB/287-8

703-5. GENERAL CONSTRUCTION REQUIREMENTS

The general construction requirements for all hot bituminous pavements (including limitations of operations, preparation of mixture, preparation of surface, placement and compaction of mixture, surface

requirements, correction of unacceptable pavement, Quality Control Testing, etc.) shall be in accordance with *Section 330 of FDOT's Standard Specifications*(latest edition).

703-6. CRACKS AND POTHOLE PREPARATION

703-6.1. CRACKS

Cracks in roadway pavement shall be repaired prior to the application of asphaltic concrete by the following steps:

1. All debris to be removed from cracks by compressed air or other suitable method.
2. Apply a multiple layered application of bituminous binder and fine aggregate, as appropriate to the depth of the crack until the void of the crack is completely filled to the level of the surrounding roadway surface.
3. If application of asphaltic concrete is not to begin immediately after crack repair, cracks are to be sanded to prevent vehicular tracking.
4. Payment for crack filling shall be included in the unit price for asphaltic concrete.

703-6.2. POTHOLE

Potholes shall be repaired prior to the application of asphaltic concrete by the following steps:

1. All debris is to be removed from potholes by hand, sweeping, or other suitable method.
2. A tack coat is to be applied to the interior surface of the pothole.
3. The pothole is to be completely filled with asphaltic concrete, and thoroughly compacted.
4. Payment for pothole preparation shall be included in the unit price for asphaltic concrete.

703-7. ADJUSTMENT OF MANHOLES AND APPURTANENCES

The necessary adjustments of sanitary sewer and storm drain manholes and appurtenances shall be accomplished by the Contractor. The Contractor shall be paid on a per unit basis for each item. Refer to *Section 401-2* of these Technical Specifications for additional information.

The use of manhole adjustment risers is acceptable under the following conditions:

1. The riser shall meet or exceed all FDOT material, weld, and construction requirements.
2. The riser shall consist of an A-36 hot rolled steel meeting or exceeding the minimum requirements of ASTM A36.
3. The riser shall be a single piece with a stainless-steel adjustment stud and shall have a rust resistant finish.
4. The use of cast iron or fiberglass risers is not permitted.

In addition, the installation of each riser shall be per manufacturer's specifications. Each manhole shall be individually measured, and each riser shall be physically marked to ensure that the proper riser is used. Also, the ring section shall be cleaned, and a bead of chemically resistant epoxy applied to the original casting, prior to installation of the riser. It is the Contractor's responsibility to ensure that the manholes are measured, the risers are physically marked, the ring sections are thoroughly cleaned, and that the epoxy is properly applied prior to installation of each riser.

If risers are not used, the adjustment of manholes shall be accomplished by the removal of pavement around manhole, grade adjustment of ring and cover, and acceptable replacement and compaction of roadway materials prior to paving. A full depth backfills using asphalt is acceptable. The use of Portland cement for backfill is not acceptable.

All manhole and valve box adjustments shall be accomplished prior to the application of final asphaltic concrete surface. Unless otherwise noted in the specs or on the plans, the paving operation shall occur within seven (7) calendar days from the completion of the adjustment. On arterial roadways, the manholes are to be ramped with asphalt during the time period between initial adjustment and final resurfacing. Water and gas valves, sewer cleanouts, valve boxes, tree aeration vents, etc., will be adjusted by the Contractor with the cost for this work to be included in the unit cost of the asphalt. Care must be taken around said appurtenances to ensure that they are not paved over. It is the Contractor's responsibility to inform the owners of all utilities of impending work and coordinate their adjustments, so they are completed prior to the scheduled paving.

703-8. ADDITIONAL ASPHALT REQUIREMENTS

1. All impacted radius returns within project limits shall be paved unless otherwise directed by the Construction Inspector or Engineer, with payment to be included in the per ton bid item for asphalt.
2. All pavement markings impacted by placement of asphalt shall be replaced prior to the road being open to traffic unless otherwise noted in the contract scope and plans.
3. All project related debris shall be hauled off the job site by the Contractor in a timely manner and at their own expense in conformance with all regulatory requirements.
4. The Contractor shall pay particular attention to sweeping when paving. Prior to paving, all construction areas shall be swept with a Municipal type sweeper (either vacuum or mechanical type) that picks up and hauls off, dust and dirt. The sweeper must be equipped with its own water supply for pre-wetting to minimize dust. Moreover, the Contractor shall sweep debris off from sidewalks, driveways, curbs and roadways each day before leaving the job site.
5. The application of tack and prime coats (either required or placed at the Engineer's discretion) shall be placed per *Section 300 of FDOT's Standard Specifications*. Tack shall also be applied to the face of all curbs and driveways. The cost (including heating, hauling, and applying) shall be included in the per ton bid item for asphalt, unless otherwise noted in the project scope and plans.
6. Leveling course and spot patching shall be applied to sections of the road as noted on the plans, or as directed by the Engineer, per *Section 330 of FDOT's Standard Specifications*. The cost shall be included in the per ton unit cost for asphalt, unless otherwise noted in the project scope and plans.
7. If an asphalt rubber binder is required, it shall conform to the requirements of *Section 336 of FDOT's Standard Specifications*.
8. On all streets with curb and gutter, the final compacted asphalt shall be one-quarter inch ($\frac{1}{4}$ ") above the lip or face of said curb per *City Standard Detail Index 101*.

703-9. BASIS OF MEASUREMENT

Basis of measurement will be the number of tons of asphaltic concrete completed, in place and accepted. Truck scale weights will be required for all asphaltic concrete used. The scales must be calibrated and certified by an independent party and carry a state certification.

703-10. BASIS OF PAYMENT

Payment shall be made at the contract unit price for asphaltic concrete surface as specified and measured above. This price shall include all materials, preparation, hauling, placement, tack and/or prime coat either required or placed at Engineer's discretion, leveling, spot patching, filling of cracks, pothole repair, sweeping, debris removal, labor, equipment, tools, and incidentals necessary to complete the asphalt work in accordance with the plans and specifications.

704. ADJUSTMENT TO THE UNIT BID PRICE FOR ASPHALT

When this Section applies to the contract, the unit bid price for asphalt will be adjusted in accordance with the following provisions:

1. Price adjustment for asphalt shall only be made when the current FDOT Asphalt Price Index varies more than ten percent (10%) from the bid price at the time of the bid opening.
2. The Bituminous Material Payment Adjustment Index published monthly by the FDOT shall be used for the adjustment of unit prices. This report is available on FDOT's internet site. The address is: <https://www.fdot.gov/construction/fuel-bit/fuel-bit.shtm> For additional information, call FDOT at (850) 414-4252.
3. The FDOT Payment Adjustment Index in effect at the time of the bid opening will be used for the initial determination of the asphalt price.
4. The FDOT Payment Adjustment Index in effect at the time of placement of the asphalt will be used for payment calculation.
5. The monthly billing period for contract payment will be the same as the monthly period for the FDOT Payment Adjustment Index.
6. No adjustment in bid prices will be made for either tack coat or prime coat.
7. No price adjustment reflecting any further increases in the cost of asphalt will be made for any month after the expiration of the allowable contract time.
8. The city reserves the right to make adjustments for decreases in the cost of asphalt.

705. ASPHALT DRIVEWAYS

New driveways or existing asphalt driveways that must be altered for project construction shall be constructed or replaced in accordance with the specifications for paving the street with the exception that the base shall be six inches (6"). Remove only enough to allow adequate grade for access to the street. Use Section 703 Asphaltic Concrete, of these Technical Specifications, as specified for the street paving.

When the finished surface of the existing drive is gravel, replacement shall be of like material. Payment shall be the same as Asphalt Driveways.

705-1. BASIS OF MEASUREMENT

Measurement shall be the number of square yards of Asphalt Driveways in place and accepted.

705-2. BASIS OF PAYMENT

Payment shall be the unit price per square yard for Asphalt Driveways as measured above, which price shall be full compensation for all work described in this section of the specifications and shall include all materials, equipment, tools, labor and incidentals necessary to complete the work.

706. CONCRETE CURBS

Concrete Curbs shall be constructed to the line, grade and dimensions as shown on the plans. Unless otherwise noted, all concrete curbs shall have fiber mesh reinforcement and have a minimum strength of 3000 psi at 28 days. Expansion joints shall be placed at intervals not to exceed a hundred feet (100') and scored joints shall be placed at intervals not to exceed ten feet (10'). In addition, all the requirements of these city Technical Specifications Sections 301, 302 and 303 shall also apply. The Contractor shall notify the Project Inspector a minimum of twenty-four (24) hours in advance of the placement of all concrete curbs.

The finished surface must have a reasonably uniform texture, must be within 1/4 inch of a true profile grade, and must have no deviation in excess of 1/4 inch from a straight edge applied to the pavement perpendicular to the centerline. Areas varying from a true surface in excess of the above stated tolerance may be accepted without correction if the Engineer determines that they were caused by preexisting conditions which could not reasonably have been corrected by the milling operations. Any unsuitable texture or profile, as determined by the Engineer, must be corrected by the Contractor at no additional expense to the city.

706-1. BASIS OF MEASUREMENT

The basis of measurement shall be linear feet of curb in place and accepted.

706-2. BASIS OF PAYMENT

Payment shall be the unit price per linear foot of curb, which price shall be full compensation for all work described in this and other applicable parts of the specifications and shall include all materials, equipment, tools, labor and incidentals necessary to complete the work.

707. CONCRETE SIDEWALKS AND DRIVEWAYS

707-1. CONCRETE SIDEWALKS

Concrete sidewalks shall be constructed to the line, grade and dimensions as shown on the plans or herein specified. Unless otherwise noted, all concrete sidewalks shall have fiber mesh reinforcement and have a minimum strength of 3000 psi at 28 days. Unless otherwise specified, all concrete sidewalks shall have a minimum width of four feet (4'). Concrete sidewalks shall have a minimum thickness of four inches (4''), except at driveway crossings where a minimum thickness of six inches (6'') is required. Also, 6/6 X 10/10 welded wire mesh reinforcement is required for all sidewalk that crosses driveways. The welded wire mesh shall be positioned in the middle to upper third of the placement. No compensation shall be given if the welded wire mesh is not properly placed. Expansion joints shall be placed at intervals of not more than 100 hundred feet and scoring marks shall be made every five feet (5'). Concrete shall be poured only on compacted subgrade prepared in accordance with Section 702 of these Technical Specifications. In addition, all the requirements of Sections 301, 302 and 303 of these Technical Specifications shall also apply.

707-2. CONCRETE DRIVEWAYS

Concrete driveways, whether new construction or replacement, shall be a minimum of six inches (6'') in thickness with 6/6 x 10/10 welded wire mesh reinforcement and a minimum horizontal distance between expansion joints of no less than four feet (4') measured in any direction. The welded wire mesh shall be positioned in the middle to upper third of the placement. No compensation shall be given if the welded wire mesh is not properly placed. Concrete shall be poured only on compacted subgrade prepared in accordance with *Section 702* of these Technical Specifications. In addition, all the requirements of *Sections 301, 302 and 303* of these Technical Specifications shall also apply.

The Contractor shall notify the Project Inspector a minimum of twenty-four (24) hours in advance of the placement of all concrete sidewalks and driveways.

707-3. CONCRETE CURB RAMPS

The contractor is responsible for constructing ADA compliant concrete curb ramps per the plans and installing detectable warning surfaces on said ramps as called for in the plan set. Concrete curb ramps and detectable warning surfaces are to be constructed per FDOT Standards and Specifications.

707-4. BASIS OF MEASUREMENT

The basis of measurement shall be the number of square feet of four inch (4") concrete sidewalk, six inch (6") concrete sidewalk, and six inch (6") concrete driveways in place and accepted.

707-5. BASIS OF PAYMENT

Payment shall be the unit price per square foot for each item as measured above, which shall be full compensation for all work described in this section and other applicable parts of the specifications and shall include all materials, equipment, tools, welded wire mesh where required, labor and incidentals necessary to complete the work.

708. MILLING OPERATIONS

708-1. EQUIPMENT, CONSTRUCTION & MILLED SURFACE

Unless otherwise noted in the specs, plans or this Section, the milling operation shall be performed in accordance with *Section 327 of FDOT's Standard Specifications*. The Contractor shall notify the city Project Manager a minimum of twenty-four (24) hours in advance of all milling.

708-2. ADDITIONAL MILLING REQUIREMENTS

The following are the additional milling requirements:

- A. If the milling machine is equipped with preheating devices, the Contractor is responsible to secure any necessary permits, and for complying with all local, state and federal environmental regulations governing operation of this type of equipment.
- B. All milled surfaces must be repaved within seven (7) days from the time it was milled, unless otherwise noted in the contract documents.
- C. Prior to paving, all milled areas shall be swept with a Municipal type sweeper either of the vacuum or the mechanical type that picks up and hauls off, dust and dirt. The sweeper must be equipped with its own water supply for pre-wetting to minimize dust. Moreover, the Contractor shall sweep debris off of sidewalks, driveways and curbs in addition to the roadways before leaving the job site.
- D. In cases where concrete valley swales are present, the adjoining pavement shall be milled to allow for the new asphalt grade to be flush with the concrete surface.
- E. The Contractor shall be responsible for removing any asphalt that remains in the curb line and/or median curbs after the milling operation of a street is complete. The cost of this removal shall be included in the bid item for milling.
- F. All radius returns on streets to be milled shall also be milled unless otherwise directed by the Engineer, with payment to be included in the bid item for milling.
- G. Any leveling or base replacement required after milling shall be applied to sections of the road as noted on the plans, or directed by the Engineer, per *Section 330 of FDOT's Standard Specifications*. The cost shall be included in the per ton unit cost for asphalt, unless otherwise noted in the project scope and plans.

- H. Any roadway base material exposed as a result of the milling operation shall be primed that same day (unless otherwise directed by the Engineer) per *Section 300 of FDOT's Standard Specifications*. Repairs required to said base that result from a failure to place the prime in a timely manner shall be done to the city's satisfaction, and at the Contractor's expense. No paving of the exposed base can commence until the city approves the repaired base. The cost of said prime shall be included in the bid item for milling.
- I. Prior to the placement of asphalt, the face of all curbs and driveways shall be tacked after the milling operation is complete.

708-3. SALVAGEABLE MATERIALS

Unless otherwise specified, all salvageable materials resulting from milling operations shall remain the property of the city. The transporting and stockpiling of salvageable materials shall be performed by the Contractor. The Contractor shall contact the city Project Manager to schedule delivery of material at least 48 hours prior to starting work.

708-4. DISPOSABLE MATERIALS

All surplus materials not claimed by the city shall become the responsibility of the Contractor. The Contractor shall dispose of the material in a timely manner and in accordance with all regulatory requirements in areas provided by the Contractor at no additional expense to the city.

708-5. ADJUSTMENT AND LOCATION OF UNDERGROUND UTILITIES

All private utilities and related structures requiring adjustment shall be located and adjusted by their owners at the owner's expense. city-owned utilities and structures shall be located by the Owner/City and adjusted by the contractor. The Contractor shall arrange their schedule to allow utility owners the time required for such adjustments (minimum 48 hours' notice per State Statute). All utility adjustments shall be completed prior to the commencement of milling and resurfacing operations.

708-6. ADJUSTMENT OF UTILITY MANHOLES

The necessary adjustments of sanitary sewer and stormwater utility manholes and appurtenances shall be accomplished by the Contractor in accordance with *Section IV, Sections 703-7* of the city's Technical Specifications.

708-7. TYPES OF MILLING

There are two types of milling used by the city:

- A. **Wedge** – This will consist of milling a six foot (6') wide strip along the curb line of the pavement adjacent to the curb so the new asphalt will align with the original curb height and pavement cross section.
- B. **Full Width** – This will consist of milling the entire roadway (i.e. curb line/edge of pavement to curb line/edge of pavement). All existing horizontal and vertical geometry shall remain unless otherwise indicated or approved by the Engineer.

708-8. MILLING OF INTERSECTIONS

Intersections, as well as other areas (including radius returns) are to be milled and repaved to restore and/or improve the original drainage characteristics. Said work should extend approximately fifty (50) feet from the low point of the existing swale.

708-9. BASIS OF MEASUREMENT

The quantity to be paid for will be the area milled, in square yards, completed and accepted.

708-10. BASIS OF PAYMENT

The unit price for milling shall include: all materials, preparation, hauling, transporting and stockpiling of salvageable materials, disposal of all surplus material, any required milling of radius returns and intersections, prime and/or tack coat either required or placed at Engineer's discretion, removal of asphalt from curbs, sweeping, labor, equipment, and all incidentals necessary to complete the milling in accordance with the plans and specifications.

800 SERIES: TRAFFIC SIGNALS, SIGNS AND MARKINGS

801. TRAFFIC SIGNAL EQUIPMENT AND MATERIALS

All traffic signal work shall be performed per *FDOT's Standard Specifications Sections 603 through 699*, unless otherwise specified in the contract documents and plans.

This specification includes, but is not limited to, the following items: all necessary equipment, materials, guaranties, acceptance procedures, signal timings, field tests, grounding, conduit, signal and interconnect cable, span wire assemblies, pull and junction boxes, electrical power service assemblies, poles, signal assemblies, pedestrian assemblies, inductive loop detectors, pedestrian detectors, traffic controller assemblies, controller cabinets and accessories, removal of existing traffic signal equipment, and internally illuminated signs.

All traffic signal installations shall be mast arms and conform to the requirements of FDOT's Mast Arm Assembly standard and shall be signed and sealed by a professional engineer registered in the State of Florida. All mast arm calculations, as well as the geotechnical report, shall also be signed and sealed by a professional engineer registered in the State of Florida. All mast arm colors shall be determined and approved by the city's Traffic Engineering Division prior to ordering from the manufacturer.

All traffic signal indicators for vehicles and pedestrians shall be LEDs and, approved by both the city's Traffic Engineering Division and FDOT. In addition to this, all pedestrian signal indicators shall utilize countdown features.

Contractor changes to the operation of an existing signal is prohibited unless directed by the city's Traffic Engineering Division.

All damaged inductive loop detectors shall be restored by the contractor per *FDOT Index 17781*.

801-1. BASIS OF MEASUREMENT AND PAYMENT

The basis of measurement and payment shall be specified in the contract documents and/or plans and shall include all equipment, preparation, materials, testing and incidentals required to complete the work per the plans.

802. SIGNING AND MARKING

All signing and marking work shall be performed per most current FDOT's Standard Specifications, unless otherwise specified in the contract documents and plans. This specification includes the following work: RPM's (*Section 706*), painted traffic stripes and markings (*Section 710*), thermoplastic stripes and markings (*Section 711*) and tubular delineators/flex posts (*Sections 705 and 972*).

The Contractor is responsible to ensure that striping is correctly placed. Errors in striping or markings shall be "blacked-out" with paint, unless otherwise directed by the Engineer. No payment will be made for these incorrect or "blacked-out" areas. Omissions in striping or markings shall be corrected to the city's satisfaction prior to any payment being made.

The Contractor is responsible for restoring all striping in paint and reflective beading per the FDOT indices mentioned above. The city's Traffic Engineering department shall follow up with thermoplastic striping at a later date unless otherwise specified.

802-1. BASIS OF MEASUREMENT AND PAYMENT

The basis of measurement and payment shall be specified in the contract documents and/or plans and shall include all equipment, preparation, materials, and incidentals required to complete the work per the plans.

803. ROADWAY LIGHTING

All roadway lighting shall be constructed per most current *Sections 715 and 992 of FDOT's Standard Specifications*, unless otherwise specified in the contract documents and plans.

803-1. BASIS OF MEASUREMENT AND PAYMENT

The basis of measurement and payment shall be specified in the contract documents and/or plans and shall include all equipment, materials, testing, and incidentals required to complete the work per the plans.

900 SERIES: LANDSCAPING/RESTORATION

901. WORK IN EASEMENTS OR PARKWAYS

Restoration is an important phase of construction, particularly to residents affected by the construction progress.

The Contractor will be expected to complete restoration activities within a reasonable time following primary construction activity. Failure by the Contractor to accomplish restoration within a reasonable time shall be justification for a temporary stop on primary construction activity or a delay in approval of partial payment requests.

Reasonable care shall be taken for existing shrubbery. Contractor shall replace all shrubbery removed or disturbed during construction. No separate payment shall be made for this work.

The Contractor shall make provision and be responsible for the supply of all water, if needed, on any and all phases of the contract work. The Contractor shall not obtain water from local residents or businesses except as the Contractor shall obtain written permission.

902. GENERAL PLANTING SPECIFICATIONS

902-1. IRRIGATION

902-1.1. DESCRIPTION

- A. The work specified in this Section consists of the installation of an automatic underground irrigation system as shown or noted in the plans. Provide all labor, materials, equipment, services and facilities required to perform all work in connection with the underground sprinkler irrigation system as indicated on the drawings and/or specifications. Work noted as “NIC”, “existing”, or “by others” is not included in this pay item.
- B. The irrigation plans are schematic in nature. Valves and pipes shall be located in the turf/landscape areas except at road/paving crossings. All piping under paving shall be sleeved. Changes in the irrigation system layout shall be modified with the approval of the Engineer.

902-1.1.1. QUALITY ASSURANCE

- A. The irrigation work shall be installed by qualified personnel or a qualified irrigation subcontracting company that has experience in irrigation systems of similar size, scope, mainline, system pressure, controls, etc.
- B. All applicable ANSI, ASTM, FEDSPEC Standards and Specifications, and all applicable building codes and other public agencies having jurisdiction upon the work shall apply.
- C. Workmanship: All work shall be installed in a neat, orderly, and responsible manner with the recognized standards of workmanship. The Engineer reserves the right to reject material or work which does not conform to the contract documents. Rejected work shall be removed or corrected at the earliest possible time at the Contractor’s expense.
- D. Operation and Maintenance Manuals: The Contractor shall prepare and deliver to the Engineer within ten (10) calendar days prior to completion of construction a minimum of three (3) hard cover binders, with three rings and a USB with the electronic design files (including the irrigation As Builts), containing the following information:
 1. Index sheet stating the Contractor’s address and business telephone number, twenty-four (24) hour emergency phone number, person to contact, list of equipment with name(s) and address(es) of

local manufacturer’s representative(s) and local supplier where replacement equipment can be purchased.

2. Catalog and part sheet on every material and equipment installed under this contract.
3. Complete operating and maintenance instructions on all major equipment.
4. Provide the Engineer and the city maintenance staff with a written the Operations Manual and “hands on” training for major equipment and show evidence in writing to the Engineer at the conclusion of the project that this service has been rendered.
 - a. Four-hour instruction (minimum) for the Irrigation Zones equipment operation and maintenance.
 - b. Two-hour instruction (minimum) for automatic control valve operation and maintenance.

902-1.1.2. PROJECT CONDITIONS

- A. The Contractor shall coordinate the work with all other trades, all underground improvements, the location and planting of trees and all other planting. Verify planting requiring excavation of twenty-four-inch (24”) diameter and larger with the Engineer prior to installation of main lines.
- B. Provide temporary irrigation at all times to maintain plant materials during the construction period.
- C. The Contractor is responsible to maintain the work area and equipment until final acceptance by the Engineer. Repairs and replacement of equipment broken, stolen, or missing as well as regular maintenance operations shall be the obligation of the Contractor.
- D. The Contractor shall submit a traffic control plan (per FDOT specifications) to the Engineer prior to initiating construction on the site. The Contractor shall be responsible for the maintenance of traffic signs, barriers, and any additional equipment to comply with the FDOT standards and to ensure the safety of its employees and the public.

902-1.1.3. WARRANTY

- A. The Contractor(s) shall warrant the irrigation system components to give satisfactory service for one (1) year period from the date of acceptance by the Engineer and the city. Should any problems develop within the warranty period due to inferior or faulty materials, the Contractor shall be corrected at no expense to the city.

902-1.2. PRODUCTS

902-1.2.1. GENERAL

- A. All materials throughout the system shall be new and in perfect condition. No deviations from the specifications shall be allowed except as noted.

902-1.2.2. PIPING

- A. The irrigation system pipe shall be as stated herein and shall be furnished, installed and tested in accordance with these specifications.
- B. All pipe is herein specified to be Polyvinyl Chloride (PVC) Pipe, 1120, Schedule 40, conforming to ASTM D2665 and D1785.
- C. All nipples, pipe connections, bushings, swing joints, connecting equipment to the mainline is required to be threaded Polyvinyl Chloride (PVC) Pipe, Schedule 80 per detail drawings.

902-1.2.3. PIPE FITTINGS

- A. All pipe fittings for Schedule 40 PVC pipe shall be as follows: Fittings shall conform to the requirements of ASTM D2466, Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80. All fittings shall bear the manufacturer’s name or trademark, material designation, size, applicable IPS schedule and NSF seal of approval. The connection of mainline pipe

to the automatic control valve shall be assembled with threaded Schedule 80 fittings and threaded Schedule 80 nipples.

902-1.2.4. PVC PIPE CEMENT AND PRIMER

- A. Provide solvent cement and primer for PVC solvent weld pipe and fittings as recommended by the manufacturer. Pipe joints for solvent weld pipe to be belled end. Submit to the city Project Manager for approval. The solvent that cement that should be used is 303 PVC Cement Regular Clear.
- B. Purple primer shall be applied after the pipe and fittings have been cut and cleaned. The Primer shall be of contrasting color and be easily recognizable against PVC pipe. The purple primer cleaner for PVC is 8800.

902-1.2.5. THREADED CONNECTIONS

- A. Threaded PVC connections shall be made using Teflon tape or Teflon pipe sealant.

902-1.2.6. GATE VALVES

902-1.2.6.1. MANUAL GATE VALVES TWO INCHES (2") AND SMALLER

- A. Provide the following, unless otherwise noted on Drawings:
 1. 200-250 psi Ball Valve
 2. Nibco Brass Body Construction, female threaded on both sides, sized appropriately to source pipe - with Teflon Ball Seals
 3. Slip/Threaded Coupler
 4. Schedule 80 Nipple

902-1.2.6.2. GATE VALVES TWO AND A HALF INCHES (2½") AND LARGER

- A. Provide the following, unless otherwise noted on Drawings:
 1. AWWA-C509
 2. 200 lb. O.W.G.
 3. Cast Iron body - ASTM A 126 Class B
 4. Deep socket joints
 5. Rising stem
 6. Bolted bonnet
 7. Double disc
 8. Equipped with two inches (2") square operating key with tee handle
- B. Provide two (2) operating keys for gate valve three inches (3") and larger. The "street key" shall be five feet (5') long with a two inch (2") square operating nut.

902-1.2.7. SLEEVES

- A. Sleeves: (Existing by city of Clearwater)
 1. The Contractor shall verify the location of all existing sleeves as shown on the roadway, utility and/or irrigation plans and notify the Engineer of any discrepancies.
- B. Schedule 80 or higher, sized two (2) times the diameter of pipe to be sleeved

902-1.2.8. REMOTE CONTROL VALVES

- A. The electric globe remote control valve shall be a solenoid actuated; balance-pressure across-the-diaphragm type capable of having a flow rate per manufacturer's recommendations with a pressure loss not to exceed 6.1 pounds per square inch (psi). The valve pressure rating shall not be less than 150 psi. Submit to the city Project Manager for approval.

- B. The valve body and bonnet shall be constructed of high impact weather resistant plastic, stainless steel, and other chemical/UV resistant materials. The valve's one-piece diaphragm shall be of durable santoprene material with a clog resistant metering orifice.
- C. The valve body shall have a one-inch (1"), 1 1/2", 2", 3" (FNPT) inlet and outlet or a one-inch (1") female threaded inlet and outlet for threaded connections.
- D. The valve construction shall be as such to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.
- E. The valve shall be as manufactured by Irritrol or approved equal. Any valve that is 3" or larger than must submit to the city Project Manager for approval.
- F. Identify all control valves using Aluminum or Bronze metal I.D. tags numbered to match drawings.
- G. All electric valves to have gate valves on source side of each valve.

902-1.2.9. VALVE BOXES

- A. For electronic irrigation valves use a Brooks #36 concrete valve box with #36-T cast iron traffic bearing cover or approved equal.
- B. For wire splices and gate valves use a Carson with T cover (Heavy Duty) ten inch (10") circular valve box with #181015 cover comparable to Brooks or approved equal. The color of the lids need to be Pantone 522C if reclaimed.

902-1.2.10. AUTOMATIC CONTROL TIMER

- A. The irrigation controller (control module) shall be programmable by a separate transmitter device only. The program shall be communicated to the Control Module from the Field Transmitter via an infrared connection. The controller shall be of a module type which may be installed in a valve box underground. The controller shall function normally if submerged in water and the communication from the transmitter shall function if submerged in water.
- B. The control module shall be housed in an ABS plastic cabinet and shall be potted to insure waterproof operation. The control module shall have two mounting slots for screws allowing the module to be securely mounted inside a valve box.
- C. The controller shall operate on one nine volt (9V) alkaline battery for one full year regardless of the number of stations utilized. The controller shall operate 1, 2, or 4 stations either sequentially or independently.
- D. The controller shall have three (3) independent programs with eight (8) start times each, station run time capability from one (1) minute to twelve (12) hours in one (1) minute increments, and a seven (7) day calendar. The controller shall turn on stations via latching solenoids installed on the valves. Manual operations shall be initiated by attaching the Field Transmitter to the Control Module and programming a manual start. The controller shall be capable of manual single station or manual program operation.
- E. The controller shall be as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California USA. Submit to the city Project Manager for approval.

902-1.2.11. FIELD TRANSMITTER

- A. The irrigation controller shall be programmable by a separate transmitter device (Field Transmitter) only. The Field Transmitter shall communicate to the Control Module via an infrared connection or over air. The Field Transmitter shall be water resistant and housed in ABS plastic and have a removable, reversible protective sheath. The Field Transmitter shall operate on one nine volt (9V) alkaline battery.
- B. The Field Transmitter shall have a large LCD screen and a seven-key programming pad. A beep sound shall confirm every key stroke. The screen shall automatically turn off after one minute when not in use.
- C. The Field Transmitter shall be capable of programming an unlimited number of UNIK Control Modules or A/C placed times, whichever is applicable.

- D. The Field Transmitter shall be as manufactured by Rain Bird Sprinkler Mfg. Corp., Glendora, California USA.
- E. Field transmitter to be provided to city Parks and Recreation at time of acceptance of project.
- F. Submit to the city Project Manager for approval.

902-1.3. EXECUTION

902-1.3.1. GENERAL INSTALLATION REQUIREMENTS

- A. Before work is commenced, hold a conference with the Engineer to discuss general details of the work.
- B. Verify dimensions and grades at job site before work is commenced.
- C. During the progress of the work, a competent superintendent and any assistants necessary shall be on site, all satisfactory to the Engineer. This superintendent shall not be changed, except with the consent of the Engineer. The superintendent shall represent the Contractor in Contractor's absence and all directions given to the superintendent shall be as binding as if given to the Contractor.
- D. Obtain and pay for all irrigation and plumbing permits and all inspections required by outside authorities.
- E. All work indicated or notes on the Drawings shall be provided whether or not specifically mentioned in these Technical Specifications.
- F. No irrigation piping or any irrigation component shall be installed in a retention pond bottom or slopes or passing through retention pond. No piping shall be 12' from top of bank.
- G. If there are ambiguities between the Drawings and Specifications, and specific interpretation or clarification is not issued prior to bidding, the interpretation or clarification will be made only by the Engineer, and the Contractor shall comply with the decisions. In the event the installation contradicts the directions given, the installation shall be corrected by the Contractor at no additional cost.
- H. Layout of sprinkler lines shown on the Drawing is diagrammatic only. Location of sprinkler equipment is contingent upon and subject to integration with all other underground utilities. Contractor shall employ all data contained in the Contract Documents and shall verify this information at the construction site to confirm the manner by which it relates to the installation.
- I. Do not proceed with the installation of the sprinkler system when it is apparent that obstructions or grade differences exist or if conflicts in construction details, legend, or specific notes are discovered. All such obstructions, conflicts, or discrepancies shall be brought to the attention of the Engineer.
- J. The disturbance of existing paving will not be permitted. Install all required sleeving prior to roadway base installation.

902-1.3.2. EXCAVATING AND BACKFILLING

902-1.3.2.1. TRENCHING - GENERAL

- A. Dig sides of trenches straight(vertically). Provide continuous support for pipe on bottom of trenches. Lay pipe to uniform grade. Trenching excavation shall follow layout indicated on Drawings.
- B. Maintain six inch (6") horizontal and minimum clearance between sprinkler lines and between all lines of other trades.
- C. Do not install sprinkler lines directly above another line of any kind.
- D. Maintain six inch (6") vertical minimum between sprinkler lines which cross at angles of 45° to 90°.
- E. Exercise care when excavating, trenching, and working near existing utilities.

902-1.3.2.2. BACKFILLING

- A. All pressure supply lines (mainline) shall have eighteen inches (18") of fill placed over the pipe.
- B. Initial backfill on all lines shall be of a fine granular material with no foreign matter larger than one half inch (½").
- C. Compact backfill according to Section 125 of FDOT Standard Specifications.

- D. Do not, under any circumstances, use equipment or vehicle wheels for compacting soil.
- E. Restore grades and repair damages where settling occurs before landscape installation begins.
- F. Compact each layer of fill with approved equipment to achieve a maximum density per AASHTO T180. Under landscaped areas, compaction shall not exceed 95% of maximum density.
- G. Compaction shall be obtained by the use of mechanical tampers or approved hand tampers. When hand tampers are used, the materials shall be deposited in layers not more than six inches (6") thick. The hand tampers shall be suitable for this purpose and shall have a face area of not more than 100 square inches. Special precautions shall be taken to prevent damage to the irrigation system piping and adjacent utilities.

902-1.3.2.3. ROUTING OF PIPING

- A. Routing of pressure and non-pressure piping lines are indicated diagrammatically on Drawings.
- B. Coordinate specimen trees and shrubs with routing of lines.
 - 1. Planting locations shall take precedence over sprinkler and piping locations.
 - 2. Report to Engineer and/or city any major deviation from routing indicated.
- C. Conform to Drawings layout without offsetting the various assemblies from the pressure supply line.
- D. Layout all systems using an approved staking method and maintain the staking of approved layout.

902-1.3.3. INSTALLATION

902-1.3.3.1. WATER SUPPLY

- A. Connections to the water sources shall be at the approximate locations indicated on the Drawings. Make minor changes caused by actual site conditions without additional cost to the city.

902-1.3.3.2. ASSEMBLIES

- A. Routing of pressure supply lines as indicated on Drawings is diagrammatic only. Install lines and required assemblies in accordance with details on Drawings.
- B. Do not install multiple assemblies on plastic lines. Provide each assembly with its own outlet. When used, the pressure relief valve shall be the last assembly.
- C. Install all assemblies in accordance with the respective detail Drawings and these Technical Specifications.
- D. Plastic pipe and threaded fittings shall be assembled using Teflon tape, applied to the male threads only.

902-1.3.3.3. SLEEVES: (EXISTING BY CITY OF CLEARWATER)

- A. The Contractor shall verify the location and size of all existing sleeves as shown on the roadway, utility and/or irrigation plans and notify the Engineer of any discrepancies before work begins.

902-1.3.3.4. PLASTIC PIPE

- A. Install plastic pipe in accord with manufacturer's recommendations.
- B. Prepare all welded joints with manufacturer's cleaner prior to applying solvent.
 - 1. Allow welded joints as least fifteen (15) minutes setup/curing time before moving or handling.
 - 2. Partially center load pipe in trenches to prevent arching and shifting when water pressure is on.
 - 3. Do not permit water in pipe until a period of at least four (4) hours has elapsed for solvent weld setting and curing, unless recommended otherwise by solvent manufacturer.
- C. Curing
 - 1. When the temperature is above 80°F, allow soluble weld joints at least twenty-four (24) hours curing time before water is introduced under pressure.
- D. Flushing the system:
 - 1. After all sprinkler pipelines and risers are in place and connected, open the control valves and flush out the system with a full head of water.
- E. Installing piping under existing pavement:

1. Piping under existing pavement may be installed by jacking & boring. Refer to *Section 503-2.3. of these Technical Specifications.*
2. Secure permission from the city Landscape Architect before cutting or breaking any existing pavement. All repairs and replacements shall be approved by city and shall be accomplished at no additional cost.

902-1.3.3.5. CONTROLLERS

- A. Install all automatic controllers as shown in the plans.
 1. The location of all controllers shall be approved by the city's Project Manager and/or Representative prior to installation.

902-1.3.3.6. REMOTE CONTROL VALVES

- A. Install at final grade. Set in turf areas whenever possible.
- B. Install valves in turf areas in a plumb position with twenty-four inch (24") minimum maintenance clearance from other equipment, three feet (3') minimum from edges of sidewalks, buildings, and walls, and no closer than seven feet (7') from the back of curb or edge of pavement along roadways.
- C. Contractor shall adjust the valve to provide the proper flow rate or operating pressure for each sprinkler zone.

902-1.3.3.7. GATE VALVES

- A. Install where indicated and with sufficient clearance from other materials for proper maintenance.
- B. Check and tighten valve bonnet packing before backfilling.
- C. Install in 10" round, Carson Heavy Duty valve box or approved equal (Pantone 522C if reclaim).

902-2. LANDSCAPE

902-2.1. GENERAL

902-2.1.1. REQUIREMENTS OF REGULATORY AGENCIES

- A. Comply with Federal, State, Local, and other duly constituted authorities, and regulatory agencies, without additional cost to the city in matters pertaining to codes, safety, and environmental matters.
- B. Any permits for the installation or construction of any of the work included under the contract, which are required by any of the legally constituted authorities having jurisdiction, shall be arranged for by the Contractor and paid for directly by the Contractor, unless otherwise agreed upon in writing.

902-2.1.2. SCOPE OF WORK

- A. All provisions of Contract, including General and Special Provisions and Plans, apply to the work specified in this Section. The Scope of Work includes everything for and incidental to executing and completing all landscape work shown on the Plans, Schedules, Notes and as specified herein.
- B. Furnish and provide all labor, plants and materials tools and equipment necessary to prepare the soil for plantings, to install and care for all plant materials (including finish grading if necessary); to remove and/or transplant existing plants if indicated; to furnish, plant, fertilize, guy and brace, water, mulch and prune all new plant materials; and to execute all other Work as described herein or indicated on the Plans.
- C. Work under this Section shall include labor and materials for final grading and raking to prepare the site for sodding, sprigging, or seeding, so finished lawn or playing field will appear even and uniform, will drain adequately, and will comply with the intent of the landscape drawings.
- D. Initial maintenance of landscape materials as specified in this document.

902-2.1.3. QUALITY ASSURANCE

- A. Landscape work shall be contracted to a single firm specializing in landscape work, who shall in turn subcontract no more than 40% of the work specified. All subcontractors under the control of the Contractor involved in the completion of the landscape work, shall be made known to the city and the city Landscape Architect prior to their commencement of work on the project.
- B. All work of this Section shall conform to the highest standard of landscape practices.
- C. The Plant Material Schedule included with these Plans is provided only for the Contractor's convenience; it shall not be construed as to conflict or predominate over the Plans. If conflict between the Plans and Specifications exists, submit to the city Project Manager for approval.
- D. During this work, the Contractor shall be responsible for maintaining safety among persons in their employ in accordance with the standards set by The Occupational Safety and Health Act of 1970 (and all subsequent amendments). City and city Landscape Architect shall be held harmless from any accident, injury or any other incident resulting from compliance or non-compliance with these standards.
- E. The Contractor shall cooperate with and coordinate with all other trades whose work is built into or affects the work in this Section.
- F. All appropriate utility companies and agencies shall be contacted 72 hours prior to excavation. Call "One Call"/ "Sunshine 811" at 8-1-1; "Sunshine 811" administrative offices may be reached at (800) 638-4097.
- G. The Contractor shall carefully examine the site and all existing conditions affecting the work, such as: soil, obstructions, existing trees, utilities, etc. Report any conditions in conflict with the work to the Landscape Architect.

902-2.1.4. SUBMITTALS

- A. The Contractor is required to submit prior to the expiration of the required maintenance period, two (2) copies of typewritten instructions recommending procedures to be established by the Contractor for maintenance of landscape work for a period of one (1) year.
- B. Furnish unit prices for all plant materials and inert materials, including labor for all specified work.

902-2.1.5. ALTERNATES, ADDITIONS, DELETIONS, SUBSTITUTIONS

- A. If there are additions/alternates included in these Plans and Specifications, the Contractor must propose prices to accomplish the work stated as additions/alternates at the time of bidding.
- B. The city, through their Project Manager, reserves the right to add or deduct any of the work stated herein without rendering the Contract void.
- C. The Contractor must have written approval by the city Project Manager for any substitutions not previously agreed to in the purchase agreement: installation without approval is entirely at the Contractor's risk.
- D. All material acquired through additions or substitutions shall be subject to all conditions and warranties stated herein.

902-2.1.6. ABBREVIATIONS/DEFINITIONS

- O.A. or HT.:** The over-all height of the plant measured from the ground to the natural, untied state of the majority of the foliage, not including extreme leaves, branches or fronds.
- C.T.:** Clear trunk is measured from the ground to the bottom of the first leaf or frond stem with no foliage from ground to specified height. For example, on Canary Island Date Palms or similar, the clear trunk measurement includes the "nut" at the base of the fronds.

C.W.: Clear wood is measured from the ground to the bottom of the base of the lowest leaf sheath or boot, trimmed in a natural manner. For example, on Canary Island Date Palms or similar, the clear wood measurement does not include the “nut” at the base of the fronds.

SPR.: Spread, branches measured in natural untied position to the average crown diameter, not including extreme leaves, branches, or fronds.

ST.TR.: Straight trunk.

MIN.: Minimum.

GAL.: Gallon container size, i.e., 1 gallon, 3-gallon, 7 gallons, etc.

O.C.: On center, distance between plant centers.

DIA.: Diameter.

LVS.: Leaves.

D.B.H.: Diameter or caliper of main trunk of tree as measured at breast height at 4-1/2 feet above grade.

CAL.: Caliper, the outside diameter of up to a four-inch tree is measured six inches above grade, larger trees are measured at 12 inches above grade.

B&B: Balled and burlapped in accordance with horticultural standards of the American Association of Nurserymen.

PPP: Plants per pot.

FG: Field grown.

STD.: Standard, single, straight trunk.

Owner: To be known as that entity which holds title or control to the premises on which the work is performed.

Owner’s Representative: Owner’s on-site representative shall be responsible for approval of quantity and quality of materials specified and execution of installation.

Contractor: Shall refer to that person or enterprise commonly known as the Landscape Contractor.

Landscape Architect: This person or firm is the responsible representative of the Owner who produces the landscape Plans and Specifications.

902-2.1.7. PRODUCT DELIVERY, STORAGE, AND HANDLING

902-2.1.7.1. PLANT MATERIALS

- A. Use Florida Grades and Standards (most current edition) for all plant materials within these Technical Specifications.
- B. Provide container-grown or, if appropriate, freshly dug trees and shrubs. Do not prune prior to delivery. Do not bend or bind trees or shrubs in such a manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery. If plant delivery is made in open vehicles, the entire load shall be suitably covered.
- C. All plants are to be handled at all times so that roots or root balls are adequately protected from sun, cold, or drying winds. No root balls for trees and container plants that have been cracked or broken shall be planted except upon special approval. Plants shall not be pulled by the tops or stems, nor handled in a rough or careless manner at any time.
- D. Trees shall be dug with adequate root balls, burlapped, and wire bound if needed. Root pruning to be done a minimum of four (4) weeks before removal from the field and planting at the site. Root balls

may not be encased in “grow bags” or other synthetic material, except plastic shrink wrap for transport only.

- E. Palms shall be planted within twenty-four (24) hours of delivery.
- F. Deliver trees and shrubs after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and cover to keep the roots moist.
- G. Label all plants of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.
- H. Time delivery so that sod will be placed within twenty-four (24) hours after stripping. Protect sod against drying and breaking by covering palettes of sod or placing in a shaded area.

902-2.1.8. JOB CONDITIONS

902-2.1.8.1. ACCEPTANCE OF JOB CONDITIONS.

- A. The Contractor shall examine the sub-grade, verify elevations, observe the conditions under which work is to be performed and notify the city Landscape Architect or Project Manager in writing of unsatisfactory conditions prior to beginning work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the city Landscape Architect. Start of work shall indicate acceptance of conditions and full responsibility for the completed work.
- B. Proceed with and complete the landscape work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work and following the approved schedule. If seasonal limitations apply, notify the city Landscape Architect for adjustments to the Schedule.
- C. Determine locations of all underground utilities and review for conflicts with planting procedures before plant installations begin.
- D. When adverse conditions to plant growth are encountered, such as rubble fill, drainage conditions or obstruction, the Contractor shall notify the city Landscape Architect in writing for change approval before work is performed
- E. Plant trees and shrubs after final grades are established and prior to sod installation or seeding lawns. Protect existing lawn, trees, and promptly repair all damages from planting operations that is satisfactory and approved by the city.

902-2.1.8.2. SCHEDULING OF WORK

- A. The work shall be carried out to completion with the utmost speed. Immediately upon award of contract, the Contractor shall prepare a construction schedule and furnish a copy to the city’s Project Manager and/or the city Landscape Architect for approval. The Contractor shall carry out the work in accordance with the approved schedule.
- B. If the Contractor incurs unforeseen costs, such as overtime hours, holidays, etc., in order to complete the work within the time stated in the Contract, and/or to maintain the progress schedule, all said costs shall be borne by the Contractor at no additional cost to the city.
- C. The city’s Project Manager and/or Representatives may request work stoppage in writing. Upon written request from the city’s Project Manager, the Landscape Contractor shall suspend delivery of material and stop all work for such a period as deemed necessary by the city of Clearwater, the city’s Project Manager, or the General Contractor, with respect to any additional costs which may result from work stoppage.

902-2.1.8.3. UTILITIES

- A. The Contractor shall perform work in a manner which will avoid conflicts with utilities. Hand excavate, as required, to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.

902-2.2. PRODUCTS

902-2.2.1. MATERIALS

902-2.2.1.1. PLANT MATERIALS: NOMENCLATURE

- A. Plant species, sizes, etc., shall be per Plans and Specifications on Plant Material Schedule. Nomenclature is per Manual of Cultivated Plant, Standard Encyclopedia of Horticulture, L.H. Bailey, or Standardized Plant Names Dictionary, American Joint Committee on Horticultural Nomenclature (latest editions) or conforms with names accepted in the nursery trade. The scientific and common name both need to be provided for each plant materials.

902-2.2.1.2. PLANT MATERIALS: QUALITY ASSURANCE

- A. Use Florida Grades and Standards (latest edition) for all plant materials within these Technical Specifications.
- B. Provide healthy, vigorous stock grown under climatic conditions similar to conditions in the locality of the project. Plants shall have a habit of growth that is normal for the species and be sound, healthy, vigorous, and free from insects, pests or their eggs, plant diseases, defects and injuries. Plants shall be well branched and densely foliated when in leaf and shall have healthy, well-developed root systems.
- C. Trees shall be heavily branched or, in the case of palms, be heavily leafed. Some plant materials may be collected stock with the approval of the Landscape Architect. Tree species must have a single main trunk (central leader), unless otherwise stated. Trees that have the main trunk forming a “Y” shape or parallel branching are not acceptable.
- D. Plant materials shall be specified and shall be Florida #1 or better as to shape and quality for the species as outlined in Grades and Standards for Nursery Plants Part I and II, Florida Department of Agriculture and Consumer Services (latest edition).
- E. The city Landscape Architect reserves the right to inspect plant materials either at the place of growth or at the project site prior to planting for compliance with requirements for name, variety, size, quality, or designated area.
- F. Landscape materials shall be shipped with certificates of inspection as required by governmental authorities. The Contractor shall comply with all governing regulations that are applicable to landscape materials.
- G. Do not make substitutions. If specified landscape material is not available, submit to the Landscape Architect proof of it being non-available. In such event, if the Landscape Architect designates an available source, such shall be acquired from designated source. When authorized, a written change order for substitute material will be made by adjustment to Contract amount.
- H. Height and/or width of trees shall be measured from ground up; width measurement shall be normal crown spread of branches with plants in the normal position. This measurement shall not include immediate terminal growth. All measurements shall be taken after pruning for specified sizes. All trees and shrubs shall conform to measurements specified in the plant material schedule, except that plant material larger than specified may be used with the approval of the city Landscape Architect, with no increase to the Contract price. Plant materials shall not be pruned prior to delivery.
- I. Plant Material shall be symmetrical, typical for variety and species. Plants used where symmetry is required shall be matched as nearly as possible.
- J. Balled and burlapped plants shall have firm, natural balls of earth of sufficient diameter and depth to encompass the feeding root system necessary for full development of the plant and to conform with the standards of the American Association of Nurserymen. Root balls and tree trunks shall not be damaged by improper binding and B & B procedures. Only natural biodegradable burlap will be acceptable.
- K. Container-grown plants may be substituted for balled and burlapped plants or vice-versa provided the quality is equal or better than specified and the Landscape Architect approves the substitution.

- L. Container-grown stock shall have been grown in containers for at least four months, but not over two years. If requested, samples must be shown to prove no root bound condition exists.

902-2.2.1.3. GRASSES: SOD OR SEED

- A. Sod or seed (as/if specified) shall be a certified species as stated on the Plan. Solid sod shall be of even thickness and with a good root structure, 95% free of noxious weed, freshly mowed before cutting, and pest and disease free when laid. It must not be stacked more than twenty-four (24) hours before laying and it must be grown in soil compatible to that in which it will be installed. Sod must be kept moist prior to and after installation through the acceptance of the project.
- B. Sod shall be laid side to side with no gaps and all at level grade, so no scalping occurs. Contractor will make changes as deemed necessary by the city before acceptance of work.
- C. Seed shall be delivered to the site in unopened bags with certification tags in place. Purity, germination and weed content shall be as certification requirements.

902-2.2.1.4. MULCH

- A. Mulch shall be as specified in the plans
- B. Install mulch to an even depth of three inches (3") before compaction, as shown in the PLANTING DETAILS in the plans.

902-2.2.1.5. STAKES AND GUYS

- A. Use the University of Florida Urban Tree Foundation Planting Details and Specifications Staking details. Use the latest edition of the Staking Details from the Urban Tree Foundation (http://urbantree.org/details_staking.shtml)
- B. For single trunk palms, stakes shall be cut from 2" x 4" pressure treated (p.t.) stock, with a minimum of three (3) stakes per palm. Batten consisting of 5 layers of burlap and 5 - 2" x 4" by 16" wood connected with two – three-quarter inch (¾") steel bands shall be used around the palm trunk. Submit to the city Project Manager for approval.
- C. Other tree staking systems may be acceptable if approved.

902-2.2.1.6. PLANTING SOIL

- A. Unless stated on the plans or in the specifications, install plant material in tilled and loosened native soil backfill. It is the responsibility of the Landscape Contractor to test, prior to planting and at no additional cost to the city, any soils which may be unsuitable for the vigorous growth of plants. Unsuitable conditions shall be reported to the Landscape Architect immediately in writing.
- B. When required, planting soil media shall be provided by the Contractor and shall consist of one-third (1/3) peat and two-thirds (2/3) sandy loam, with no lumps over one inch (1").
- C. Backfill and clean fill dirt provided by the Contractor shall be in a native, friable soil with known analysis and composition that is like soil makeup. There must be slight acid reaction to the soil (about 6.0 – 6.5 pH) with no excess of calcium or carbonate, and it shall be free from weeds, clay, stones, stumps, roots and toxic substances or any other materials that might be harmful to plant growth or a hindrance to grading, planting, and maintenance procedures and operations. No heavily organic soil, such as muck or peat shall be used as fill dirt.

902-2.2.1.7. TREE PROTECTION

- A. Wood fencing shall be 2" x 4" pressure treated stock with flagging on horizontal members. Space vertical members six feet (6') to eight feet (8') on center. The barricade shall be placed so as to protect the critical protection zone area, which is the area surrounding a tree within a circle described by a radius of one foot (1') for each inch of the tree's diameter at breast height DBH (four and one half feet) above grade.

902-2.2.1.8. ROOT BARRIER SYSTEM

- A. Submit to city Project Manager and Landscape Architect for approval (if applicable).

902-2.2.1.9. PACKAGED MATERIALS

- A. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at the site.

902-2.2.1.10. PESTICIDES

- A. Pesticides shall be only approved, safe brands applied according to manufacturer’s directions.

902-2.3. EXECUTION

902-2.3.1. PREPARATION

902-2.3.1.1. OBSTRUCTIONS BELOW GROUND

- A. It shall be the responsibility of the Contractor to locate and mark all underground utilities, irrigation lines and wiring prior to commencement of the work.
- B. If underground construction, utilities, or other obstructions are encountered in excavation of planting areas or pits, the city Project Manager and Landscape Architect shall be immediately notified to select a relocated position for any materials necessary.

902-2.3.1.2. GRADING AND PREPARATION FOR PLANT MATERIALS

- A. All proposed landscape areas containing existing turf grass or weeds shall be treated with mutually agreed on herbicide per manufacturer’s specifications. All proposed landscape areas adjacent to water bodies shall be treated with “Rodeo” or approved equal per the manufacturer’s specifications.
- B. New plant materials will not be installed until 98% weed/turf eradication has been achieved. More than one application may be required to produce an acceptable planting bed.
- C. Pre-emergent herbicides are not a substitute for spray treatment of “Rodeo” or approved equal and may be used only with the written approval of the Landscape Architect.
- D. Should any plant material in the same or adjacent beds be damaged by these chemicals, the same size, quantity, and quality of plants shall be immediately replaced by the Contractor at no cost to the city.
- E. Any necessary corrections or repairs to the finish grades shall be accomplished by the Contractor. All planting areas shall be carefully graded and raked to smooth, even finish grade, free from depressions, lumps, stones, sticks or other debris and such that they will conform to the required finish grades and provide uniform and satisfactory surface drainage without puddling.
- F. The Contractor shall remove debris (sticks, stones, rubbish) over one- and one-half inches (1½”) in any dimension from individual tree, shrub and hedge pits and dispose of the excavated material off the site.

902-2.3.1.3. PREPARATION FOR ANNUAL BED PLANTING

- A. Prepare native subgrade by rototilling or loosening by hand methods. Spread three inches (3”) of one-third (1/3) Florida peat and two-thirds (2/3) sandy, or other approved organic soil amendment over the full length and width of planting area for annuals. Rototill organic layer six inches (6”) to eight inches (8”) into the native soil. Grade the planting bed by “crowning” to ensure that surface drainage, percolation, and aeration occur at rapid rates.

902-2.3.1.4. PREPARATION FOR SEEDING AND SOD AREAS

- A. All proposed sod areas containing existing turf grass or weeds shall be treated with Monsanto’s “Round-Up” per manufacturer’s specifications. All proposed sod areas adjacent to water bodies shall be treated with “Rodeo” per the Manufacturer’s Specifications.

- B. Limit preparation to areas which will be planted promptly after preparation. Loosen sub-grade of seed and sod areas to a minimum depth of four inches (4”).
- C. Immediately prior to any turf work, the Contractor shall finish grade the soil to a smooth, even surface assuring positive drainage away from buildings and the subsequent turf flush to the tops of adjacent curbs and sidewalks. The surface shall be sloped to existing yard drains.
- D. Moisten prepared seed and sod areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

902-2.3.2. INSTALLATION

902-2.3.2.1. BERM CONSTRUCTION (IF SPECIFIED)

- A. Install berms at location and design shown on Plans and at the height and slope indicated. Height stated is for finished berm with soil at natural compaction.
- B. Exact location and configuration of berms may require modification to allow proper drainage; such changes will be coordinated with the Landscape Architect.
- C. If shown on the Plan, construct berms using clean sandy loam fill dirt which is well-drained, free of rocks, roots, or other debris, with a soil pH of an acid Nature (about 6.0 - 6.5). No heavily organic soil, such as muck or peat shall be used in berm construction.

902-2.3.2.2. LAYOUT OF PLANT MATERIALS

- A. Unless otherwise stipulated, plant materials shall be approximately located per the plans by scale measurements using established building, columns, curbs, screen walls, etc., as the measuring reference point. Slight shifting may be required to clear wires, prevent blockage of signage, etc.
- B. Shrubs and ground covers shall be located and spaced as noted on the plant material schedule
- C. Leave an eighteen-inch (18”) (450 millimeters) borders of mulched space between outer leaves of installed plant material and the bed line, curb, or building foundation wall for all plant sizes.
- D. Any necessary “minor” adjustments in the layout of planting shall be made by the Contractor with the approval of the city Project Manager and Landscape Architect in order to conform as nearly as possible to the intent of the Plans.

902-2.3.2.3. PLANTING PROCEDURES

- A. All shrubs, trees and ground covers or vines shall be planted in pits having vertical sides and being circular in outline. Planting pit shall be two (2) times the width of the root ball.
- B. Plants shall be set straight or plumb, in the locations shown, planted “high” with 10% of the root ball height above the surrounding grade.
- C. Native soil shall be used in back-filling plant pits or as specified. The Contractor shall be responsible for providing additional soil for building tree saucers.
- D. When balled and burlapped plants are set, undisturbed native soil shall be left under the base of the root ball to prevent voids. Backfill loosened native soil around the sides of the root ball. Remove the top 4 four inches (4”) (100 millimeters) of burlap wire, and all tie-down material from the root ball. Do not remove these materials from the bottom of the root ball. Thoroughly water-in before bringing the backfill up to the proper grade. Use the Florida Grades and Standards (latest edition). Failure to comply is cause for rejection.
- E. Containerized plants shall be installed with undisturbed native soil left under the base of the root ball to prevent voids. Planting pit shall be three (3) to five (5) times the width of the root ball. Backfill tilled and loosened native soil around the sides of the root ball. Thoroughly water-in before bringing the backfill up to the proper grade.
- F. Plant spacing shall be “on center” and varies with the different plant species. Space each variety of plant equally in the planting areas. Shrubs and ground cover adjacent to straight or curved edges shall be triangular - spaced in rows parallel to those edges. Plant a minimum of eighteen inches (18”) from the back of the curb to the outside edge of the plant.

902-2.3.2.4. SODDING

- A. During periods of drought, sod shall be watered sufficiently at its origin to moisten the soil adequately to the depth to which it is to be cut.
- B. Solid sod shall be laid tightly with closely abutting staggered joints with an even surface edge and sod edge, in a neat and clean manner to the edge of all the paving and shrub areas. Cut down soil level to one inch (1”) to one- and one-half inches (1-1/2”) below top of walks prior to laying sod.
- C. Within two (2) hours after installing sod and prior to rolling, irrigate the sod. Sufficient water shall be applied to wet the sod thoroughly and to wet the sod to a depth of two inches (2”) (50 millimeters). Watering shall be done in a manner that will avoid erosion due to the application of excessive quantities, and the watering equipment shall be a type that will prevent damage to the finished sod surface. Watering shall be repeated as necessary to keep sod moist until rooted to subgrade.
- D. The sod shall be pressed firmly into contact with the sod bed using a turf roller or other approved equipment so as to eliminate air pockets, provide a true and even surface and insure knitting without any displacement of the sod or deformation of the surfaces of sodded areas. After the sodding operation has been completed and rolled, the edges of the area shall be smooth and conform to the grades indicated.
- E. If, in the opinion of the Landscape Architect, top dressing is necessary after rolling, clean silica sand shall be used to fill voids. Evenly apply sand over the entire surface to be leveled, filling-in dips and voids and thoroughly washing into the sod areas.
- F. On slopes 3:1 or steeper, and as required, a geotextile fabric shall be installed per manufacturer’s specifications prior to placing sod. The sod shall be fastened in place with suitable wooden pins or by other approved method.

902-2.3.2.5. SEEDING

- A. Seed shall be installed per the specifications of the State of Florida Department of Transportation. See plan for type of seed.

902-2.3.2.6. TREE GUYING, BRACING AND STAKING

- A. Use the latest edition of the Staking Details from the Urban Tree Foundation (http://urbantree.org/details_staking.shtml). Submit to the city Project Manager for approval.
- B. Contractor shall remove all tree guying, staking, and bracing from trees 1 year after the date of final acceptance of the landscape work.

902-2.3.2.7. MULCHING

- A. All planting beds shall be weed-free prior to mulching.
- B. All plant beds and tree rings shall be mulched evenly with a three inch (3”) layer (before compaction) of 1.5” round pine bark nuggets or brown shredded hard wood mulch, or other mulch as specified on the Plans or General Notes. Submit to the city Project Manager for approval.
- C. Mulch shall not be placed against the trunks of plant materials or foundations of buildings. Maintain a minimum six-inch (6”) clearance for trees and shrub trunks and a minimum six-inch (6”) clearance for the walls of buildings.

902-2.3.2.8. CLEAN-UP

- A. During landscape work, store materials and equipment where directed by the city.
- B. The Contractor shall promptly remove any materials and equipment used on the job, keeping the area neat at all times. Upon completion of all planting, dispose of all excess soil and debris leaving pavements and work areas in safe and orderly condition.
- C. The clean-up of the site shall include the removal and proper disposal of the tree guying, staking, and bracing materials as described in specifications. No pruning should be done by the contractor, but can be done by the landscape contractor.

902-2.3.2.9. PROTECTION

- A. The Contractor shall provide safeguards for the protection of workmen and others on, about, or adjacent to the work, as required under the parameters of the Occupational Safety and Health Administration (OSHA) standards.
- B. The Contractor shall protect the city's and adjacent property from damage.
- C. The Contractor shall protect the landscape work and materials from damage due to landscape operations. Maintain protection during installation and maintenance periods.
- D. The Contractor shall provide protection (tree barricades) for all existing trees and palms as specified.

902-2.3.2.10. REPAIR OF DAMAGES

- A. The Contractor shall repair all damage caused by their operations to other materials, property, or trades to a level equal in quality to the existing condition prior to damage.
- B. The Contractor shall be held responsible for all damage done by their work or employees to other materials or trades' work. Patching and replacement of damaged work may be done by others, at the city's direction, but the cost of same shall be paid by the Contractor who is responsible for the damage.

902-2.3.3. MAINTENANCE

- A. The Contractor shall maintain all plant materials in a first-class condition from the beginning of landscape construction until Final Acceptance.
- B. Operations:
 - 1. Maintenance shall include, but not be limited to, watering of turf and planting beds, mowing, fertilizing, cultivation, weeding, pruning, disease and pest control, replacement of dead materials, straightening, turf or planter settlement corrections, replacement of rejected materials, staking and guying repair and tightening, wash-out repairs and regrading, and any other procedures consistent with the good horticultural practice necessary to insure normal, vigorous and healthy growth of all work under the Contract. Mowing shall be consistent with the recommended height per the University of Florida Cooperative Extension Service.
 - 2. Within the warranty period, the Contractor shall notify the city of any maintenance practices being followed or omitted which would be detrimental to the healthy, vigorous growth of the landscape.
 - 3. The Contractor shall be responsible for the final watering of not less than one inch (1") of water for all planted materials before leaving the site.

902-2.3.4. INSPECTION, REJECTION, AND ACCEPTANCE

902-2.3.4.1. INSPECTION

- A. Upon completion of the installation, the Contractor will notify the city or the city's Project Manager that the job is ready for inspection. Within fifteen (15) days of notifications, the installation will be inspected by the Landscape Architect. A written and/or graphic inspection report will be sent to the city and/or Landscape Contractor.

902-2.3.4.2. REJECTION AND REPLACEMENT

- A. The Landscape Architect shall be final judge as to the suitability and acceptability of any part of the work. Plant material will be rejected if it does not meet the requirements set forth in the Plans and Specifications.
- B. Replace any rejected materials immediately or within fifteen (15) days and notify the Landscape Architect that the correction has been made.

902-2.3.4.3. ACCEPTANCE

- A. After replacement of rejected plant material, if any, have been made, and completion of all other correction items, the city or Project Manager will accept the project in writing.

- B. Upon Final Acceptance, the city assumes responsibility for maintenance within the terms of the Contract. Acceptance will in no way invalidate the Contractor’s warranty period.
- C. The Contractor’s warranty period will begin after final acceptance of the project by the Owner.
 - 1. If evidence exists of any lien or claim arising out of or in connection with default in performance of this Contract, the city shall have the right to retain any payment sufficient to discharge such claim and all costs in connection with discharging such claim.
 - 2. Where the Specifications call for any stipulated item or an “approved equivalent”, or in words to that effect, the Contractor shall indicate the price of the type and species specified in the proposal, giving the price to be added or deducted from their Contract price. The final selection rests with the city or their representative.
 - 3. Where plants installed do not meet specifications, the city reserves the right to request plant replacement or an appropriate deduction from the Contract amount to compensate for the value not received from the under-specified plant materials. No additional compensation will be made to the Contractor for plants installed that exceed specifications.

902-2.3.5. WARRANTY

- A. The Contractor shall warranty all palms and trees furnished under this contract for a period of one (1) year and all shrubs for a period of six (6) months. Material which is either dead or in poor health during this period or at completion will be replaced at no charge to the city. Should any of the plant materials show 50% or more defoliation during the warranty period, due to the Contractor’s use of poor quality or improper materials or workmanship, the Contractor upon notice, shall replace without delay same with no additional cost to the city. Should any plant require replacing, the new plant shall be given the equal amount of warranty.

903. SODDING

Unless otherwise noted herein, the Contractor shall place all sod, either shown on the plans or at the direction of the Engineer, in conformance with the latest editions of *Sections 575, 981, 982 and 983 of FDOT’s Standard Specifications*. The area for sod application shall be loosened and excavated to a suitable depth and finished to a grade compatible with existing grass and structures. Sod shall be placed with edges in contact and shall be compacted to uniform finished grade with a sod roller immediately after placement. In sloped areas, the sod shall be graded and placed so as to prohibit erosion and undermining of the adjacent sidewalk. No sod that has been cut for more than seventy-two (72) hours can be used. The city shall be notified in advance by 2 business days and reserves the right to view and inspect the sod before installation. A city Project Manager shall inspect the sod at the site once delivered and will not be allowed to be laid until approved. The sod shall be thoroughly watered immediately after placement. The Contractor shall continue to water sod as needed and/or directed by the Engineer as indicated by sun exposure, soil, heat, and rain conditions, to establish and assure growth, until termination of the contract. Dead sod, or sod not acceptable to the Engineer, shall be removed and replaced by the Contractor at no additional compensation. Any questions concerning the type of existing sod shall be determined by the Engineer.

Unless otherwise noted on the plans, payment for sod (including labor, equipment, materials, placement, rolling, watering, etc.) shall be included in other bid items. Payment for these associated bid items may be withheld until the Contractor provides the city a healthy, properly placed stand of grass. When this work is given as a separate bid item, it shall cover all labor, equipment and materials, (including water) required for this work and shall be paid for on the basis of each square foot in place and accepted. No payment for sod shall be made until the Contractor provides the city a healthy, properly placed stand of grass.

904. SEEDING

Seed, or seed and mulch, shall only be used when specified for certain demolition projects. The seed and/or mulch shall be placed as called for on the plans in the following manner. The area to be seeded shall be brought to the required line and grade, fertilized, and seeded in basic conformance with *FDOT's Standard Specifications Sections 570, 981, 982 and 983*. However, no wildflower seed shall be used, and Argentine Bahia Seed shall be used instead of Pensacola Bahia. No sprigging will be required. Also, the addition of 20 lb. of Rye Seed (to total 60 lb. of seed per acre) will be required during the stated periods. It is also required that the Contractor maintain said seed until growth is assured.

When this work is given as a bid item, the item shall cover all labor, material, equipment (including water), required for this work, and shall be paid for on the basis of each square yard in place and accepted. If called for on the plans, but not shown as a bid item, then the cost of such work as stated above shall be included in the cost of other work.

905. LAWN MAINTENANCE SPECIFICATIONS

905-1. SCOPE

To remove trash and debris from landscape and paved area; maintenance and fertilization of plant beds and landscape materials; maintenance, repair, and operation of irrigation systems; ornamental pest control; palm pruning; maintenance of traffic; and the cleaning of hard surfaces at designated areas. The Contractor is to work with the city in coordinating maintenance activities and reporting irregularities in the work zone.

The Contractor(s) will provide the labor and materials required to maintain the specified landscaped street areas including:

- Traffic safety and Maintenance of Traffic.
- Trash and debris removal from the job site.
- Removal of weeds in landscaped areas and hard surfaces.
- Proper trimming and pruning of landscape plants and palms.
- Proper fertilization and pest control of landscape and palms (may be subcontracted).
- Irrigation service and repair.
- Mulch replacement.
- Cleaning of hard surfaces; and the
- Reporting of irregularities at the job site.

905-2. SCHEDULING OF WORK

The Contractor(s) shall accomplish all landscape maintenance required under the contract between the hours of 7:00 a.m. and 6:00 p.m. Monday through Saturday, excluding observed holidays. The city may grant, on an individual basis, permission to perform contract maintenance at other hours.

All work shall be completed in a continuous manner, such as cleanup, weeding, trimming, etc., be completed before leaving the job site.

905-3. WORK METHODS

905-3.1. MAINTENANCE SCHEDULING

The Contractor(s) will adhere to a work schedule provided by the city (see Level of Service). Any variations to that schedule, requested by either party, must be approved, either verbally or in writing by an authorized representative of the other party.

905-3.2. DUTIES PER SERVICE VISIT

The Contractor(s) shall provide the following service at each scheduled visit to the designated location:

905-3.2.1. LITTER AND DEBRIS

Remove trash and debris from the project site. Proper disposal of collected trash and debris is the Contractor's responsibility. Extraordinary amounts of debris caused by hurricanes, tornadoes, vandalism, etc., would be the responsibility of the city to clean up. The Contractor should report such accumulations of debris when they are encountered. Bids for the extraordinary cleanup from the Contractor would be considered. Work sites should be left in a clean and neat appearance upon completion. All debris from pruning process is to be removed from the job site and disposed of by the Contractor.

905-3.2.2. VISUAL CHECK

The site should be checked for irregularities, such as irrigation leaks, vehicle damage, dead or damaged plant material, vandalism, etc., which should be reported to the city within twenty-four (24) hours after providing the service.

905-3.2.3. PLANT TRIMMING AND PALM PRUNING

All plant material should be trimmed in a manner that promotes the natural shape and mature size of the particular species. Trimming should be performed at intervals that will maintain plants in a neat appearance. Trimming should be performed to promote fullness of the plants, while maintaining height restrictions in Clear Sight Zones as established on the landscape plans. Plants shall be kept trimmed to the back of curb. Brown foliage shall be removed from Liriope.

Palm pruning to be performed at least once per year, preferably in late June or July following flower formation, consistent with the following specification.

1. PHOENIX SPECIES (CANARY DATE, INDIA DATE, PYGMY DATE, ETC.):

Remove all descending fronds, to the base of the frond; all parallel and ascending fronds are to remain in order to leave a full, rounded head; seed heads may remain, but remove old faded heads that are encountered in the pruning process; and remove loose frond boots; remove vegetation, such as strangler figs, Brazilian Pepper, Asparagus fern, etc., growing in the frond boots or on the trunk. Provide the rounded, classic cut on all Medjool palm boots. No climbing spikes allowed on palms.

905-3.2.3.1. TRAFFIC CONTROL

Proper and safe work zones in vehicular traffic areas are to be set up and maintained by the Contractor, according to the approved Maintenance of Traffic specifications.

905-3.2.3.2. PEDESTRIAN SAFETY

Contractor is responsible for maintaining safe work zones in areas where pedestrian and park users are present. The city reserves the right to limit the hours of operation in certain high pedestrian use areas.

905-3.2.4. WEED REMOVAL IN LANDSCAPED AREA

Weeds should be removed on a regular basis in order to keep them from being visibly noticeable. Weed control with the use of appropriate herbicides is allowable, given they are properly applied by a certified applicator. Herbicide damage to landscape material will be remedied by Contractor at their expense.

905-3.2.5. MULCH CONDITION

Should be maintained at a thickness that will discourage weed growth as well as help retain soil moisture, usually three inches (3”).

905-3.2.6. IRRIGATION SERVICE AND REPAIR

Should be performed at each visit to assure the system’s proper operation and timing. Drip tubing should be kept covered with mulch. Timer should be checked for proper time of day and operating schedule. Leaks or breaks in the system should be repaired before the next scheduled system running time.

905-3.2.7. LAWN AND ORNAMENTAL PEST CONTROL

Should be performed by a properly licensed and certified applicator to keep pest populations at a less than damaging level. Landscape materials lost to or extensively damaged by pests will be replaced by the Contractor at the Contractor’s expense. Diazinon products are not to be used on city properties.

905-3.2.8. PALM FERTILIZATION

Apply three (3) pounds of Magnesium sulfate and one pound of Potassium evenly, per tree, across the root zone (typically within the dripline), annually in early February.

905-3.2.9. FREEZE PROTECTION

The city will provide a freeze/frost protection fabric for the Contractor to install over freeze/frost sensitive plants (Lantana and Pentas). The covering material will be stored at a city facility. Contractor will remove the covering material from storage and install over the sensitive plants, securely fastening edges of the material to the ground per manufacturer’s directions. The city will furnish metal pins needed for securing fabric to the ground. The city will notify the Contractor one (1) day or twenty-four (24) hours minimum prior to the need to protect plant material. After uses, the Contractor will prepare the fabric for storage and return it to the designated city facility. Protective covering shall be removed the following afternoon or remain in place as directed by the city. The city shall notify the Contractor by 11:00 a.m. about removing the cover or keeping it in place due to continued freezing temperatures. The city may cancel the freeze protection event at any time prior to the end of the scheduled installation day (5:00 p.m.) The Contractor will be compensated for the number of hours mobilization or on-site work at the contracted rate per man-hour unit price. The Contractor shall provide a unit price for the installation and removal of the covering fabric on a per event basis, as well as an hourly rate per employee required. The city and Contractor will coordinate appropriate irrigation operations with weather conditions. Should freeze/frost damage occur, the Contractor shall perform remedial work as per unit basis, as directed by the city.

906. LEVEL OF SERVICE

The Project Site is to be serviced weekly. Repairs to damage or vandalism to be made within seven (7) working days of reported irregularity. Weekly visits should occur no closer than six (6) and no further than ten (10) calendar days apart.

907. COMPLETION OF WORK

Within twenty-four (24) hours of completing work, notify the city Project Manager either in writing of said completion and request the substantial completion letter.

908. INSPECTION AND APPROVAL

Upon receiving notification from the Contractor, the city shall inspect the serviced location the following business day. If, upon inspection, the work specified has not been completed, the city shall contact the Contractor to indicate the necessary corrective measures. The Contractor will be given forty-eight (48) hours from this notification to make appropriate corrections. If the work has been completed successfully then the city will pay for services billed.

909. SPECIAL CONDITIONS

1. This location will be newly installed and under warranty by the installer for a twelve (12) month period on plants, trees, and palms. Landscape installer will coordinate irrigation operation with the Maintenance contractor to assure adequate irrigation to the landscape materials. Installer will also be responsible for the untying of palm heads/fronds as they feel appropriate.
2. All listed acreage or square footage figures are estimates.
3. All work shall be performed in a good and workmanlike manner, consistent with trade practices and standards which prevail in the industry.
4. The Contractor shall be responsible for damage to any plant material or site feature caused by the Contractor or their employees. The Contractor shall be notified in writing of the specific nature of the damage and cost of repair. The city shall, at its option, invoice the Contractor for the payment, or reduce by the amount of the repairs on the next regular payment to the Contractor.
5. Occasionally circumstances (standing water, prolonged inclement weather, parked vehicles, etc.) may make all or portions of a location unserviceable during the regular schedule. The Contractor shall notify the city Supervisor of such occurrences and shall schedule to perform the required work to the location as soon as the pertaining circumstances are relieved.

910. TREE PROTECTION

910-1. TREE BARRICADES

- A. A protective barrier shall be placed around all protected trees and palms prior to land preparation or construction activities within or adjacent to the work zone, including all staging and/or lay down areas. Protective barriers shall be installed as follows:
 1. At or greater than the full dripline of all species of Mangroves and Cabbage Palms.
 2. At or greater than the full dripline or all protected native pine trees and other conifer species.
 3. At or greater than two-thirds (2/3) of the dripline of all other protected species
 4. At or greater than the full dripline of trees within a specimen tree stand.
- B. Protective barriers are to be constructed using no less than two-inch (2") lumber for upright posts. Upright posts are to be at least four feet (4') in length with a minimum of one foot (1') anchored in the ground. Upright posts are to be placed at a maximum distance of eight feet (8') apart. Horizontal rails are to be constructed using no less than one-inch (1") by four-inch (4") lumber and shall be securely attached to the top of the upright post. The city's Project Manager must approve any variation from the above requirements.

- C. Whenever a protective barrier is required, it shall be in place until all construction activity is terminated. The area within the barrier limits shall remain undisturbed by any activity during construction. Native ground cover and understory vegetation existing within the barriers shall remain throughout construction. Exotic plant species may only be removed by manual labor utilizing hand tools or by other means if authorized in writing by the city's Project Manager
- D. Prior to the erection of any required protective barrier, all surface foreign material, trash or debris shall be removed from the area enclosed by the barrier, and after erection of the barrier no such material or litter shall be permitted to remain within the protected area. No equipment, chemicals, soil deposits or construction materials shall be placed within such protective barriers.
- E. No signs, building permits, wires, or other attachments of any kind shall be attached to any protected tree or palm.
- F. At all times, due care shall be taken to protect the critical root zone of trees protected by this section, and root pruning requirements shall apply to such trees.

910-2. ROOT PRUNING

- A. Where proposed construction improvements involve excavation and/or impacts to the critical root zone of protected trees, the Contractor shall be required to have an International Society of Arboriculture (ISA) certified arborist perform, or directly supervise root pruning to reduce the impacts of construction. The critical root zone is equivalent to the tree's dripline. Prior to any clearing, grubbing or excavation activities, the affected roots must be severed by clean pruning cuts at the point where grubbing or excavation impacts the root system. Roots can be pruned utilizing specified root pruning equipment designed for that purpose or by hand digging a trench and pruning roots with a pruning saw, chain saw, or other equipment designed for tree pruning. Root pruning by trenching equipment or excavation equipment is strictly prohibited. Roots located in the critical root zone that will be impacted by construction activities shall be pruned to a minimum depth of eighteen inches (18") below existing grade or to the depth of the proposed impact if less than eighteen inches (18") from existing grade. Any questions should be addressed to the city's Project Manager.
- B. Root pruning shall only be performed by or under the direct supervision of an International Society of Arboriculture (ISA) certified arborist.
- C. Any proposed root pruning trenches shall be identified on site (i.e. staked or painted) inspected and approved by the city's Project Manager and/or Representative prior to actual root pruning.
- D. Root pruning shall be performed as far in advance of other construction activities as is feasible, but at a minimum shall be performed prior to ANY impacts to the soil. Associated tree protection measures should be implemented upon completion of said root pruning.
- E. If there is a likelihood of excessive wind and/or rain exceptional care shall be taken on any root pruning activities.
- F. Root pruning shall be limited to a minimum of ten inches (10") per one inch (1") of the trunk diameter from the tree base. Any exception must be approved by the city's Project Manager prior to said root pruning.
- G. Roots shall be cut cleanly, as far from the trunk of the tree as possible. Root pruning shall be done to a minimum depth of eighteen inches (18") from existing grade, or to the depth of the disturbance if less than eighteen inches (18").
- H. Root pruning shall be performed using a root cutting machine specifically designed for this purpose. Alternate equipment or techniques must be approved by the city's Project Manager, prior to any work adjacent to trees to be preserved.
- I. Root pruning shall be completed, inspected, and accepted prior to the commencement of any excavation or other impacts to the critical root zones of trees to be protected.
- J. Excavations in an area where root are present shall not cause the tearing or ripping of tree roots. Roots must first be cleanly severed prior to continuing with the excavation or tunneled around to prevent damage to the root.

- K. Tree roots shall not be exposed to drying out. Root ends shall be covered with native soil or burlap and kept moist until final backfill or final grades has been established.
- L. When deemed appropriate (e.g., during periods of drought) the city Project Manager may require a temporary irrigation system be utilized in the remaining critical root zones of root pruned trees.
- M. When underground utility lines are to be installed within the critical root zone, the root pruning requirement may be waived if the lines are installed via tunneling or directional boring as opposed to open trenching.

910-3. PROPER TREE PRUNING

- A. All tree pruning and/or root pruning on existing trees to remain shall only be performed by or under the direct supervision of an International Society of Arboriculture (ISA) certified arborist. Furthermore, all tree work shall conform to the American National Standards Institute (ANSI) 2001, American National Standard for tree care operations – Tree, Shrub, and other Woody Plant Maintenance – Standard practices (pruning) ANSI A-300.
- B. Proper pruning techniques for all lateral branches of protected trees are required. Flush cuts (pruning cuts that remove the branch collar) and stub cuts (cuts that leave a stub on the tree) are improper techniques. Any protected tree that has been improperly pruned will not be recognized as a tree left on the project in a healthy growing condition and will require replacement consistent with the current City Code of Ordinances and Community Development Code.
- C. No protected tree shall have more than thirty percent (30%) of its foliage removed.
- D. No protected tree shall be topped, hat raked, or lion tailed. Any protected tree that has been improperly pruned will not be recognized as a tree left on the project in a healthy growing condition and will require replacement consistent with the current City Code of Ordinances and Community Development Code.
- E. Tree Trunks and limbs shall be protected. The use of tree spikes or other devices that damage trunk and bark tissue on protected trees shall be prohibited. Any protected tree that has been damaged in such a manner will not be recognized as a tree left on the project in a healthy growing condition and will require replacement consistent with the current City Code of Ordinances and Community Development Code.

911. IRRIGATION SYSTEM DESIGN

The requirements for Irrigation System Design are the following:

- A. The application rate must not exceed the ability of the soil to absorb and retain the water applied during any one application.
- B. The design operating pressure must not be greater than the available source pressure.
- C. The design operating pressure must account for peak use times and supply line pressures at final buildout for the entire system.
- D. Distribution devices and pipes should be designed for optimum uniform coverage. The first and last distribution device should have no more than a 10% difference in flow rate. This usually corresponds to about a 20% difference in pressure.
- E. “Head to head” placement of sprinklers to achieve 100% coverage.
- F. Flexibility must exist to meet a site’s peak water requirements and allow for the modification of the system’s operation to meet seasonal irrigation changes or local restrictions.
- G. Distribution equipment (such as pop-ups, rotors, bubblers and drip) in a given zone must have the same precipitation rate.
- H. Turf and landscape areas should be zoned separately based on plant water requirements. Bubblers, drip, rotors and pop-ups will all be on separate zones.
- I. All water delivery devices (heads, tree bubblers, valves) shall be free of buried obstructions 8-10” below each device to be acceptable.

- J. Install valves in Turf areas where possible
- K. Install all irrigation heads at finish grade unless approved by Parks and Rec. **before installation.**
- L. The design package should include a general irrigation schedule with recommendations and instructions on modifying the schedule for local climatic and growing conditions.
- M. If required by plant species, the design should account for the need to leach out salt buildup from poor quality water.
- N. Water supply systems (such as wells and pipelines) should be designed for varying control devices, and backflow prevention.
- O. Water conveyance systems should be designed with thrust blocks and air release valves, such that **flow velocity is 5 feet per second or less.**
- P. Pipelines should be designed to provide the system with the appropriate pressure required for maximum irrigation uniformity.
- Q. Pressure regulating or compensating equipment must be used where the system pressure exceeds the manufacturer’s recommendations.
- R. Equipment with check valves must be used in low areas to prevent low head drainage.
- S. A rain-sensing device must be used to automatically shut off system when raining.
- T. Non-planted areas, including impervious surfaces should not be irrigated.
- U. The city of Clearwater, Parks and Beautification must approve irrigation plan before irrigation construction begins.

912. IRRIGATION SYSTEM INSTALLATION

The requirements for Irrigation System Installation are the following:

- A. Only qualified specialists under the direct supervision of a “Certified Irrigation Designer” or a “Certified Irrigation Contractor” should install the irrigation system. Certifications are through “The Irrigation Association”.
- B. The construction must be consistent with the design.
- C. The designer must approve any design changes before construction.
- D. Construction and materials should meet existing standards and criteria.
- E. **Mainline** – To be laid with tracking wire / tape firmly attached throughout project. Leave 18” of excess cable at terminal ends in 6” round valve boxes. See Parks and Rec Irrigation Spec page for type.
- F. Sleeve size will be 2 times the diameter of pipe to be sleeved. Example 1.5” feed pipe dia. = 3” sleeve diameter.
- G. Acceptable safety practices must be followed during construction.
- H. All underground cables, pipes and other obstacles should be identified, and their locations flagged.
- I. Obtain all permits before construction.
- J. Always give the city Engineering and Parks & Recreation Department a copy of the As-Built plans, operating manuals, warranties, and written instructions on how to change the irrigation system’s timers/clock/controllers.
- K. At the end of construction, the site must be cleaned of all construction materials.

SECTION IVA

EAST WRF INFLUENT PUMP STATION REHABILITATION PROJECT

SUPPLEMENTAL TECHNICAL SPECIFICATIONS

(PROJECT No. 13-0016-UT)

PREPARED FOR:



CITY OF CLEARWATER
ENGINEERING DEPARTMENT
100 SOUTH MYRTLE AVENUE
CLEARWATER, FL 33756

PREPARED BY:



ARDURRA GROUP, INC.
4921 MEMORIAL HIGHWAY, SUITE 300
TAMPA, FL 33634

This item has been digitally signed and sealed by Loc P. Truong, P.E. on the date adjacent to the seal.

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Bid Documents

September 2023

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SECTION 01005

GENERAL REQUIREMENTS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Description

The work to be completed consists of the furnishing of all labor, materials and equipment, and the performance of all Work included in this Contract. At all times during the project the Water Reclamation Facility (WRF) shall remain in service. Throughout the project, the Contractor shall cooperate fully with operations staff in order to minimize disruption to facility operations. No facility or structure shall be taken out of service, except those specifically scheduled to be renovated or demolished, without the prior written approval of the Owner or Engineer. Plant operations and regulatory compliance will take priority over and may impact the construction schedule.

B. The construction period for this project is four hundred fifty (450) consecutive calendar days until Substantial Completion, followed by an additional thirty (30) consecutive calendar days for Final Completion.

C. Work Included

The Contractor shall furnish all labor, superintendence, materials, plants, power, light, heat, fuel, water, tools, appliances, equipment, supplies and other means of construction necessary or proper for performing and completing the Work. The Contractor shall perform and complete the Work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Engineer, and in strict accordance with the Contract Documents. The Contractor shall clean up the Work and maintain it during and after construction, until accepted, and shall do all work and pay all costs incidental thereto. The Contractor shall repair or restore all structures and property that may be damaged or disturbed during performance of the Work.

The cost of incidental work described in these General Requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the work and shall be included in the prices for the various Contract Items. No additional payment will be made therefore.

The Contractor shall provide and maintain such modern plant, tools, and equipment as may be necessary, in the opinion of the Engineer, to perform

1 in a satisfactory and acceptable manner all the work required by this
2 Contract. Only equipment of established reputation and proven efficiency
3 shall be used. The Contractor shall be solely responsible for the adequacy
4 of his workmanship, materials and equipment, prior review of the Engineer
5 notwithstanding.
6

7 D. Public Utility Installation and Structures
8

9 Public utility installations and structures shall be understood to include all
10 poles, tracks, pipes, wires, conduits, house service connections, vaults,
11 manholes and all other appurtenances and facilities pertaining thereto
12 whether owned or controlled by the Owner, other governmental bodies or
13 privately owned by individuals, firms or corporations, used to serve the
14 public with transportation, traffic control, gas, electricity, telephone,
15 sewerage, drainage, water or other public or private property which may be
16 affected by the work shall be deemed included hereunder.
17

18 The Contractor shall protect all public utility installations and structures from
19 damage during the work. Access across any buried public utility installation,
20 or structure, shall be made only in such locations and by means reviewed
21 by the Engineer. The Contractor shall so arrange their operations as to
22 avoid any damage to these facilities. All required protective devices and
23 construction shall be provided by the Contractor at their expense. All
24 existing public utilities damaged by the Contractor, which are shown on the
25 Plans or have been located in the field by the utility, shall be repaired by the
26 Contractor, at their expense, as directed by the Engineer. No separate
27 payment shall be made for such protection or repairs to public utility
28 installations or structures.
29

30 Public utility installations or structures owned or controlled by the Owner or
31 other governmental body, which are shown on the Plans to be removed,
32 relocated, replaced or rebuilt by the Contractor shall be considered as a part
33 of the general cost of doing the Work and shall be included in the prices bid
34 for the various contract items. No separate payment shall be made
35 therefore.
36

37 Where public utility installations or structures owned or controlled by the
38 Owner or other governmental body are encountered during the course of
39 the Work, and are not indicated on the Plans or in the Specifications, and
40 when, in the opinion of the Engineer, removal, relocation, replacement or
41 rebuilding is necessary to complete the work under this Contract, such work
42 shall be accomplished by the utility having jurisdiction, or such work may be
43 ordered, in writing by the Engineer, for the Contractor to accomplish. If such
44 work is accomplished by the utility having jurisdiction it will be carried out
45 expeditiously and the Contractor shall give full cooperation to permit the
46 utility to complete the removal, relocation, replacement or rebuilding as

1 required. If such work is accomplished by the Contractor, it will be in
2 accordance with the General and Supplemental General Conditions.

3
4 The Contractor shall give written notice to Owner and other governmental
5 utility departments and other owners of public utilities of the locations of
6 their proposed construction operations, at least forty-eight hours in advance
7 of breaking ground in any area or on any unit of the work.

8
9 The maintenance, repair, removal, relocation or rebuilding of public utility
10 installations and structures, when accomplished by the Contractor as herein
11 provided, shall be done by methods reviewed by the Engineer.

12 13 1.02 DRAWINGS AND SPECIFICATIONS

14 15 A. Drawings

16
17 When obtaining data and information from the Drawings, figures shall be
18 used in preference to scaled dimensions, and large scale drawings in
19 preference to small scale drawings.

20 21 B. Copies Furnished to Contractor

22
23 The Engineer may incorporate the addenda into a set of “conformed”
24 drawings and specifications, and may provide one electronic copy of each
25 to the Contractor. The conformed drawings and specifications shall not
26 supersede the Contract Documents provided to the Contractor. It shall be
27 the responsibility of the Contractor to check that the conformed drawings
28 and specifications properly include all revisions/addenda to the Contract
29 Documents. The Contractor shall furnish each of the subcontractors,
30 manufacturers, and suppliers such copies of the Contract Documents as
31 may be required for their work. Additional copies of the Drawings and
32 Specifications, when requested, may be furnished to the Contractor at cost
33 of reproduction.

34 35 C. Supplementary Drawings

36
37 When, in the opinion of the Engineer, it becomes necessary to explain more
38 fully the work to be done or to illustrate the work further or to show any
39 changes which may be required, Drawings known as Supplementary
40 Drawings, with Specifications pertaining thereto, will be prepared by the
41 Engineer and copies thereof will be given to the Contractor and the Owner.

42 43 D. Contractor to Check Drawings and Data

44
45 The Contractor shall verify all dimensions, quantities and details shown on
46 the Drawings, Supplementary Drawings, Schedules, Specifications or other

1 data received from the Engineer and shall notify him of any errors,
2 omissions, conflicts and discrepancies found therein. The Contractor shall
3 submit to the Engineer a Request for Information (RFI), consecutively
4 numbered, detailing all conflicts and discrepancies. Engineer shall promptly
5 provide a response to all RFIs submitted by the Contractor. Contractor will
6 not be allowed to take advantage of any conflicts and discrepancies, as full
7 instructions will be furnished by the Engineer, should such conflicts and
8 discrepancies be discovered.

9
10 E. Specifications

11
12 The Technical Specifications generally consist of three parts: General,
13 Products, and Execution. The General Section contains General
14 Requirements that govern the work. Products and Execution modify and
15 supplement these by detailed requirements for the work and shall always
16 govern whenever there appears to be a conflict.

17
18 F. Intent

19
20 All Work called for in the Specifications applicable to this Contract, but not
21 shown on the Drawings in their present form, or vice versa, shall be of like
22 effect as if shown or mentioned in both. Work not specified in either the
23 Drawings or in the Specifications, but involved in carrying out their intent or
24 in the complete and proper execution of the work, is required and shall be
25 performed by the Contractor as though it were specifically delineated or
26 described.

27
28 The apparent silence of the Specifications as to any detail, or the apparent
29 omission from them of a detailed description concerning any work to be
30 done and materials to be furnished, shall be regarded as meaning that only
31 the best general practice is to prevail and that only material and
32 workmanship of the best quality is to be used, and interpretation of these
33 Specifications shall be made upon that basis.

34
35 The inclusion of the Related Requirements (or work specified elsewhere) in
36 the General part of the specifications is only for the convenience of the
37 Contractor, and shall not be interpreted as a complete list of related
38 Specification Sections.

39
40 1.03 MATERIALS AND EQUIPMENT

41
42 A. Manufacturer

43
44 The names of proposed manufacturers, suppliers and dealers who are to
45 furnish materials, fixtures, equipment, appliances or other fittings shall be
46 submitted to the Engineer for review. Such review must be obtained before

1 shop drawings will be checked. No manufacturer will be approved for any
2 materials to be furnished under this Contract unless the Contractor shall be
3 of good reputation and have a plant of ample capacity. The Contractor
4 shall, upon the request of the Engineer, be required to submit evidence that
5 he has manufactured a similar product to the one specified and that it has
6 been previously used for a like purpose for a sufficient length of time to
7 demonstrate its satisfactory performance. All transactions with the
8 manufacturers or subcontractors shall be through the Contractor, unless the
9 Contractor shall request, in writing to the Engineer, that the manufacturer or
10 subcontractor deal directly with the Engineer. Any such transactions shall
11 not in any way release the Contractor from his full responsibility under this
12 Contract.

13
14 Any two or more pieces of material or equipment of the same kind, type or
15 classification, and being used for identical types of service, shall be made
16 by the same manufacturer.

17
18 B. Delivery

19
20 The Contractor shall deliver materials in ample quantities to ensure the most
21 speedy and uninterrupted progress of the work so as to complete the work
22 within the allotted time. The Contractor shall also coordinate deliveries in
23 order to avoid delay in, or impediment of, the progress of the work of any
24 related Contractor.

25
26 C. Tools and Accessories

27
28 The Contractor shall, unless otherwise stated in the Contract Documents,
29 furnish with each type, kind or size of equipment, one complete set of
30 suitably marked high grade special tools and appliances that are needed to
31 adjust, operate, maintain or repair the equipment. Such tools and
32 appliances shall be furnished in approved painted steel cases, properly
33 labeled and equipped with good grade cylinder locks and duplicate keys.

34
35 Spare parts shall be furnished as specified. Where spare parts are
36 specified to be “manufacturer’s recommended” or “as recommended by the
37 manufacturer”, the Contractor shall furnish those spare parts that are
38 normally or commonly recommended by the manufacturer as shown on the
39 manufacturer’s readily available literature.

40
41 Each piece of equipment shall be provided with a substantial nameplate,
42 securely fastened in place and clearly inscribed with the manufacturer's
43 name, year of manufacture, serial number, weight and principal rating data.

44
45 D. Installation of Equipment

1 The Contractor shall have on hand sufficient proper equipment and
2 machinery of ample capacity to facilitate the work and to handle all
3 emergencies normally encountered in work of this character.
4

5 Equipment shall be erected in a neat and workmanlike manner on the
6 foundations at the locations and elevations shown on the Drawings, unless
7 directed otherwise by the Engineer during installation. All equipment shall
8 be correctly aligned, leveled and adjusted for satisfactory operation and
9 shall be installed so that proper and necessary connections can be made
10 readily between the various units.
11

12 The Contractor shall furnish, install and protect all necessary anchor and
13 attachment bolts and all other appurtenances needed for the installation of
14 the devices included in the equipment specified. Anchor bolts shall be as
15 reviewed by the Engineer and made of ample size and strength for the
16 purpose intended. Substantial templates and working drawings for
17 installation shall be furnished.
18

19 The Contractor shall, at their own expense, furnish all materials and labor
20 for, and shall properly bed in non-shrink grout, each piece of equipment on
21 its supporting base that rests on masonry foundations. Grout shall
22 completely fill the space between the equipment base and the foundation.
23 All metal surfaces coming in contact with concrete or grout shall receive a
24 coat of coal tar epoxy equal to Kop-Coat 300M.
25

26 E. Service of Manufacturer's Representative
27

28 The prices for equipment shall include the cost of furnishing a competent
29 and experienced engineer or superintendent who shall represent the
30 manufacturer and shall assist the Contractor, when required, to install,
31 adjust, test and place in operation the equipment in conformity with the
32 Contract Documents.
33

34 Prior to placing the equipment in permanent operation, the manufacturer
35 shall furnish to the Engineer and Contractor a written Certificate of Proper
36 Installation stating that the equipment has been installed in strict
37 accordance with the manufacturer's recommendations.
38

39 After the equipment is placed in operation by the Contractor, such engineer
40 or superintendent shall make all adjustments and tests required by the
41 Engineer to prove that such equipment is proper and in satisfactory
42 operating condition, and shall instruct/train such personnel as may be
43 designated by the Owner in the proper operation and maintenance of such
44 equipment.
45

46 1.04 INSPECTION AND TESTING

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A. General

For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Five copies of the reports shall be submitted and the authorities' certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.

If in the making of any test of any material or equipment it is ascertained by the Engineer that the material or equipment does not comply with the Contract, the Contractor will be notified thereof and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the work and replace it with acceptable material, without cost to the Owner.

Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.

The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage that may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

B. Costs

All inspection and testing of materials furnished under this Contract will be performed by the Owner or duly authorized inspections engineers or inspection bureaus without cost to the Contractor, unless otherwise expressly specified.

The cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents shall be borne by the Contractor and such costs shall be deemed to be included in the Contract price.

Materials and equipment submitted by the Contractor as equivalent to those specified may be tested by the Owner for compliance with the specifications. The Contractor shall reimburse the Owner for the expenditures incurred in making such tests on materials and equipment that are rejected for non-compliance.

C. Inspection of Materials

1 The Contractor shall give notice in writing to the Engineer, sufficiently in
2 advance of his intention to commence the manufacture or preparation of
3 materials especially manufactured or prepared for use in or as part of the
4 permanent construction. Such notice shall contain a request for inspection,
5 the date of commencement and the expected date of completion of the
6 manufacture or preparation of materials. Upon receipt of such notice, the
7 Engineer will arrange to have a representative present at such times during
8 the manufacture as may be necessary to inspect the materials or they will
9 notify the Contractor that the inspection will be made at a point other than
10 the point of manufacture, or they will notify the Contractor that inspection
11 will be waived. The Contractor must comply with these provisions before
12 shipping any material. Such inspection shall not release the Contractor
13 from its responsibility for furnishing materials meeting the requirements of
14 the Contract Documents.

15
16 D. Certificate of Manufacture

17
18 When inspection is waived or when the Engineer so requires, the Contractor
19 shall furnish authoritative evidence in the form of Certificates of Manufacture
20 that the materials to be used in the work have been manufactured and
21 tested in conformity with the Contract Documents. These certificates shall
22 be notarized and shall include copies of the results of physical tests and
23 chemical analyses, where necessary, that have been made directly on the
24 product or on similar products of the manufacturer.

25
26 E. Shop Tests of Operating Equipment

27
28 Each piece of equipment for which pressure, duty, capacity, rating,
29 efficiency, performance, function or special requirements are specified shall
30 be tested in the shop of the maker in a manner that shall conclusively prove
31 that its characteristics comply fully with the requirements of the Contract
32 Documents. No such equipment shall be shipped to the work until the
33 Engineer notifies the Contractor, in writing, that the results of such tests are
34 acceptable.

35
36 Five copies of the manufacturer's actual test data and interpreted results
37 thereof, accompanied by a certificate of authenticity sworn to by a
38 responsible official of the manufacturing company, shall be forwarded to the
39 Engineer for review.

40
41 The cost of shop tests and of furnishing manufacturer's preliminary and
42 shop test data of operating equipment shall be borne by the Contractor.

43
44 F. Preliminary Field Tests

1 As soon as conditions permit, the Contractor shall furnish all labor,
2 materials, and instruments and shall make preliminary field tests of
3 equipment. If the preliminary field tests disclose any equipment furnished
4 under this Contract that does not comply with the requirements of the
5 Contract Documents, the Contractor shall, prior to the acceptance tests,
6 make all changes, adjustments and replacement required. The Contractor
7 shall assist in the preliminary field tests as applicable.
8

9 G. Final Field Tests

10
11 Upon completion of the work and prior to final payment, all equipment and
12 systems installed under this Contract shall be subjected to acceptance tests
13 as specified or required to prove compliance with the Contract Documents.
14

15 The Contractor shall furnish labor, fuel, energy, water and all other
16 materials, equipment and instruments necessary for all acceptance tests,
17 at no additional cost to the Owner. The equipment suppliers and
18 subcontractors shall assist in the final field tests, as applicable.
19

20 H. Failure of Tests

21
22 Any defects in the materials and equipment or their failure to meet the tests,
23 guarantee or requirements of the Contract Documents shall be promptly
24 corrected by the Contractor by replacement or otherwise as directed by the
25 Engineer. The decision of the Engineer as to whether or not the Contractor
26 has fulfilled his obligations under the Contract shall be final and conclusive.
27 If the Contractor fails to make these corrections or if the improved materials
28 and equipment, when tested, shall again fail to meet the guarantees or
29 specified requirements, the Owner, notwithstanding its partial payment for
30 work, materials and equipment, may reject the work, materials and
31 equipment and may order the Contractor to remove them from the site at
32 his own expense.
33

34 I. Final Inspection

35
36 During such final inspections, the work shall be clean and free from water.
37 In no case will the final change order be prepared until the Contractor has
38 complied with all requirements set forth and the Engineer has made his final
39 inspection of the entire work and is satisfied that the entire work is properly
40 and satisfactorily constructed in accordance with the requirements of the
41 Contract Documents.
42

43 1.05 TEMPORARY STRUCTURES

44 A. Temporary Fences
45
46

1 If, during the course of the work, it is necessary to remove or disturb any
2 fence or part thereof, the Contractor shall, at his own expense, if so ordered
3 by the Engineer, provide a suitable temporary fence, which shall be
4 maintained until the permanent fence is replaced. The Engineer shall be
5 solely responsible for the determination of the necessity for providing a
6 temporary fence and the type of temporary fence to be used.

7
8 B. Temporary Driveways

9
10 At its own expense, the Contractor shall furnish, install, maintain and
11 remove all temporary driveways and access roads required to provide
12 access to the work and through the site of the work to maintain existing
13 operations and to allow construction of other projects in the area. The
14 Contractor shall fully cooperate with the Owner in providing this access.

15
16 C. Temporary Structures and Facilities

17
18 The Contractor shall construct any temporary piping and facilities as
19 required in order to maintain existing treatment capacity and operations
20 during construction.

21
22 1.06 TEMPORARY SERVICES

23
24 A. First Aid

25
26 The Contractor shall keep upon the site, at each location where work is in
27 progress, a completely equipped first aid kit and shall provide ready access
28 thereto at all times when people are employed on the work.

29
30 1.07 LINE AND GRADE

31
32 A. Line and Grade

33
34 All work under this Contract shall be constructed in accordance with the
35 lines and grades shown on the Drawings, or as given by the Engineer. The
36 full responsibility for maintaining alignment and grade rests upon the
37 Contractor.

38
39 The Contractor, prior to commencing of construction, shall have established
40 bench marks and base line controlling points. The Contractor shall so place
41 excavation and other materials as to cause no inconvenience in the use of
42 the reference marks provided. He shall remove any obstructions placed by
43 him contrary to this provision.

44
45 B. Surveys

1 The Contractor shall furnish and maintain, at his own expense, stakes and
2 other such materials to establish all working or construction lines and
3 grades, as required, and shall be solely responsible for the accuracy
4 thereof.

5
6 All surveying shall be performed in accordance with Specification 01050.

7
8 C. Safeguarding Marks

9
10 The Contractor shall safeguard all points, stakes, grade marks, monuments
11 and bench marks made or established on the work, bear the cost of re-
12 establishing them if disturbed, and bear the entire expense of rectifying work
13 improperly installed due to not maintaining or protecting or to removing
14 without authorization such established points, stakes and marks.

15
16 The Contractor shall safeguard all existing and known property corners,
17 monuments and marks adjacent to but not related to the work and, if
18 required, shall bear the cost of re-establishing them if disturbed or
19 destroyed.

20
21 1.08 ADJACENT STRUCTURES AND LANDSCAPING

22
23 A. The Contractor shall also be entirely responsible and liable for all damage
24 or injury as a result of his operations to all other adjacent public and private
25 property, structures of any kind and appurtenances thereto met with during
26 the progress of the work. The cost of protection, replacement in their
27 original locations and conditions or payment of damages for injuries to such
28 adjacent public and private property and structures affected by the work,
29 whether or not shown on the Drawings or specified shall be included in the
30 various Contract Items and no separate payments will be made therefore.
31 Where such public and private property, structures of any kind and
32 appurtenances thereto are not shown on the Drawings and when, in the
33 opinion to avoid interference with the work, payment therefore will be made
34 as provided for in the General Conditions.

35
36 Contractor is expressly advised that the protection of buildings structures,
37 tunnels, tanks, pipelines, etc. and related work adjacent to and in the vicinity
38 of their operations, wherever they may be, is solely his responsibility.
39 Conditional inspection of buildings or structures in the immediate vicinity of
40 the project which may reasonably be expected to be affected by the Work
41 shall be performed by and be the responsibility of the Contractor.

42
43 Contractor shall, before starting operations, make an examination of the
44 interior and exterior of the adjacent structures, buildings, facilities, etc., and
45 record by noted, measurements, photographs, etc., conditions which might
46 be aggravated by open excavation and construction. Repairs or

1 replacement of all conditions disturbed by the construction shall be made to
2 the satisfaction of the Owner and to the satisfaction of the Engineer. This
3 does not preclude conforming to the requirements of the insurance
4 underwriters. Copies of surveys, photographs, reports, etc., shall be given
5 to the Engineer.
6

7 Prior to the beginning of any excavations, the Contractor shall advise the
8 Engineer of all buildings or structures on which he intends to perform work
9 or which performance of the project work will affect.

10
11 B. Protection of Trees

12
13 1. The Contractor shall adequately protect all trees and shrubs with
14 boxes or otherwise in accordance with ordinances governing the
15 protection of trees. No excavated materials shall be placed so as to
16 injure such trees or shrubs. Trees or shrubs destroyed through
17 negligence of the Contractor or his employees shall be replaced with
18 new stock of similar size and age, in the proper season and at the
19 sole expense of the Contractor.
20

21 2. Beneath trees or other surface structures, where possible, pipelines
22 may be built in short tunnels, backfilled with excavated materials,
23 except as otherwise specified, or the trees or structures carefully
24 supported and protected from damage.
25

26 3. The Owner may order the Contractor, for the convenience of the
27 Owner, to remove trees along the line or trench excavation. If so
28 ordered, the Owner will obtain any permits required for removal of
29 trees.
30

31 C. Lawn Areas

32
33 Lawn areas shall be left in as good condition as before the starting of the
34 work. Where sod is to be removed, it shall be carefully removed, and later
35 replaced, or the area where sod has been removed shall be restored with
36 new sod.
37

38 D. Restoration of Fences

39
40 Any fence, or part thereof, that is damaged or removed during the course
41 of the work shall be replaced or repaired by the Contractor and shall be left
42 in as good or better a condition as existed before starting the work. The
43 manner in which the fence is repaired or replaced and the materials used in
44 such work shall be subject to the review of the Engineer. No additional
45 payment will be made for the replacement or repair of any fence.
46

1 1.09 PROTECTION OF WORK AND PUBLIC

2
3 A. Barriers and Lights

4
5 During the prosecution of the work, the Contractor shall put up and maintain
6 at all times such barriers and lights as will effectively prevent accidents. The
7 Contractor shall provide suitable barricades, red lights, "danger" or "caution"
8 or "street closed" signs and watchmen at all places where the work causes
9 obstructions to the normal traffic or constitutes in any way a hazard to the
10 public.

11
12 B. Smoke Prevention

13
14 The Contractor shall use hard coal, coke, oil or gas as fuel for equipment
15 generating steam. A strict compliance with ordinances regulating the
16 production of emission of smoke will be required. No open fires will be
17 permitted.

18
19 C. Noise

20
21 The Contractor shall eliminate noise to as great an extent as practicable at
22 all times. Air compressing plants shall be equipped with silencers and the
23 exhaust of all gasoline motors or other power equipment shall be provided
24 with mufflers. In the vicinity of hospitals and schools, special care shall be
25 used to avoid noise or other nuisances. The Contractor shall strictly
26 observe all local regulations and ordinances covering noise control.

27
28 No work shall be done between the hours of 7:00 P.M. and 7:00 A.M., or on
29 Sundays except as scheduled and required to occur during lower flow
30 periods. If the proper and efficient prosecution of the work requires
31 operations during the night, the written permission of the Engineer shall be
32 obtained before starting such items of the work.

33
34 D. Access to Public Services

35
36 Neither the materials excavated nor the materials or plant used in the
37 construction of the work shall be so placed as to prevent free access to all
38 fire hydrants, valves or manholes.

39
40 E. Dust Prevention

41
42 The Contractor shall prevent dust nuisance from his operations or from
43 traffic by keeping the roads and/or construction areas sprinkled with water
44 at all times or when directed by the Owner and/or Engineer.

45
46 1.10 CUTTING AND PATCHING

1
2 A. The Contractor shall do all cutting, fitting or patching of his portion of the
3 work that may be required to make the several parts thereof join and
4 coordinate in a manner satisfactory to the Engineer and in accordance with
5 the Drawings and Specifications. The work shall be performed by
6 competent workmen skilled in the trade required by the restoration.
7

8 1.11 CLEANING
9

10 A. During construction of the work, the Contractor shall, at all times, keep the
11 site of the work and adjacent premises as free from material, debris and
12 rubbish as is practicable and shall remove the same from any portion of the
13 site if, in the opinion of the Engineer, such material, debris, or rubbish
14 constitutes a nuisance or is objectionable.
15

16 The Contractor shall remove from the site all of his surplus materials and
17 temporary structures when no further need therefore develops.
18

19 B. Final Cleaning
20

21 At the conclusion of the work, all erection plant, tools, temporary structures
22 and materials belonging to the Contractor shall be promptly taken away,
23 and he shall remove and promptly dispose of all water, dirt, rubbish or any
24 other foreign substances.
25

26 The Contractor shall thoroughly clean all equipment and materials installed
27 by him and shall deliver such materials and equipment undamaged in a
28 bright, clean, polished and new operating condition.
29

30 1.12 MISCELLANEOUS
31

32 A. Protection against Siltation and Bank Erosion
33

34 1. The Contractor shall arrange his operations to minimize siltation and
35 bank erosion on construction sites and on existing or proposed water
36 courses, drainage ditches, wetlands and other areas of concern.
37

38 2. The Contractor, at his own expense, shall remove any siltation
39 deposits and correct any erosion problems as directed by the
40 Engineer that results from his construction operations.
41

42 3. The Contractor shall be solely responsible for any fines resulting from
43 the encroachment of any environmentally protected areas.
44

45 B. Protection of Wetland Areas
46

1 The Contractor shall properly dispose of all surplus material, including soil,
2 in accordance with Local, State and Federal regulations and the permits
3 issued for this project. Under no circumstances shall surplus material be
4 disposed of in wetland areas as defined by the Florida Department of
5 Environmental Protection, Southwest Florida Water Management District,
6 U.S. Army Corps of Engineers, etc.

7
8 C. Existing Facilities

9
10 The work shall be so conducted to maintain existing facilities in operation
11 insofar as is possible. Requirements and schedules of operations for
12 maintaining existing facilities in service during construction shall be as
13 described in these Specifications.

14
15 D. Use of Chemicals

16
17 All chemicals used during project construction or furnished for project
18 operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or
19 of other classification, must show approval of either EPA or USDA. Use of
20 all such chemicals and disposal of residues shall be in strict conformance
21 with manufacturers' instructions.

22
23 E. Tree Removal

24
25 The Contractor shall notify the Engineer and any regulatory authorities forty-
26 eight (48) hours in advance of any removal of trees on the project. No
27 clearing shall occur and no earth moving equipment shall be placed on-site
28 until after the notice has been issued. The Contractor shall provide
29 maintenance of the tree barricades and other preventive measures to
30 protect the trees that are to remain. Failure to notify the Engineer before
31 removing trees shall result in the in-kind replacement of the tree at no
32 additional cost to the Owner.

33
34 F. Sanitary and Storm Sewer Systems

35
36 The Contractor shall be entirely responsible for the satisfactory installation
37 of storm sewer and sanitary sewer systems to be in substantial
38 conformance to the approved Drawings. No roadway base or paving shall
39 be constructed until the Contractor has performed lamping of these lines to
40 his and the Engineer's satisfaction, and all storm sewer and sanitary sewer
41 invert grades are verified in the field by the Owner. The lamping of lines
42 and verification of elevations in no way absolves the Contractor from any of
43 contractual obligations.
44

1 G. Related Permits

2
3 The Contractor recognizes that the Owner has applied for, and may have
4 received, certain permits pertaining to the work. At the sole discretion of
5 the Owner, the Owner may assign said permits to the Contractor and the
6 Contractor shall accept said assignments upon such request from the
7 Owner.
8

9 H. All work in the vicinity of open waters, wetlands or any jurisdictional area is
10 to be performed in strict accordance with the environmental permits and
11 their conditions. Erosion barriers, when shown on the construction
12 Drawings, are the minimum required. If the Contractor's construction
13 methods require that additional erosion control is necessary to satisfy these
14 permits, such controls shall be supplied, installed and maintained
15 throughout the construction process by the Contractor at no additional cost
16 to the Owner or Engineer.
17

18 It is the sole responsibility of the Contractor to submit, in a timely manner,
19 any information, data, etc. that is required as a condition of a permit.
20 Required information, data, etc. shall be submitted directly to the permitting
21 agency by the Contractor with copies to the permittee and the Engineer.
22 The Contractor will be held responsible for any fine(s) or other action
23 resulting from a violation of permit conditions.
24

25 1.13 DISPOSAL

26
27 A. The Contractor shall directly pay all tipping fees associated with disposal of
28 construction demolition debris. The Contractor shall include in its bid all
29 costs associated with disposal of construction debris including collection,
30 storage, hauling and tipping fees.
31

32 1.14 RESTORATION OF PROPERTY

33
34 A. Responsibility. All damage resulting from construction work on existing
35 structures, wetland areas, roadway pavement, driveways, other paved
36 areas, fences, utilities, traffic control devices and any other obstruction not
37 specifically named herein, shall be repaired, restored or replaced by the
38 Contractor unless otherwise specified.
39

40 B. Temporary Repairs. All damage named in Paragraph A above shall be at
41 least temporarily repaired, restored or replaced immediately following
42 construction efforts at that location. Temporary restoration shall mean
43 putting the affected area back into a safe, usable condition. In no case shall
44 trenches remain open over night within a street right-of-way unless the
45 governing Traffic Control Division grants specific approval.
46

1 C. Permanent Repairs. All damage shall be permanently repaired, restored,
2 or replaced not later than the 30th calendar day following the completion of
3 construction at that location unless otherwise stipulated. Permanent repairs
4 shall be accomplished in a professional workmanship-like manner in
5 accordance with Specifications contained herein, or contract documents, if
6 addressed. The Contractor may be relieved of the 30-day time limit above
7 only by specific written agreement with the Engineer.
8

9 D. Owner Retribution. In the event that the Contractor fails to make the
10 permanent repairs within the time specified, the Owner, at its option, will,
11 with its own resources or by contract with others, cause the repair,
12 restoration, or replacement of the affected area to be accomplished. The
13 costs of such work will be deducted either from the next pay request or from
14 any other monies owed the Contractor.
15

16
17 PART 2 – PRODUCTS (NOT USED)

18
19 PART 3 – EXECUTION (NOT USED)

20
21
22
23

END OF SECTION

1
2
3
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1 SECTION 01014

2
3 SUMMARY OF WORK

4
5 PART 1 – GENERAL

6
7 1.01 LOCATION OF WORK

- 8
9 A. All Work of this Contract is located in rights-of-way, easements, or on
10 property owned by the City of Clearwater, Florida.

11
12 1.02 WORK TO BE DONE

- 13
14 A. The Contractor shall furnish all labor, materials, equipment, tools, services
15 and incidentals to complete all work required by these Specifications and as
16 shown on the Drawings.

- 17
18 B. The Contractor shall perform the work complete, in place and ready for
19 continuous service, and shall include repairs, testing, permits, clean up,
20 replacements, and restoration required as a result of damages caused
21 during this construction.

- 22
23 C. All materials, equipment, skills, tools, and labor which is reasonably and
24 properly inferable and necessary for the proper completion of the work in a
25 substantial manner and in compliance with the requirements stated or
26 implied by these Specifications or Drawings shall be furnished and installed
27 by the Contractor without additional compensation, whether specifically
28 indicated in the Contract Documents or not.

- 29
30 D. The Contractor shall comply with all Municipal, County, State, Federal, and
31 other codes applicable to the proposed construction work.

32
33 1.03 GENERAL DESCRIPTION OF WORK TO BE PERFORMED

- 34
35 A. The work of this Contract comprises the general rehabilitation of the
36 following facilities, as shown on the Contract Drawings and as specified
37 herein, including but not limited to:

- 38
39 1. Mobilization, demobilization, insurances, permits and bonds.
40 2. Demolition and disposal of the existing odor control scrubber tower
41 3. Demolition of the influent pumps, piping assemblies and meter
42 assembly
43 4. Demolition of equipment inside the blower room at the sludge
44 handling building
45 5. Installation of new influent pumps and piping assemblies
46 6. Installation of new influent meter assembly

7. Installation of new bypass manhole
8. Installation of new large bubble mixing unit inside the wet well
9. Installation of new spray nozzle system inside the wet well
10. Modification of the existing wet well
11. Application of coating/painting in wet well, bypass manhole, and blower room
12. Installation of new electrical equipment and SCADA programming
13. Operation and maintenance of temporary bypass pumping

1.04 CONSTRUCTION ACTIVITIES

A. General

1. Upon successful construction completion of each new component, and pre-operational testing, Contractor shall conduct testing as required by the Contract Documents.
2. Contractor shall ensure that, prior to start-up of any component, all handrails, walkways, lighting and associated safety-related facilities are in place.
3. Contractor shall provide Engineer a minimum of 14-calendar days advance written notice of any requested change in operation to the existing facility, bypass requirements or connections to existing facilities, and shall obtain the Engineer's written review before scheduling this work.

B. Restrictions

1. In planning its work, the Contractor shall consider the following requirements.
 - a. The Contractor shall not take any existing facilities out of service without obtaining the Engineer's prior written review and Owner's approval.
 - b. All new facilities shall be tested in accordance with Specification 01625 to demonstrate to the Engineer and Owner that the new facility and associated equipment properly operates prior to taking any other existing facilities or equipment out of service.
 - c. All manipulation of valves shall be performed by the Owner's personnel. The Contractor shall not be allowed to manipulate any valves except in emergencies. If there is an emergency, the Owner shall be notified immediately.

1
2 PART 2 – PRODUCTS (NOT USED)

3
4 PART 3 – EXECUTION (NOT USED)

5
6 END OF SECTION
7

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1 SECTION 01015

2
3 CONTROL OF WORK

4
5 PART 1 – GENERAL

6
7 1.01 WORK PROGRESS

- 8
9 A. The Contractor shall provide equipment that will be efficient, safe,
10 appropriate, and large enough to secure a satisfactory quality of work and
11 a rate of progress that will ensure the completion of the work within the
12 Contract Time(s). If, at any time, such facilities appear to the Engineer to
13 be inefficient, inappropriate, insufficient, or unsafe for securing the quality
14 of work required or for producing the rate of progress aforesaid, he may
15 order the Contractor to increase the facilities equipment, and the Contractor
16 shall conform to such order. Failure of the Engineer to give such order shall
17 in no way relieve the Contractor of his obligations to secure the quality of
18 the work and rate of progress required to meet the Contract Time(s).

19
20 1.02 PRIVATE LAND

- 21
22 A. The Contractor shall not enter or occupy private land outside of easements,
23 except by permission of the Owner.

24
25 1.03 WORK LOCATIONS

- 26
27 A. Work shall be located substantially as indicated on the Drawings, but the
28 Engineer reserves the right to make such modifications in locations as may
29 be found desirable to avoid interference with existing structures or for other
30 reasons. Where fittings are noted on the Drawings, such notation is for the
31 Contractor's convenience and does not relieve him from laying and jointing
32 different or additional items where required.

33
34 1.04 OPEN EXCAVATIONS

- 35
36 A. All open excavations shall be adequately safeguarded by providing
37 temporary barricades, caution signs, lights, and other means to prevent
38 accidents to persons, and damage to property. The Contractor shall, at his
39 own expense, provide suitable and safe bridges and other crossings for
40 accommodating travel by Owner's personnel, pedestrians, and workmen.
41 Bridges provided for access to private property during construction shall be
42 removed when no longer required. The length of open trench will be
43 controlled by the particular surrounding conditions and does not endanger
44 existing facilities. If the excavation becomes a hazard, or if it excessively
45 restricts traffic, construction procedures such as limiting the length of open

1 trench, prohibiting stacking excavated material in the street, and requiring
2 that the trench shall not remain open overnight.

- 3
4 B. The Contractor shall take precautions to prevent injury to the public due to
5 open trenches. All trenches, excavated material, equipment, or other
6 obstacles, which could be dangerous to the public, shall be well lighted at
7 night.
8

9 1.05 TEST PITS

- 10
11 A. The Contractor shall excavate test pits (pot-hole) for locating underground
12 pipelines or structures in advance of construction to verify that the work can
13 be constructed as intended. Test pits shall be excavated and backfilled by
14 the Contractor so as not to create a hazardous area. Test pits shall be
15 backfilled immediately after their purpose has been satisfied and the surface
16 restored and maintained in a manner satisfactory to the Engineer.
17

18 1.06 MAINTENANCE OF TRAFFIC

- 19
20 A. Unless permission to close a street is received in writing from the proper
21 authority, all excavated material shall be placed so that vehicular and
22 pedestrian traffic may be maintained at all times. If the Contractor's
23 operations cause traffic hazards, he shall repair the road surface, provide
24 temporary ways, erect wheel guards or fences, or take other measures for
25 safety satisfactory to the Engineer.
26

- 27 B. Detours around construction will be subject to the review and approval of
28 the Owner and the Engineer. Where detours are permitted, the Contractor
29 shall provide all necessary barricades and signs as required to divert the
30 flow of traffic. While traffic is detoured the Contractor shall expedite
31 construction operations and those periods when traffic is being detoured will
32 be strictly controlled by the Owner.
33

- 34 C. The Contractor shall take precautions to prevent injury to the public due to
35 open trenches. Night watchmen may be required where special hazards
36 exist, or police protection provided for traffic while work is in progress. The
37 Contractor shall be fully responsible for damage or injuries whether or not
38 police protection has been provided.
39

40 1.07 CARE AND PROTECTION OF PROPERTY

- 41
42 A. The Contractor shall be responsible for the preservation of all public and
43 private property and shall use every precaution necessary to prevent
44 damage thereto. If any direct or indirect damage is done to public or private
45 property by or on account of any act, omission, neglect, or misconduct in
46 the execution of the work on the part of the Contractor, such property shall

1 be restored by the Contractor, at his expense, to a condition similar or equal
2 to that existing before the damage was done, or he shall make good the
3 damage in other manner acceptable to the Engineer.
4

5 B. All sidewalks that are disturbed by the Contractor's operations shall be
6 restored to their original condition with the use of similar or comparable
7 materials. All curbing shall be restored in a condition equal to the original
8 construction and in accordance with the best modern practice.
9

10 C. Along the location of the work all fences, walks, bushes, trees, shrubbery,
11 and other physical features shall be protected and restored in a thoroughly
12 workmanlike manner. Fences and other features removed by the
13 Contractor shall be replaced in the location indicated by the Engineer as
14 soon as conditions permit. All grass areas beyond the limits of construction
15 that have been damaged by the Contractor shall be restored to original
16 conditions.
17

18 D. Trees close to the work shall be boxed or otherwise protected against injury.
19 The Contractor shall trim all branches that are susceptible to damage
20 because of his operations, but in no case shall any tree be cut or removed
21 without prior notification of the appropriate tree authority. All injuries to bark,
22 trunk, limbs, and roots of trees shall be repaired by dressing, cutting, and
23 painting in accordance with approved methods, using only approved tools
24 and materials.
25

26 E. The protection, removal, and replacement of existing physical features shall
27 be part of the work under the Contract and all costs in connection therewith
28 shall be included in the unit and/or lump sum prices established.
29

30 1.08 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND
31 UTILITIES
32

33 A. The Contractor shall assume full responsibility for the protection of all
34 buildings, structures, and utilities, public or private, including poles, signs,
35 services to buildings, utilities in the street, gas pipes, water pipes, hydrants,
36 sewers, drains, and electric and telephone cables, whether or not they are
37 shown on the Drawings. The Contractor shall carefully support and protect
38 all such structures and utilities from injury of any kind. Any damage
39 resulting from the Contractor's operations shall be repaired by him at his
40 expense.
41

42 B. The Contractor shall bear full responsibility for obtaining all locations of
43 underground structures and utilities (including existing water services, drain
44 lines, and sewers). Services shall be maintained and all costs or charges
45 resulting from damage thereto shall be paid by the Contractor.
46

1 C. If, in the opinion of the Engineer, permanent relocation of a utility owned by
2 the Owner is required, the Engineer may direct the Contractor in writing, to
3 perform the work. Work so ordered will be paid for at the unit prices bid in
4 the Proposal, if applicable, or as extra work as provided for in the General
5 Conditions. If relocation of a privately owned utility is required, the Owner
6 will notify the Utility to perform the work as expeditiously as possible. The
7 Contractor shall fully cooperate with the Owner and Utility and shall have
8 no claim for delay due to such relocation.
9

10 D. Underground and above ground utilities/facilities are identified on the
11 Drawings based on best information available at the time for the preparation
12 of the plans. It is the responsibility of the Contractor to locate all utilities
13 prior to any excavation. The Contractor shall be responsible for any
14 damage to existing underground utilities and facilities and shall coordinate
15 the protection of these utilities with the Owner.
16

17 1.09 DISTRIBUTION SYSTEMS AND SERVICES

18
19 A. The Contractor shall interrupt water, telephone, Cable TV, sewer, gas, or
20 other related utility services and disrupt the normal functioning of the system
21 as little as possible and shall notify the Engineer and public well in advance
22 of any requirement for dewatering, isolating, or relocating a section of a
23 utility, so that necessary arrangements may be made with the appropriate
24 agency.
25

26 B. If it appears that utility service will be interrupted for an extended period, the
27 Engineer may order the Contractor to provide temporary service lines.
28 Inconvenience of the users shall be the minimum, consistent with the
29 existing conditions. The safety and integrity of the system is of prime
30 importance in scheduling work.
31

32 1.10 PROTECTION OF CONSTRUCTION AND EQUIPMENT

33
34 A. All newly constructed work shall be carefully protected from injury or
35 damage in every way. No wheeling or walking or placing of heavy loads
36 shall be allowed and any portion injured or damaged shall be reconstructed
37 by the Contractor at his own expense.
38

39 1.11 WATER FOR CONSTRUCTION PURPOSES

40
41 A. The Contractor shall be responsible for providing and paying for all water
42 required for construction purposes. The Contractor shall make all
43 connections and other provisions, including backflow prevention and
44 metering provisions, necessary to obtain said water from the local utility's
45 potable and/or reclaimed water system, as required. The Contractor shall

1 pay the appropriate party for all water used for construction purposes. Bid
2 prices shall include the costs incurred for water usage.
3

4 1.12 MAINTENANCE OF FLOW
5

- 6 A. The Contractor shall, at his own cost, provide for the flow of sewers, drains,
7 and water courses interrupted during the progress of the work, and shall
8 immediately remove all offensive matter. The entire procedure for
9 maintaining existing flows shall be reviewed by the Engineer in advance of
10 the interruption of any flow.
11

12 1.13 COOPERATION WITHIN THIS CONTRACT
13

- 14 A. All firms or persons authorized to perform any work under this Contract shall
15 cooperate with the General Contractor and his subcontractors or trades and
16 shall assist in incorporating the work of other trades where necessary or
17 required.
18
19 B. Cutting and patching, drilling, and fitting shall be carried out where required
20 by the trade or subcontractor having jurisdiction, unless otherwise indicated
21 herein or directed by the Engineer.
22

23 1.14 COOPERATION OUTSIDE THIS CONTRACT
24

- 25 A. As part of normal and/or emergency system operations and maintenance,
26 the Owner may employ the services of contractors outside this contract. As
27 such, the Contractor of this Work shall coordinate their schedule with and
28 accommodate said contractor as necessary for the execution of their work.
29 This coordination shall be provided at no additional cost to the Owner.
30
31 B. As part of normal and/or emergency system operations and maintenance,
32 the Owner has normal delivery and maintenance suppliers that will be on-
33 site on a regular basis. Contractor shall allow continuous access to all
34 equipment and facilities, so as not to impede the operation and
35 maintenance of said facility. This coordination shall be provided at no
36 additional cost to the Owner.
37

38 1.15 CLEAN-UP
39

- 40 A. During the course of the work, the Contractor shall keep the site of his
41 operations in a clean and neat condition. He shall remove, transport, and
42 properly dispose of all surplus broken pavement, crushed concrete, lumber,
43 excess steel, equipment, temporary structures, and any other refuse from
44 the construction operation, on a weekly basis or as directed by the Owner
45 and/or Engineer. At the conclusion of the work, remove, transport and
46 properly dispose of any surplus excavation, and refuse remaining from the

1 construction operation, and leave the entire site of his work in a neat and
2 orderly condition.

3
4 B. The Contractor shall provide for disposal of excavated material removed
5 from the site.

6
7 1.16 COORDINATION WITH ELECTRICAL UTILITY

8
9 A. The Contractor shall be responsible for coordinating with the power
10 company to have electrical service supplied to the site.

11
12 1.17 WORK SEQUENCE

13
14 A. The Owner may incur penalties for failure to maintain service/operations.
15 Therefore, the Contractor will schedule and complete the work in a manner
16 that assures that the facility maintains service including redundancy
17 throughout the duration of the project. Prior to taking any service or
18 operation off-line, Contractor shall prepare a work sequence plan and
19 coordinate all shut downs with the Owner and Engineer. All temporary
20 measures and materials required to meet this condition during construction
21 shall be provided, installed, maintained and removed by the Contractor. All
22 costs associated with this effort shall be borne by the Contractor. All fines
23 imposed by failure to meet this operating condition, due to the Contractor's
24 Work Sequence, shall be borne by the Contractor.

25
26 PART 2 – PRODUCTS (NOT USED)

27
28 PART 3 – EXECUTION (NOT USED)

29
30
31 END OF SECTION

SECTION 01016

CONSTRUCTION PHASING PLAN

PART 1 – GENERAL

1.01 CONSTRUCTION PHASING PLAN

- A. At all times during construction of the project, the City of Clearwater’s East Water Reclamation Facility shall remain in service, except for temporary shutdowns described herein. Throughout construction, the Contractor shall cooperate fully with operations staff in order to minimize disruption to the facility’s operation.
- B. The general intent of this project is to allow the facility to treat raw sewage during the rehabilitation of the existing influent sewer and pump station. This will require the furnishing, installation, and operation of a temporary bypass piping system by the Contractor to allow the rehabilitation of existing piping, influent pump station and the installation of a new influent sewer structure.
- C. No facility or structure shall be taken out of service until a temporary utilities/facility or the new replacement utility/facility or structure is fully constructed, tested, and accepted by the Owner.
- D. The suggested phasing plan specified herein shall be representative only. It is up to the Contractor to devise their own phasing plan, which will meet the requirements as specified herein. The Contractor shall submit to the Engineer a construction phasing plan for approval, prior to beginning any construction onsite.
- E. Brief shutdown of equipment may be allowed during critical phases. The Contractor shall notify the Owner and Engineer for approval, two (2) weeks prior to any temporary shutdowns.
- F. The Contractor shall conduct operations in such a manner that will maintain access to private property/driveways at all times and will result in minimum inconvenience to the public accessing the neighborhood roads and/or business establishments and shall provide temporary access during construction.
- G. The Contractor shall be responsible for constructing any temporary utilities/facilities and temporary pumping in order to keep the stormwater system in-service during construction. All materials, piping, equipment, power, labor, etc. associated with temporary utilities/facilities or temporary pumping shall be the responsibility of the Contractor.

1 H. Suggested Phasing
2

- 3 1. The Contractor shall be required to maintain all existing
4 utilities/structures in service until those new utilities/structures are
5 constructed, tested and accepted by the Owner.
6
- 7 2. Prior to taking out any structure or facilities, the Contractor shall
8 make temporary piping connections as required. All power, labor,
9 equipment, and materials for any temporary piping and pumping
10 shall be the responsibility of the Contractor.
11
- 12 3. The following is a non-comprehensive list of tasks that should occur
13 during this project, including but not limited to the following steps:
14
- 15 a. Demolish odor control scrubber tower, blower room and
16 remove trees;
 - 17 b. Construct bypass manhole;
 - 18 c. Construct and install temporary bypass piping;
 - 19 d. Operate and maintain the new temporary bypass system;
 - 20 e. Isolate existing influent pump station, influent flow meter
21 assembly, influent screen area by closing gates at the
22 headworks;
 - 23 f. Rehabilitate existing influent pump station, influent meter
24 assembly, blower room at the sludge handling building,
25 including equipment demolition and installation;
 - 26 g. Change operation from temporary bypass system to the
27 improved treatment processes;
 - 28 h. Remove temporary bypass system and restore project area.
29

30
31 PART 2 – PRODUCTS (NOT USED)

32
33 PART 3 – EXECUTION (NOT USED)

34
35 END OF SECTION

1
2 SECTION 01030

3
4 SPECIAL PROJECT PROCEDURES

5
6 PART 1 – GENERAL

7
8 1.01 WORKMANSHIP, MATERIAL AND EQUIPMENT

9
10 A. When a particular product is specified or called for, it is intended and shall
11 be understood by the Contractor that the Contractor's proposal includes
12 those products in its bid. Should the Contractor desire to incorporate
13 products equal to those specified, the Contractor shall furnish information
14 as described in the General Conditions. The alternate product or products
15 submitted by the Contractor shall meet the requirements of the
16 Specifications and shall, in all respects, be equal to the products specified
17 by name herein.

18
19 B. All apparatus, mechanism, equipment, machinery, and manufactured
20 articles for incorporation into the Work shall be the new and unused
21 standard products of recognized reputable manufacturers unless
22 specifically noted otherwise.

23
24 C. Contractor shall properly dispose of all excess materials from the site.

25
26 1.02 CONNECTIONS TO EXISTING SYSTEMS

27
28 A. The Contractor shall perform all work necessary to locate, excavate and
29 prepare for connections to the existing systems, as shown on the Drawings.
30 All connections to existing systems shall be coordinated with the Owner
31 and/or Engineer prior to commencing the work. All connections to existing
32 systems shall be attended by the Owner and/or Owner's Representative.
33 The costs for this work and for the actual connection to the existing systems
34 shall be included in the various prices bid and shall not result in any
35 additional cost to the Owner.

36
37 1.03 EXISTING UNDERGROUND PIPING, STRUCTURES AND UTILITIES

38
39 A. The attention of the Contractor is directed to the fact that during excavation,
40 the possibility exists that the Contractor may encounter water, gas,
41 telephone, electrical, and/or other utilities not shown on the Drawings. The
42 Contractor shall exercise extreme care before and during excavation to
43 locate and flag these lines so as to avoid damage thereto. Should damage
44 occur to an existing line, the Contractor shall immediately contact the utility
45 and the Owner. If the repair is to be completed by the Contractor, it shall

1 be carried out in a timely and quality manner. Costs associated with such
2 damage shall be borne by the Contractor at no additional cost to the Owner.

3
4 B. It is the responsibility of the Contractor to ensure that all utility or other poles,
5 the stability of which may be endangered by the close proximity of
6 excavation, are temporarily supported in position while work proceeds in the
7 vicinity of the pole and that utility or other companies concerned be given
8 reasonable advance notice of any such excavation by the Contractor.

9
10 C. The locations of existing utilities are shown without express or implied
11 representation, assurance, or guarantee that they are complete or correct
12 or that they represent a true picture of underground piping to be
13 encountered. Encountering existing utilities at different depths or locations
14 than shown on the Drawings shall not be cause for additional costs to the
15 Owner.

16
17 D. The existing piping and utilities that interfere with new construction shall be
18 rerouted as shown, specified, or required. The Contractor shall excavate
19 test pits sufficiently ahead of the proposed work to predict potential conflicts.
20 Before any piping and utilities not shown on the Drawings are disturbed, the
21 Contractor shall immediately notify the Engineer of the location of the
22 pipeline or utility and shall reroute or relocate the pipeline or utility as
23 directed.

24
25 E. The Contractor shall exercise care in any excavation to locate all existing
26 piping and utilities. All utilities that do not interfere with completed work
27 shall be carefully protected against damage. Any existing utilities damaged
28 in any way by the Contractor shall be restored or replaced by the Contractor
29 at his expense, as directed by the Engineer.

30
31 F. It is intended that wherever existing utilities such as water, gas, telephone,
32 electrical, or other service lines must be crossed, deflection of the pipe
33 within recommended limits and cover shall be used to satisfactorily clear
34 the obstruction unless otherwise indicated on the Drawings. However,
35 when in the opinion of the Owner or Engineer this procedure is not feasible,
36 he may direct the use of fittings for the utility crossing. The Contractor shall
37 verify utility crossings with test pits prior to construction as required by the
38 Engineer.

39
40 1.04 SLEEVES AND OPENINGS

41
42 A. The Contractor shall provide all openings, channels, chases, etc., and install
43 anchor bolts and other items to be embedded in concrete, as required to
44 complete the work under this Contract, together with those required by
45 subcontractors, and shall do all cutting and patching, excepting cutting and
46 patching of materials of a specified trade and as stated otherwise in the

1 following paragraph.

- 2
- 3 B. The Contractor shall coordinate with the subcontractors to provide all
- 4 sleeves, inserts, hangers, anchor bolts, etc., of the proper size and material
- 5 for the execution of the work. The Contractor shall be responsible for any
- 6 corrective cutting and refinishing required to make the necessary openings,
- 7 chases, etc. In no case shall beams, lintels or other structural members be
- 8 cut without the written acceptance of the Engineer.
- 9

10 1.05 PROVISIONS FOR CONTROL OF EROSION

- 11
- 12 A. Sufficient precautions shall be taken during construction to minimize the
- 13 run-off of polluting substances such as silt, clay, fuels, oils, bitumens,
- 14 calcium chloride, or other polluting materials harmful to humans, fish, or
- 15 other life, into the supplies and surface waters of the state. Control
- 16 measures must be adequate to assure that turbidity in the receiving water
- 17 will not be increased more than 10 nephelometric turbidity units (NTU), or
- 18 as otherwise required by the state or other controlling body, in water used
- 19 for public water supply or fish unless limits have been established for the
- 20 particular water. In surface water used for other purposes, the turbidity must
- 21 not exceed 25 NTU unless otherwise permitted. Special precautions shall
- 22 be taken in the use of construction equipment to prevent operations that
- 23 promote erosion.
- 24
- 25 B. The Contractor shall comply with the requirements of the EPA-NPDES
- 26 generic permit for storm water discharges and the storm water pollution
- 27 prevention plan developed for the project.
- 28

29 1.06 VALVE INDICES

- 30
- 31 A. The Contractor shall be responsible for furnishing tags for all valves
- 32 required on the work and installing the tags required for his own work. Tags
- 33 on above ground valves shall be non-corrosive metal or plastic, 2 inches in
- 34 diameter, 19-gauge thickness. Tags for buried valves shall be secured to
- 35 a concrete base as shown on the Drawings. Submit to the Engineer for
- 36 review, two (2) samples of each type of tag proposed and manufacturer's
- 37 standard color chart and letter styles. Tags shall have stamped on them
- 38 the information shown on the Drawings and the data described herein. The
- 39 Contractor shall submit to the Engineer for review, not less than 120 days
- 40 before start-up, a valve schedule containing all valves required for the work.
- 41 The schedule shall contain for each valve, the location, type, a number,
- 42 words to identify the valve's function, and the normal operating position.
- 43 The information contained in the valve schedules shall be coded on the tags
- 44 in a system provided by the Owner. Above ground valve tags shall be
- 45 furnished with non-corrosive metal wire for attachment thereof.
- 46

1 1.07 HURRICANE PREPAREDNESS PLAN

- 2
- 3 A. Within 30 days of the date of Notice to Proceed, the Contractor shall submit
- 4 to the Engineer and Owner a Hurricane Preparedness Plan. The Plan
- 5 should outline the necessary measures that the Contractor proposes to
- 6 perform at no additional cost to the Owner in case of a hurricane warning.
- 7
- 8 B. In the event of inclement weather, or whenever Engineer shall direct; the
- 9 Contractor shall carefully protect the Work and materials against damage
- 10 or injury from the weather. If, in the opinion of Engineer, any portion of Work
- 11 or material has been damaged or injured by reason of failure on the part of
- 12 the Contractor or subcontractors to set protect the Work, such Work and
- 13 materials shall be removed and replaced at the expense of the Contractor.
- 14

15 1.08 WARRANTIES

- 16
- 17 A. The Contractor's one-year warranty or guarantee period shall be part of the
- 18 project's Performance Bond.
- 19

20 1.09 WATERTIGHTNESS

- 21
- 22 A. Special precautions shall be taken in the curing of concrete to reduce
- 23 concrete cracking as called for in Section 03300. All water-retaining
- 24 structures (those that are intended to hold a liquid) shall be filled and tested
- 25 for leaks by the Contractor, with water acceptable to the Engineer, prior to
- 26 surface coating or painting. The procedure and manner in which any leaks
- 27 are repaired must be reviewed by the Engineer. All costs associated with
- 28 the testing and repair of leaks shall be at the expense of the Contractor.
- 29

30 1.10 CONSTRUCTION CONDITIONS

- 31
- 32 A. The Contractor shall strictly adhere to the specific requirements of the
- 33 governmental unit or agencies having jurisdiction over the work. Wherever
- 34 there is a difference in the requirements of a jurisdictional body and these
- 35 Specifications, the more stringent shall apply.
- 36

37 1.11 PUBLIC NUISANCE

- 38
- 39 A. The Contractor shall not create a public nuisance including, but not limited
- 40 to, encroachment on adjacent lands, flooding of adjacent lands, or
- 41 excessive noise.
- 42
- 43 B. Sound levels measured by the Engineer personnel shall not exceed 45 dBA
- 44 7 PM to 7 AM or 55 dBA 7 AM to 7 PM. This sound level shall be measured
- 45 at the exterior of the exterior wall of the nearest residence. Levels at the
- 46 equipment shall not exceed 85 dBA measured five (5) feet from the

1 equipment at any time. Sound levels in excess of these values are sufficient
2 cause to have the work suspended. Work stoppage by the Engineer or
3 Owner for excessive noise shall not relieve the Contractor of completing the
4 Work in accordance with the Contract Time(s), at no additional cost to the
5 Owner.

6
7 C. No extra charge may be made for time lost due to work stoppage resulting
8 from the creation of a public nuisance.
9

10 1.12 HAZARDOUS LOCATIONS

11
12 A. Contractor shall perform work in accordance with OSHA, state and local
13 safety requirements.
14

15 1.13 SUSPENSION OF WORK DUE TO WEATHER

16
17 A. During inclement weather, all work that could be damaged or rendered
18 inferior by such weather conditions shall be suspended. The orders and
19 decisions of the Engineer as to suspensions shall be final and binding. The
20 ability to issue such an order shall not be interpreted as a requirement to do
21 so. During suspension of the work for any cause, the work shall be suitably
22 covered and protected so as to preserve it from injury by the weather or
23 otherwise; and, if the Engineer shall so direct, rubbish and surplus materials
24 shall be removed.
25

26 B. The Contractor shall be responsible for documenting all inclement weather
27 conditions.
28

29 1.14 RELOCATIONS

30
31 A. The Contractor shall be responsible for the relocation of structures,
32 including but not limited to light poles, signs, sign poles, fences, piping,
33 conduits, and drains that interfere with the positioning of the work as set out
34 on the Drawings. The cost of all such relocations shall be borne by the
35 Contractor at no additional cost to the Owner.
36

37 1.15 SALVAGE

38
39 A. Any existing equipment or material including, but not limited to, valves,
40 pipes, fittings, couplings, etc., which is removed or replaced as a result of
41 construction under this project may be designated by the Owner to be
42 salvaged. Any existing equipment or material to be salvaged shall remain
43 onsite and the Contractor shall be responsible for delivering the salvage
44 equipment/materials to the exact location onsite as directed by the
45 Engineer.
46

47 1.16 PERMITS

- 1
2 A. Upon notice of award, the Contractor shall immediately apply for all
3 applicable permits, not previously obtained by the Owner, from the
4 appropriate governmental agency or agencies. No work shall commence
5 until all applicable permits have been obtained and copies delivered to the
6 Engineer. The costs for obtaining all permits shall be borne by the
7 Contractor.

8
9 1.17 PUMPING

- 10
11 A. The Contractor with his own equipment shall perform all pumping necessary
12 to prevent flotation of any part of the structures during construction
13 operations. All water collected during pumping operations shall be properly
14 disposed of in accordance with these specifications and/or regulatory
15 requirements, whichever is more stringent.
16
17 B. The Contractor shall, with his own equipment, pump out water that may
18 seep or leak into the excavations or structures. All water collected during
19 pumping operations shall be properly disposed of in accordance with these
20 specifications and/or regulatory requirements, whichever is more stringent.
21 Below grade galleries and other operating areas shall be kept dry at all
22 times. The extent of pumping required in tanks, channels and other non-
23 operating areas will be determined by the Owner/Engineer.

24
25 1.18 NOTIFICATION OF WORK ON EXISTING FACILITIES

- 26
27 A. Before commencing work on any of the existing structures or equipment,
28 the Contractor shall notify the Owner/Engineer, in writing, at least 10
29 calendar days in advance of the date he proposed to commence such work.

30
31 1.19 OWNER OCCUPANCY AND OPERATION OF COMPLETED FACILITIES

- 32
33 A. It is assumed that portions of the work will be completed prior to completion
34 of the entire work. Upon completion of construction of each individual
35 facility, including testing, if the Owner, at his sole discretion, desires to
36 accept the individual facility, the Contractor will be issued a dated certificate
37 of completion and acceptance for each individual facility. The Owner will
38 assume ownership and begin operation of the individual facility on that date
39 and the one-year guaranty period shall commence on that date. The Owner
40 has the option of not accepting any individual completed facility but
41 accepting the entire work as a whole when it is completed and tested.

42
43 1.20 POTENTIAL IMPACTS ON THE SCHEDULE

- 44
45 A. The Owner may incur penalties for failure to maintain service/operations.
46 Therefore, the Bidders are noticed that this work is at an active and
47 operating Water Reclamation Facility and that plant operations, regulatory

1 compliance and required testing will take priority over and may impact the
2 construction schedule.

3

4

5 PART 2 – PRODUCTS (NOT USED)

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7 PART 3 – EXECUTION (NOT USED)

8

9

10

END OF SECTION

11

1 SECTION 01040

2
3 COORDINATION

4
5 PART 1 – GENERAL

6
7 1.01 PROJECT COORDINATION

8
9 A. The Contractor shall provide for the complete coordination of all
10 construction efforts. This shall include but not necessarily be limited to
11 coordination of the following:

- 12
13 1. The work of subcontractors.
14
15 2. The flow of material and equipment from suppliers.
16
17 3. The effort of equipment manufacturers during testing and start-up.
18
19 4. The interrelated work with public and private utility companies.
20
21 5. The interrelated work with the Owner where tie-ins to existing
22 facilities are required.
23
24 4. The effort of independent testing agencies.
25
26 5. The work to be provided under allowances.

27
28 PART 2 – PRODUCTS (NOT USED)

29
30 PART 3 – EXECUTION (NOT USED)

31
32
33 END OF SECTION
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1 SECTION 01050

2
3 FIELD ENGINEERING AND SURVEYING

4
5 PART 1 – GENERAL

6
7 1.01 REQUIREMENTS INCLUDED

- 8
9 A. The Contractor shall provide and pay for all field engineering and survey
10 services required. Such work shall include survey work to establish existing
11 and/or proposed lines and grades and to locate and lay out site boundaries
12 and easements, project control, site improvements, structures, controlling
13 lines and levels and all other survey required for the construction of the
14 work. Also included are such engineering services as are specified or
15 required to execute the Contractor's construction methods. Engineers and
16 surveyors shall be licensed professionals registered in the State of Florida.
17
18 B. The accuracy of any method of staking shall be the responsibility of the
19 Contractor. All surveying for vertical and horizontal control shall be the
20 responsibility of the Contractor.
21
22 C. The Contractor shall be held responsible for the preservation of all stakes
23 and marks. If any stakes or marks are carelessly or willfully disturbed by
24 the Contractor, the Contractor shall not proceed with any work until he has
25 established such points, marks, lines and elevations as may be necessary
26 for the prosecution of the work.
27

28 1.02 SURVEY REFERENCE POINTS

- 29
30 A. Existing basic horizontal and vertical control points for the project are those
31 designated on the Drawings. The Contractor shall locate and protect control
32 points prior to starting site work and shall preserve all permanent reference
33 points during construction. In working near any permanent property corners
34 or reference markers, the Contractor shall use care not to remove or disturb
35 any such markers. In the event that markers must be removed or are
36 disturbed due to the proximity of construction work, the Contractor shall
37 have them referenced and reset by a Registered Land Surveyor.
38

39 1.03 PROJECT SURVEY REQUIREMENTS

- 40
41 A. The Contractor shall engage the services of a Florida Registered Land
42 Surveyor to establish all lines and grades on the Drawings necessary to
43 fully construct the work in accordance with Chapter 5J-17 of the Florida
44 Administrative Code.
45
46 B. The Registered Land Surveyor shall establish and stake all pipeline and

1 roadway right-of-way adjacent to construction at 100' intervals on tangents,
2 50' intervals on curves and at all changes in direction. The surveyor shall
3 place lath and hub at such points with stations indicated. Tack in hub shall
4 not be permitted.

5
6 1. The Registered Land Surveyor shall utilize current right-of-way
7 maps, plats and property deeds, all being of public record, in
8 conjunction with existing monumentation to establish the existing
9 right-of-way lines and utility easement boundaries.

10
11 C. The Registered Land Surveyor shall establish a temporary benchmark
12 system in accordance with Chapter 5J-17 F.A.C. and shall provide a written
13 list to the Contractor for his use.

14
15 D. The Contractor shall provide an as-built survey of all pipes and structures
16 constructed under the project that shall be signed and sealed by a Florida
17 Registered Surveyor and Mapper. At minimum, the As-Built Survey shall
18 include:

- 19
20 1. Top of concrete elevations and northings and eastings for all basins
21 and structures;
22 2. Weir elevations for all basins and structures;
23 3. Pipe inverts for gravity pipelines and top of pipe elevations for
24 pressure pipelines for all yard piping, and northings and eastings of
25 all changes in pipe direction.

26
27 1.04 RECORDS

28
29 A. Contractor shall maintain a complete, accurate log of all control and survey
30 work as construction progresses. Survey notes indicating the information
31 and measurements used in establishing locations and grades shall be kept
32 in notebooks and furnished to the Engineer with the Record Drawings.

33
34 1.05 SUBMITTALS

35
36 A. Submit name and address of surveyor to the Engineer.

37
38 B. On request of the Engineer, submit documentation to verify accuracy of field
39 engineering work.

40
41 PART 2 – PRODUCTS (NOT USED)

42
43 PART 3 – EXECUTION (NOT USED)

44
45
46 END OF SECTION

1 SECTION 01065

2
3 PERMITS AND EASEMENTS

4
5 PART 1 – GENERAL

6
7 1.01 REQUIREMENTS INCLUDED

- 8
9 A. The Contractor shall be responsible to ensure that the construction of the project
10 adheres to City, County, State, and Federal standards, and regulations, and to
11 all permits and easements acquired for the project.
12
13 B. The Contractor shall coordinate all work within rights-of-way with the agency
14 having jurisdiction, including all road/lane closures, road/lane narrowing and
15 detours.
16
17 C. Copies of any Permits, Deeds, Easement Agreements or License Agreements
18 that the Owner has obtained will be available for review by prospective bidders
19 at the City of Clearwater’s Plan Room – website address:
20 www.myclearwater.com/cityprojects. The Contractor shall conduct all operations
21 in accordance with the requirements of all Permits, Easements and License
22 Agreements.
23
24 D. Where Permits, Deeds, Easement Agreements, or License Agreements require
25 that certain Work is to be performed only in the presence of a representative of
26 the permitting entity, the Contractor shall provide all coordination and
27 notification required to assure full compliance with the permit conditions.
28
29 E. The Owner has obtained or will obtain certain Permits, Deeds, Easement
30 Agreements, or License Agreements required for construction of the project. A
31 listing of those Permits, Deeds, Easement Agreements, or License Agreements
32 that the Owner has obtained or applied for is listed below. The Contractor shall
33 be responsible for obtaining all other Permits, Easement Agreements, or
34 License Agreements necessary for the proper execution of the Work not
35 specifically noted to be obtained by the Owner.
36
37 F. The Contractor shall comply with all terms, conditions, provisions, and
38 requirements of all permits issued or to be issued for the Project. Should the
39 Contractor's failure to comply with said permits lead to enforcement action by
40 any of the permitting or jurisdictional agencies, any resultant costs in the forms
41 of repairs, fines, penalties, administrative costs, attorney's fees, or consultant
42 fees shall be deducted from the Contract Price or shall be otherwise collectible
43 from the Contractor and its Surety, jointly and severally.
44
45 G. The Contractor shall notify the Owner a minimum of 30 days prior to the
46 expiration of a permit if said expiration occurs prior to completion of the Work.
47

1 H. Prior to any land clearing or tree removal, the Contractor shall construct a soil
2 tracking device in accordance with current Florida Department of Transportation
3 design standards.
4

5 1.02 PERMITS
6

7 A. Each bidder shall be familiar with the requirements of the permit conditions that
8 relate to construction activities and shall include the cost of satisfying these
9 permit conditions in developing a bid for the project.
10

11 B. At a minimum, the Contractor shall register with appropriate authorities, obtain
12 the following permits, comply with their respective conditions, and submit copies
13 of all applications and final permits to Engineer and Owner:
14

- 15 1. City of Clearwater building permit(s)
- 16 2. Generic Permit For Discharge of Groundwater From Dewatering
17 Operations –or- Generic Permit for Discharges from Petroleum
18 Contaminated Sites
- 19 3. Generic Permit for Storm Water Discharge from Large and Small
20 Construction Activities
21

22 C. The Contractor shall obtain all construction permits required including those
23 necessary for clearing, grubbing, and tree removal. No clearing shall occur and
24 no earth-moving equipment shall be placed on-site until after the permits have
25 been issued.
26

27 D. The Contractor shall obtain, implement, and comply with all local and state
28 permits required for dewatering, including consumptive or water use permitting,
29 if required for construction from the Southwest Florida Water Management
30 District.
31

32 E. The Contractor shall conduct water quality sampling and testing to obtain,
33 implement and comply with the requirements of a Generic Permit for Discharge
34 of Ground Water from Dewatering Operations in accordance with 62-621.300(2)
35 FAC. The Contractor shall submit a Notice of Intent (NOI) To Use the Generic
36 Permit for Discharge of Groundwater from Dewatering Operations. If dewatering
37 activities are associated with construction activities, the FDEP currently allows
38 the dewatering activity to be covered under the Generic Permit for Stormwater
39 discharge from Large and Small Construction Activates described in the next
40 paragraph.
41

42 F. In lieu of section F. above, the Contractor may elect to conduct water quality
43 sampling and testing to obtain, implement and comply with the requirements of
44 a Generic Permit for Discharges from Petroleum Contaminated Sites in
45 accordance with 62-621.300 FAC. As of October 2016, the East WRF was
46 listed by the FDEP as an Active Petroleum Cleanup Site.
47

1 G. The Contractor shall obtain, implement, and comply with the requirements of a
2 Generic Permit for Storm Water Discharge from Large and Small Construction
3 Activities (CGP), in accordance with 62-621.300(4) FAC. The Contractor shall
4 submit a CGP Notice of Intent (NOI) to the Florida Department of Environmental
5 Protection (FDEP) and develop and submit a Storm Water Pollution Prevention
6 Plan (SWPPP) as part of the CGP. The Contractor shall:

- 7
- 8 1. Obtain the CGP form and NOI Application Form from the FDEP or its
9 website, DEP Documents 62-621.300(4)(a) and 62-621.300(4)(b),
10 respectively.
 - 11 2. Develop an SWPPP in compliance with FDEP storm water permitting
12 rules that shall include, at a minimum, the following:
 - 13 a. A site evaluation of how and where pollutants may be mobilized
14 by storm water.
 - 15 b. A site plan for managing storm water runoff.
 - 16 c. Identification of appropriate erosion and sediment controls
17 including Best Management Practices to reduce erosion,
18 sedimentation, and storm water pollution.
 - 19 d. A maintenance and inspection schedule.
 - 20 e. Plan and procedures for record keeping.
 - 21 f. A map depicting storm water exit areas.
 - 22 3. Complete and submit the NOI Application, including all attachments, to
23 the local FDEP office along with the appropriate application fee.
 - 24 4. The Contractor shall furnish a copy of the FDEP Notice of Permit, along
25 with a copy of the SWPPP, to the Engineer.

26
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28
29
30
31 1.03 EASEMENTS

32
33 A. The project area is within the property of the City of Clearwater. Refer to the
34 Contract Drawings to see the appropriate staging and working area.

35
36 PART 2 – PRODUCTS (NOT USED)

37
38 PART 3 – EXECUTION (NOT USED)

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1 SECTION 01090

2 REFERENCE STANDARDS

3
4
5 PART 1 – GENERAL

6
7 1.01 REQUIREMENTS INCLUDED

- 8
9 A. Abbreviations and acronyms are used in the Contract Documents to identify
10 reference standards.

11
12 1.02 QUALITY ASSURANCE

- 13
14 A. Application: When a standard is specified by reference, comply with
15 requirements and recommendations stated in that standard, except when
16 requirements are modified by the Contract Documents or applicable codes
17 establish stricter standards.

- 18
19 B. Publication Date: The publication in effect on the date of issue of Contract
20 Documents, except when a specific publication date is specified.

21
22 1.03 ABBREVIATIONS, NAMES, AND ADDRESSES OF ORGANIZATIONS

23
24 Obtain copies of referenced standards direct from publication source, when
25 needed for proper performance of Work, or when required for submittal by Contract
26 Documents.

27
28 AA Aluminum Association
29 900 19th Street NW
30 Washington, DC 20006

31
32 AASHTO American Association of State Highway
33 and Transportation Officials
34 444 North Capitol Street, NW Suite 249
35 Washington, DC 20001

36
37 ACI American Concrete Institute
38 38800 Country Club Drive
39 Farmington Hills, MI 48331

40
41 AI Asphalt Institute
42 2696 Research Park Drive
43 Lexington KY 40511

44
45 AISC American Institute of Steel Construction
46 One East Wacker Drive
47 Suite 3100

1		Chicago, IL 60601-2001
2		
3	AISI	American Iron and Steel Institute
4		1140 Connecticut Avenue
5		Suite 705
6		Washington DC 20036
7		
8	ANSI	American National Standards Institute
9		1819 L Street, NW
10		Washington, DC 20036
11		
12	ASME	American Society of Mechanical Engineers
13		Three Park Avenue
14		New York, NY 10016-5990
15		
16	ASTM	American Society for Testing and Materials
17		100 Barr Harbor Drive
18		West Conshohocken, PA, 19428
19		
20	AWWA	American Water Works Association
21		6666 W. Quincy Avenue
22		Denver, CO 80235
23		
24	AWS	American Welding Society
25		550 N.W. LeJeune Road
26		Miami, FL 33126
27		
28	CRSI	Concrete Reinforcing Steel Institute
29		933 N. Plum Grove Road
30		Schaumburg, IL 60173-4758
31		
32	FS	Federal Specification General Services
33		Administration Specifications and Consumer
34		Information Distribution Section (WFSIS)
35		470 L'enfant Plaza – Suite 8100
36		Washington, DC 20407
37		
38	NEMA	National Electrical Manufacturers' Association
39		1300 North 17 th Street
40		Suite 1847
41		Rosslyn, VA 22209
42		
43	PCA	Portland Cement Association
44		5420 Old Orchard Road
45		Skokie, IL 60077
46		
47	PCI	Prestressed Concrete Institute

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209 W. Jackson Blvd.
Chicago, IL 60606

SSPC

Society for Protective Coatings
40 24th Street, . 6th floor
Pittsburgh, PA 15222

UL

Underwriters' Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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1 SECTION 01150

2
3 MEASUREMENT AND PAYMENT

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. This section defines the Work included in each bid item in the Bid / Proposal
10 section of the Contract Documents. Payment will be made based on the
11 specified items included in the description in this section for each pay item
12 number and as verified in the field by the Engineer or Owner's
13 Representative.
14
- 15 B. All prices included in the Bid Form / Schedule of Prices shall be full
16 compensation for all labor, supervision, materials, tools, equipment, and
17 incidentals necessary to complete the Work as shown on the Drawings
18 and/or as specified in the Contract Documents. Actual quantities of each
19 item bid on a unit price basis will be determined upon completion of the
20 construction in the manner established for each item in this section.
21 Payment for all items listed in the Bid Form / Schedule of Prices shall
22 constitute full compensation for all work shown and/or specified to be
23 performed under the Contract.
24
- 25 C. Restoration is considered to be an integral part of the Work, and all bid
26 prices shall include the cost of restoration necessitated by the Work related
27 to that bid item. All existing structures and property including, but not limited
28 to, paving, stabilized roads, drainage piping and ditches, catch basins, head
29 walls, yard culverts, lawns, fences, trees, shrubs, ground areas, decorative
30 walls, walkways, sidewalks, driveways, alleys, curbs, gutters, irrigation
31 systems, buildings, structures and equipment that are altered, removed or
32 damaged during construction shall be restored to the same or better
33 condition than existed prior to construction at no additional cost to the
34 Owner. Cleanup is an integral part of restoration process.
35
- 36 D. The Contractor shall exercise care to preserve and protect existing facilities
37 during all periods for the construction phase. All existing structures,
38 equipment, and private property, including, but not limited to paving,
39 stabilized roads, drainage piping and ditches, latch basins, head walls, yard
40 culverts, lawns, fences, trees, shrubs, ground areas, decorative walls,
41 walkways, driveways, alleys, curbs, gutters and irrigations systems that are
42 altered, removed or damaged during construction and are not included in
43 the proposed alterations of the new work shall be restored to the same or
44 better condition than existed prior to construction.
45

- 1 E. The Contractor shall be responsible for all traffic maintenance requirements
2 necessitated by the construction/installation of those specific bid items
3 requiring traffic maintenance. The cost for this work shall be included in the
4 specific unit price submitted for that particular bid item.
5

6 PART 2 – PRODUCTS (NOT USED)
7

8 PART 3 – EXECUTION
9

10 3.01 MEASUREMENT AND PAYMENT
11

12 A. General Conditions, Mobilization and Demobilization (Bid Item No. 1)
13

- 14 1. Description: This pay item includes compensation for the furnishing of all
15 labor, materials, tools, equipment, and supervision required to perform the
16 work as shown on the drawings and specified herein, including but not limited
17 to preparatory work and operations in mobilizing for beginning work on the
18 project; the movement of personnel, equipment, supplies and incidentals to
19 the project site; safety equipment, first aid supplies, sanitary and other
20 facilities, as required by these Specifications, special provisions, and State
21 and local laws and regulations. The costs of bonds, permits and required
22 insurance, and any other preconstruction expenses necessary for the start
23 of the work, excluding the cost of construction materials. The price to be paid
24 for this item shall be based on such work being completed and accepted for
25 the site, all site renovations completed, and all materials and equipment
26 removed, for the lump sum unit price in the Bid Schedule. The standard
27 retainage will be applied to this item.
28
- 29 2. Measurement: Measurement for General Conditions, Mobilization and
30 Demobilization shall be on a lump sum basis, and the cost shall not exceed
31 five percent (5%) of the proposed Base Bid Total (Bid Item No.3 to Bid Item
32 No.8).
33
- 34 3. Payment: 20% of mobilization payment shall be withheld until all shop
35 drawings have been approved by the Engineer. 50% of this pay item will be
36 paid upon demonstration of mobilization and the balance will be paid with
37 the final pay request.
38
- 39 4. Bid Item: Payment for General Conditions, Mobilization and Demobilization
40 shall be made at the Contract Lump Sum price for Item No.1 – Mobilization
41 and Demobilization as follows:
42

Bid Item No.	Description
1	Mobilization and Demobilization

1 B. Demolition (Bid Item No. 2)

- 2
3 1. Description: This pay item includes all labor, materials, tools, equipment,
4 and supervision required to perform the work as shown on the drawings and
5 specified herein, including but not limited to the demolition and the disposal
6 of the existing odor control scrubber tower; removal of pumps, valves,
7 piping; electrical equipment at the existing pump station; removal of the
8 influent meter assembly and the equipment in the blower room, located at
9 the sludge handling building.
10
11 2. Measurement: Measurement for Demolition shall be on a lump sum basis,
12 the cost shall not exceed eight percent (8%) of the proposed Base Bid Total
13 (Bid Item No.3 to Bid Item No.8). Percentage complete will be calculated
14 based upon progress of construction of associated individual items in
15 accordance with the breakdown in the approved Schedule of Values.
16
17 3. Payment: Payment for Bid Item 2 shall be made as a percentage complete
18 of the lump sum amount indicated on the Bid Form.
19
20 4. Bid Item: Payment for Demolition shall be made at the Contract Lump Sum
21 price for Item No.2 – Demolition as follows:
22

Bid Item No.	Description
2	Demolition

23
24
25 C. Sitework (Bid Item 3)

- 26
27 1. Description: This pay item includes furnishing all labor, materials, tools,
28 equipment, and supervision required to perform the work as shown on the
29 drawings and specified herein, including but not limited to the general site
30 work such as erosion control, paving, grading, site excavation and
31 restoration; installation of fall protection gratings; coring hole and cover
32 pipe/wall openings; installation of bypass manhole; dewatering; and repair,
33 coating and painting requirements for the wet well, bypass manhole and the
34 blower room in the sludge handling building.
35
36 2. Measurement: Measurement for Civil Improvements shall be on a lump
37 sum basis. Percentage complete will be calculated based upon progress of
38 construction of associated individual items in accordance with the
39 breakdown in the approved Schedule of Values.
40
41 3. Payment: Payment for Bid Item 3 shall be made as a percentage complete
42 of the lump sum amount indicated on the Bid Form.
43

- 1 4. Bid Item: Payment for Sitework shall be made at the Contract Lump Sum
2 price for Item No.3 – Sitework as follows:
3

Bid Item No.	Description
3	Sitework

4
5 D. Pump Station Improvement (Bid Item 4)
6

- 7 1. Description: This pay item includes furnishing all labor, materials, tools,
8 equipment, and supervision required to perform the work as shown on the
9 drawings and specified herein, including but not limited to the installation of
10 influent pumps, piping, valves, pipe supports, baffle wall at the influent pump
11 station; and the installation of the influent meter assembly at the headworks
12 such as meter, piping and valves, etc.
13
14 2. Measurement: Measurement for Pump Station Improvement shall be on a
15 lump sum basis. Percentage complete will be calculated based upon
16 progress of construction of associated individual items in accordance with
17 the breakdown in the approved Schedule of Values.
18
19 3. Payment: Payment for Bid Item 4 shall be made as a percentage complete
20 of the lump sum amount indicated on the Bid Form.
21
22 4. Bid Item: Payment for Pump Station Improvement shall be made at the
23 Contract Lump Sum price for Item No.4 – Pump Station Improvement as
24 follows:
25

Bid Item No.	Description
4	Pump Station Improvement

26
27
28 E. Large Bubble Mixing System (Bid Item 5)
29

- 30 1. Description: This pay item includes furnishing all labor, materials, tools,
31 equipment, and supervision required to perform the work as shown on the
32 drawings and specified herein, including but not limited to the Civil,
33 Mechanical, and Electrical, I&C improvements required to install the
34 complete large bubble mixing system. The work consists of installing air
35 compressor unit at the blower room inside the sludge handling building; yard
36 piping; installation of air lines and accumulator plates inside the wet well;
37 and general electrical and I&C requirements.
38
39 2. Measurement: Measurement for Large Bubble Mixing System shall be on
40 a lump sum basis. Percentage complete will be calculated based upon
41 progress of construction of associated individual items in accordance with

1 the breakdown in the approved Schedule of Values.

2
3 3. Payment: Payment for Bid Item 5 shall be made as a percentage complete
4 of the lump sum amount indicated on the Bid Form.

5
6 4. Bid Item: Payment for Large Bubble Mixing System shall be made at the
7 Contract Lump Sum price for Item No.5 – Large Bubble Mixing System as
8 follows:

9

Bid Item No.	Description
5	Large Bubble Mixing System

10
11
12 F. Tank Spray Cleaning System (Bid Item 6)

13
14 1. Description: This pay item includes furnishing all labor, materials, tools,
15 equipment, and supervision required to perform the work as shown on the
16 drawings and specified herein, including but not limited to the Civil and
17 Mechanical improvements required to install the complete tank spray
18 cleaning system. The work consists of installing piping, valves, pressure
19 gauge, strainer on the exterior of the pump station; and installing piping and
20 spray heads inside the pump station.

21
22 2. Measurement: Measurement for Tank Spray Cleaning System shall be on
23 a lump sum basis. Percentage complete will be calculated based upon
24 progress of construction of associated individual items in accordance with
25 the breakdown in the approved Schedule of Values.

26
27 3. Payment: Payment for Bid Item 6 shall be made as a percentage complete
28 of the lump sum amount indicated on the Bid Form.

29
30 4. Bid Item: Payment for Tank Spray Cleaning System shall be made at the
31 Contract Lump Sum price for Item No.6 – Tank Spray Cleaning System as
32 follows:

33

Bid Item No.	Description
6	Tank Spray Cleaning System

34
35
36 G. Temporary Bypass Pumping (Bid Item 7)

37
38 1. Description: This pay item includes furnishing all labor, materials, tools,
39 equipment, and supervision required to perform the work as shown on the
40 drawings and specified herein, including but not limited to the setup,

1 operation and breakdown of the temporary bypass pumping; the installation
2 of roller pipe support and concrete pipe support.

3
4 2. Measurement: Measurement for Temporary Bypass Pumping shall be on
5 a lump sum basis. Percentage complete will be calculated based upon
6 progress of construction of associated individual items in accordance with
7 the breakdown in the approved Schedule of Values.

8
9 3. Payment: Payment for Bid Item 7 shall be made as a percentage complete
10 of the lump sum amount indicated on the Bid Form.

11
12 4. Bid Item: Payment for Temporary Bypass Pumping shall be made at the
13 Contract Lump Sum price for Item No.7 – Temporary Bypass Pumping as
14 follows:

Bid Item No.	Description
7	Temporary Bypass Pumping

15
16
17
18 H. Electrical, Instrumentation and Controls (Bid Item 8)

19
20 1. Description: This pay item includes furnishing all labor, materials, tools,
21 equipment, and supervision required to perform the work as shown on the
22 drawings and specified herein, including but not limited to the installation of
23 power system, testing, and all other work incidental to the completion of
24 electrical system and SCADA integration; excluding the electrical and I&C
25 work required for the large bubble mixing system, which is included in Bid
26 Item 5.

27
28 2. Measurement: Measurement for Electrical, Instrumentation and Controls
29 shall be on a lump sum basis. Percentage complete will be calculated based
30 upon progress of construction of associated individual items in accordance
31 with the breakdown in the approved Schedule of Values.

32
33 3. Payment: Payment for Bid Item 8 shall be made as a percentage complete
34 of the lump sum amount indicated on the Bid Form.

35
36 4. Bid Item: Payment for Electrical, Instrumentation and Controls shall be
37 made at the Contract Lump Sum price for Item No.8 – Electrical,
38 Instrumentation and Controls as follows:

Bid Item No.	Description
8	Electrical, Instrumentation and Controls

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I. Permit Allowance (Bid Item 9)

- 1. Description: Fees for obtaining applications for permits required by the City of Clearwater and the State of Florida in accordance with the plans and specifications, such as Building Permit, NPDES, and etc. The permit allowance is \$5,000 dollars.
- 2. Measurement: The quantity measured for payment shall be the actual receipt supporting permit fees.
- 3. Payment: Payment will be made at the actual cost to the Contractor for the permits required and acquired. Upon completion of the permitting process, the Contractor will submit receipts for permit fees to the City. A change order shall be executed to adjust (increase or decrease) the lump sum contract price for any difference between the bid item allowance amount and the actual permit fees.
- 4. Bid Item: Payment for Permit Allowance shall be made at the actual expenses for Item No.9 – Permit Allowance as follows:

Bid Item No.	Description
9	Permit Allowance

J. Owner's Contingency (Bid Item 10)

- 1. Description: This pay item includes a contingent amount. Only the amount properly authorized by the City and documented will be paid to the Contractor. At project closeout, any amount remaining in contingency funds shall not be paid out as part of any final payment and shall remain with the contract. The total of the contingency fee will be no more than 15% of the Base Bid Schedule Subtotal (Bid Item No.1 to Bid Item No. 8).
- 2. Measurement: Measurement will be for the negotiated work acceptably furnished and installed as directed by the Owner.
- 3. Payment: Payment will be for the actual negotiated work installed. The basis of negotiated prices and subcontractors' invoices will be included in the Contractor's pay application. Copies of all invoices, equipment costs, and other supporting documentation shall be included.
- 4. Bid Item: Payment for Owner's Contingency shall be made at the negotiated expenses for Item No.10 – Owner's Contingency as follows:

1

Bid Item No.	Description
10	Owner's Contingency

2

3

4

5

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END OF SECTION

1 SECTION 01152

2 APPLICATIONS FOR PAYMENT

3
4
5 PART 1 – GENERAL

6
7 1.01 REQUIREMENTS INCLUDED

- 8
9 A. Submit Applications for Payment to the Engineer in accordance with the
10 approved payment schedule, and in the format established by the Owner.
11
12 B. Contractor shall submit to the Engineer for review, the proposed Application
13 for Payment form, prior to the first payment request. Format shall be MS
14 Excel.
15

16 1.02 FORMAT AND DATA REQUIRED

- 17
18 A. Submit applications typed on forms either provided in these Specifications,
19 furnished by the Owner, or as approved by the Owner, with itemized data
20 typed on 8-1/2 inch x 11 inch or 8-1/2 inch x 14-inch white paper
21 continuation sheets.
22
23 B. Provide itemized data on continuation sheet:
24
25 1. Format, schedules, line items and values: those of the Schedule of
26 Values accepted by the Engineer.
27

28 1.03 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

- 29
30 A. Application Form:
31
32 1. Fill in required information, including that for Change Orders
33 executed prior to date of submittal of application.
34
35 2. Fill in summary of dollar values to agree with respective totals
36 indicated on continuation sheets.
37
38 3. Execute certification with signature of a responsible officer of the
39 Contractor.
40
41 B. Continuation Sheets:
42
43 1. Fill in total list of all scheduled component items of work, with item
44 number and scheduled dollar value for each item.
45

- 1 2. Fill in dollar value in each column for each scheduled line item when
- 2 work has been performed or products stored.
- 3 3. List each Change Order executed prior to date of submission, at the
- 4 end of the continuation sheets.
- 5
- 6 a. List by Change Order Number, and description, as for an
- 7 original component item of work.
- 8
- 9 4. To receive approval for payment on component material stored on
- 10 site, submit copies of the original invoices with the Application for
- 11 Payment. The application for payment must also include a table
- 12 summarizing the amount of each invoice and the schedule of values
- 13 line item to which the stored materials apply.
- 14

15 1.04 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

- 16
- 17 A. Provide substantiating data, containing suitable information for review of
- 18 costs requested with a cover letter identifying:
- 19
- 20 1. Project.
- 21
- 22 2. Application number and date.
- 23
- 24 3. Detailed list of enclosures.
- 25
- 26 4. For stored products:
- 27
- 28 a. Item number and identification as shown on application.
- 29
- 30 b. Description of specific material.
- 31
- 32 c. Supplier invoices.
- 33
- 34 d. A table identifying stored material, amount stored, amount
- 35 installed, and schedule of values item, which the material
- 36 applies.
- 37
- 38 B. Submit one copy of data and cover letter for each copy of application.
- 39
- 40 C. Contractor shall maintain an updated construction schedule in accordance
- 41 with these Specifications. As a prerequisite for monthly progress payments,
- 42 Contractor shall submit the updated construction schedule with the
- 43 applications for progress payments. If the Contractor fails to submit the
- 44 required updated schedule within the time prescribed, the Engineer may
- 45 withhold progress payment estimates until such a time as the Contractor
- 46 submits the required updated schedule.

- 1
2 D. Contractor shall maintain an updated set of As-Built Drawings in
3 accordance with these Specifications. As a prerequisite for monthly
4 progress payments, Contractor shall submit the updated As-Built Drawings
5 with the applications for progress payments. If the Contractor fails to submit
6 the updated As-Built Drawings, the Engineer may withhold progress
7 payment estimates until such a time as the Contractor submits same.
8

9 1.05 PREPARATION OF APPLICATION FOR FINAL PAYMENT

- 10
11 A. Fill in application form as specified for progress payments.
12
13 B. Use continuation sheet for presenting the final statement of accounting as
14 specified in the Specification.
15
16 C. All appropriate information must be entered on the application form.
17
18 1. The line title, "Application Period", must indicate the dates between
19 which all work was completed during the pay period. These dates
20 must be consecutive with the dates of the previous Payment Request
21 and they must not overlap.
22
23 2. All blank lines within the "Contract Data" and "Summary of Project
24 Status" section of the application must be completed. Also, if any
25 Change Orders have been approved, the "Change Orders" section
26 must include that information.
27
28 3. All calculations and arithmetic must be precise to the penny.
29
30 4. The application must be signed and dated by an authorized
31 representative of the Contractor.
32

33 1.06 SUBMITTAL PROCEDURE

- 34
35 A. Prior to submitting a completed Application for Payment request, the
36 Contractor shall arrange a field meeting with the Owner and/or Engineer to
37 review and verify all installed quantities and/or stored materials. Only when
38 the Owner/Engineer and Contractor agree on installed quantities and
39 percentages, should the Application for Payment be submitted.
40
41 B. Submit six (6) copies of Applications for Payment to the Engineer at the
42 times stipulated in the General Conditions.
43
44 C. When the Engineer finds Application properly completed and correct, he will
45 transmit certificate for payment to Owner, with copy to Contractor.
46

1 PART 2 – PRODUCTS (NOT USED)

2

3 PART 3 – EXECUTION (NOT USED)

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END OF SECTION

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1 SECTION 01153

2
3 CHANGE ORDER PROCEDURES

4
5 PART 1 – GENERAL

6
7 1.01 REQUIREMENTS INCLUDED

- 8
9 A. Promptly implement Change Order procedures.
- 10
11 1. Provide full written data required to evaluate changes.
- 12
13 2. Maintain detailed records of work done on a time and material/force
- 14
15 account basis.
- 16
17 3. Provide full documentation to Engineer on request.
- 18
19 B. Designate in writing the member of Contractor's organization:
- 20
21 1. Who is authorized to accept changes in the work.
- 22
23 2. Who is responsible for informing others in the Contractor's employ of
- 24 the authorization of changes in the work.

25 1.02 DEFINITIONS

- 26
27 A. Change Order: See General Conditions.
- 28
29 B. Work Directive Change: A written order to the Contractor, signed by Owner
- 30
31 and Engineer, which amends the Contract Documents as described,
- 32
33 authorizes Contractor to proceed with a change that affects the Contract
- 34
35 Sum or the Contract Time, and that will be included in a subsequent Change
- 36
37 Order.
- 38
39 C. Engineer's Supplemental Instructions: A written order, instructions, or
- 40
41 interpretations, signed by Engineer making minor changes in the Work not
- 42
43 involving a change in Contract Sum or Contract Time.
- 44
45 D. Field Order: A written order to the Contractor, signed by the Engineer and
- 46
the Contractor, which is issued to interpret/clarify the Contract Documents,
- order minor changes in the work. The work described by a Field Order is
- to be accomplished without change to the Contract Sum, Contract Time,
- and/or claims for other costs.

1.03 PRELIMINARY PROCEDURES

1 A. Owner and Engineer may initiate changes by submitting a Work Directive
2 Change to the Contractor. Request will include:

- 3
4 1. Detailed description of the change, products, and location of the
5 change in the Project.
6
7 2. Supplementary or revised Drawings and Specifications.
8
9 3. The projected time span for making the change, and a specific
10 statement as to whether overtime work is or is not authorized.
11
12 4. A specific period of time during which the requested price will be
13 considered valid.
14

15 B. Contractor may initiate changes by submitting a written notice to the
16 Engineer, containing:

- 17
18 1. Description of the proposed changes.
19
20 2. Statement of the reason for making the changes.
21
22 3. Statement of the effect on the Contract Sum and the Contract Time.
23
24 4. Statement of the effect on the work of separate contractors.
25
26 5. Documentation supporting any change in Contract Sum or Contract
27 Time, as appropriate.
28

29 1.04 CONSTRUCTION CHANGE AUTHORIZATION

30
31 A. Work Directive Change will describe changes in the Work, both additions
32 and deletions, with attachments of revised Contract Documents to define
33 details of the change and will designate the method of determining any
34 change in the Contract Sum and any change in Contract Time.
35

36 B. Owner and Engineer will sign and date the Work Directive Change as
37 authorization for the Contractor to proceed with the changes.
38

39 1.05 DOCUMENTATION OF PROPOSALS AND CLAIMS

40
41 A. Support each quotation for a lump sum proposal, and for each unit price,
42 which has not previously been established, with sufficient substantiating
43 data to allow the Engineer to evaluate the quotation.
44

45 B. On request, provide additional data to support time and cost computations:
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1. Labor required.
2. Equipment required.
3. Products required.
 - a. Recommended source of purchase and unit cost.
 - b. Quantities required.
4. Taxes, insurance, and bonds.
5. Credit for work deleted from Contract, similarly documented.
6. Overhead and profit.
7. Justification for any change in Contract Time.

C. Support each claim for additional costs, and for work done on a time-and-material/force account basis, with documentation as required for a Lump Sum proposal, plus additional information:

1. Name of the Owner's authorized agent who ordered the work and date of the order.
2. Dates and times work was performed and by whom.
3. Time record, summary of hours worked, and hourly rates paid.
4. Receipts and invoices for:
 - a. Equipment used, listing dates, and times of use.
 - b. Products used, listing of quantities.
 - c. Subcontracts.

1.06 PREPARATION OF CHANGE ORDERS AND FIELD ORDERS

- A. Engineer will prepare each Change Order and Field Order.
- B. Change Order will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change.

- 1 C. Change Order will provide an accounting of the adjustment in the Contract
2 Sum and in the Contract Time.
3
4 D. Field Order will describe interpretations or clarifications of Contract
5 Documents, order minor changes in the Work, and/ or memorialize trade-off
6 agreements.
7
8 E. Field Order work will be accomplished without change in the Contract Sum,
9 Contract Time, and/or claims for other costs.

10
11 1.07 LUMP SUM/FIXED PRICE CHANGE ORDER
12

- 13 A. Engineer initiates the form, including a description of the changes involved
14 and attachments based upon documents and proposals submitted by
15 Contractor, or requests from Owner, or both.
16
17 B. Once Engineer has completed and signed the form, all copies should be
18 sent to Contractor for review. After review by Contractor, all copies should
19 be sent to Owner for review. Engineer should make distribution of executed
20 copies.
21

22 1.08 UNIT PRICE CHANGE ORDER
23

- 24 A. Content of Change Orders will be based on either:
25
26 1. Engineer's definition of the scope of the required changes.
27
28 2. Contractor's Proposal for a change, as recommended by Engineer.
29
30 3. Survey of complete work.
31
32 B. The amounts of the unit prices to be:
33
34 1. Those stated in the Agreement.
35
36 2. Those mutually agreed upon between Owner and Contractor.
37
38 C. When quantities of each of the items affected by the Change Order can be
39 determined prior to start of the work:
40
41 1. Owner and Engineer will sign and date a Work Directive Change as
42 authorization for Contractor to proceed with the changes.
43
44 D. When quantities of the items cannot be determined prior to start of the work:
45

- 1 1. Engineer or Owner will issue a Work Directive change directing the
2 Contractor to proceed with the change on the basis of unit prices,
3 and the Engineer will cite the applicable unit prices.
- 4
- 5 2. Upon completion of the change, the Engineer will determine the cost
6 of such work based on the unit prices and quantities used.
7 Contractor shall submit documentation to establish the number of
8 units of each item and any claims for a change in Contract Time.
- 9
- 10 3. Engineer will sign and date the Change Order to establish the
11 change in Contract Sum and in Contract Time.
- 12
- 13 4. Contractor will sign and date the Change Order to indicate their
14 agreement with the terms therein.
- 15
- 16 5. Owner will then sign the change order.
- 17

18 1.09 TIME AND MATERIAL/FORCE ACCOUNT CHANGE ORDER/CONSTRUCTION
19 CHANGE AUTHORIZATION

- 20
- 21 A. Engineer and Owner will issue a Work Directive Change directing
22 Contractor to proceed with the changes.
- 23
- 24 B. Upon completion of the change, the Contractor shall submit itemized
25 accounting and supporting data.
- 26
- 27 C. Engineer will determine the allowable cost of such work, as provided in
28 General Conditions and Supplementary Conditions.
- 29
- 30 D. Engineer will sign and date the Change Order to establish the change in
31 Contract Sum and in Contract Time.
- 32
- 33 E. Contractor will sign and date the Change Order to indicate agreement
34 therewith.
- 35
- 36 F. Owner will then sign the Change Order.
- 37

38 1.10 CORRELATION WITH CONTRACTOR'S SUBMITTALS

- 39
- 40 A. Not greater than monthly revise Schedule of Values and Application for
41 Payment forms to record each change as a separate item of work and to
42 record the adjusted Contract Amount.
- 43
- 44 B. Not greater than monthly revise the Progress Schedule to reflect each
45 change in Contract Time. Revise sub-schedules to show changes for other
46 items of work affected by the Change Order.
- 47
- 48 C. Upon completion of work under a Change Order, enter pertinent changes
49 in Record Documents.
- 50

1 PART 2 – PRODUCTS (NOT USED)

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3 PART 3 – EXECUTION (NOT USED)

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END OF SECTION

1 SECTION 01200

2
3 MEETINGS AND CONFERENCES

4
5 PART 1 – GENERAL

6
7 1.01 PRE-CONSTRUCTION CONFERENCE

8
9 A. In accordance with the Contract Documents, prior to the commencement of
10 Work, a preconstruction conference shall be held at a mutually agreed time
11 and place.

12
13 B. The purpose of the conference shall be to designate responsible personnel
14 and establish a working relationship. Matters requiring coordination shall
15 be discussed and procedures for handling such matters established. The
16 agenda shall include as a minimum:

- 17 1. Contractor's Initial Construction Schedule
- 18 2. Procedures for Transmittal, Review and Distribution of Shop Drawings
- 19 3. Procedures for Submittal and Review of Monthly Applications for
20 Payment
- 21 4. Maintaining As-Built Drawings
- 22 5. Critical Work Sequencing and Construction Restrictions
- 23 6. Field Decisions and Change Orders
- 24 7. Field Office, Storage Areas and Security
- 25 8. Equipment and Material Deliveries
- 26 9. Safety Meetings and Program
- 27 10. Traffic Control Plan
- 28 11. Pre-construction Video

29
30
31 C. The Engineer shall preside at the conference and shall arrange for
32 preparation and distribution of the minutes.

33
34
35 1.02 PROGRESS MEETINGS

36
37 A. The Owner shall schedule and conduct regular project meetings at least
38
39
40
41
42
43

1 monthly and at other times as deemed necessary by the progress of the
2 work. The Contractor and the Engineer shall be represented at each
3 meeting. The Contractor and/or Engineer may request attendance by
4 representatives of material Supplier(s) and Subcontractor(s).
5

6 B. The Engineer shall preside at the conference and shall arrange for keeping
7 the minutes and distributing them to all persons in attendance. The purpose
8 of the meetings shall include but not be limited to reviewing the progress of
9 the Work, maintaining coordination of efforts, discussing changes in
10 scheduling and resolving problems that may develop; claims review; and
11 future scheduling.
12

13 PART 2 – PRODUCT (NOT USED)

14 PART 3 – EXECUTION (NOT USED)

15
16
17
18 END OF SECTION
19
20
21
22
23

1 SECTION 01300

2
3 SUBMITTALS

4
5 PART 1 – GENERAL

6
7 1.01 GENERAL SUBMITTAL REQUIREMENTS

- 8
9 A. All submittals, regardless of origin, shall be transmitted in the format
10 provided to the Contractor by the Engineer, certified and signed by the
11 Contractor indicating the submittal to be correct and in accordance with the
12 Contract Documents, and noting any special instructions regarding the
13 submittal. Each submittal shall identify the submittal number in the format
14 required by the Engineer, with the name and number of this contract, the
15 Contractor's name, and references to applicable specification paragraphs
16 and Contract Drawings. Each submittal shall indicate the intended use of
17 the item in the Work. When catalog pages are submitted, applicable items
18 shall be clearly identified. The current revision, issue number, and date
19 shall be indicated on all drawings and descriptive data.
20
- 21 B. Contractor shall stamp each submittal and said stamp shall be Contractor's
22 representation to Owner and Engineer that Contractor accepts full
23 responsibility for determining and verifying all quantities, dimensions, field
24 construction criteria, materials, catalog numbers, and similar data, and that
25 he has reviewed or coordinated each submittal with the requirements of the
26 Work and the Contract Documents.
27
- 28 C. All deviations from the Contract Documents shall be identified on each
29 submittal and shall be tabulated in Contractor's letter of transmittal. Such
30 submittals shall indicate, as pertinent to the deviation, essential details of
31 all changes proposed by Contractor (including modifications to other
32 facilities that may be a result of the deviation) and all required piping and
33 wiring diagrams.
34
- 35 D. Contractor shall accept full responsibility for the completeness of each
36 submission, and, in the case of a resubmission, shall verify that all
37 exceptions previously noted by Engineer have been taken into account. In
38 the event that more than one resubmission is required because of the
39 Contractor's failure to account for exceptions previously noted, Contractor
40 shall reimburse Owner for the charges of Engineer for review of the
41 additional resubmissions.
42
- 43 E. Resubmittals shall be made within seven (7) days of the date of the letter
44 returning the material to be modified or corrected, unless within seven (7)
45 days the Contractor submits an acceptable request for an extension of the
46 stipulated time period, listing the reasons the resubmittal cannot be

1 completed within that time.

2
3 F. Any need for more than one resubmission, or any other delay in obtaining
4 Engineer's review of submittals, will not entitle Contractor to extension of
5 the Contract Time unless delay of the Work is directly caused by a change
6 in the work authorized by a Change Order.

7
8 G. Contractor's letter of resubmittal shall list the date of his original submittal,
9 the date of the Engineer's letter returning the submittal, and the dates of
10 submission and return of any previous resubmittals.

11
12 H. Engineer's review of drawings and data submitted by Contractor will cover
13 only general conformity to the drawings and specifications, external
14 connections, and dimensions which affect the layout. Engineer's review
15 does not indicate a thorough review of all dimensions, quantities, and details
16 of the material, equipment, device or item shown. Engineer's review of
17 submittals shall not relieve Contractor from responsibility for errors,
18 omissions, or deviations, or responsibility for compliance with the Contract
19 Documents.

20
21 I. It is intended that submittals be handled electronically whenever possible,
22 however, when necessary to employ paper copies, five copies of each
23 drawing and necessary data, plus the number of copies that the Contractor
24 wants returned, shall be submitted to Engineer. Engineer will not accept
25 submittals from anyone but Contractor. Submittals shall be consecutively
26 numbered in direct sequence of submittal and without division by
27 subcontracts or trades. Resubmittals shall bear the number of the first
28 submittal followed by a letter (A, B, etc.), to indicate the sequence of the
29 resubmittal. If applicable, the Engineer will provide the Contractor with an
30 electronic file of the submittal format to be followed.

31
32 J. When submittals are returned marked CONFIRM or REJECTED -
33 RESUBMIT, the corrections shall be made as noted thereon and as
34 instructed by Engineer and corrected copies shall resubmitted.

35
36 K. When corrected copies are resubmitted, Contractor shall in writing direct
37 specific attention to all revisions and shall list separately any revisions made
38 other than those called for by Engineer on previous submissions.

39
40 L. When the submittals are returned marked APPROVED, NO EXCEPTIONS
41 TAKEN or MAKE CORRECTIONS NOTED resubmittal is not required.

42 43 1.02 SCHEDULE OF SUBMITTALS

44
45 A. The Contractor shall prepare and submit for approval a Schedule of
46 Submittals identifying the date of the initial submission, the beginning of

1 manufacture as applicable, and the delivery to the site. This Schedule shall
2 be submitted as a separate submittal and be approved as a prerequisite to
3 the submission of any other submittal. No other shop drawing or submittal
4 will be reviewed until the Schedule of Submittals is approved.
5

6 B. The Schedule of Submittals shall include all submittals specified to be
7 submitted including shop drawings, schedules, permits, warranties, reports,
8 and other items specified to be submitted.
9

10 C. The Schedule of Submittals shall show the submittal of each shop drawing
11 and/or submittal sufficiently in advance of performing the related work or
12 other applicable activities, or within the time specified in the individual work
13 sections of the Specifications, so that the installation will not be delayed by
14 processing times, including disapproval and resubmittal (if required),
15 coordination with other submittals, testing, purchasing, fabrication, delivery,
16 and similar sequenced activities.
17

18 D. The Schedule of Submittals shall indicate those submittals that are critical
19 to the progress schedule. The Schedule shall show other, non-critical shop
20 drawing submittals spread out over the contract time as required to
21 minimize the number of concurrent reviews being performed, or as directed
22 by the Engineer. All equipment testing certifications, certifications of proper
23 installation, warranties, O&M manuals, spare parts and Owner training
24 materials specified to be provided shall be submitted in accordance with this
25 specification and shall either be submitted with the shop drawing submittal
26 for the equipment or submitted separately.
27

28 E. The Contractor shall develop the Schedule of Submittals such that **the total**
29 **number of submittals does not exceed thirty-one (31)**. In developing the
30 Schedule of Submittals, the Contractor shall identify separate submittals for:
31

- 32 1. Construction phasing plan
- 33 2. Each concrete coating and lining system
- 34 3. Each pipe material of construction (ductile iron, steel, PVC, HDPE, etc.).
- 35 4. Concrete and concrete reinforcement
- 36 5. Construction and start-up schedules.
37

38 In developing the Schedule of Submittals, the Contractor may identify a
39 single submittal for a given Division, such as Division 5 Miscellaneous
40 Metals, or a given Section, such as 15100 Valves, incorporating all items
41 into a single submittal. However, no submittal shall include items from two
42 (or more) different Divisions.
43

44 Monthly schedule and narrative updates that are submitted with
45 Applications for Payment will not count against the total number of
46 submittals specified above.

1
2 F. In accordance with Section IIIA, the Contractor shall reimburse the Owner
3 for Engineer's cost to review excess submittals and re-submittals and/or
4 confirmations that exceed a total ten (10) beyond that specified above (total
5 of 50 submittals and re-submittals).
6

7 G. Following is an example listing of the anticipated submittals for this project.
8

- 9 1. Schedule of Submittals
- 10 2. Surveyor Information
- 11 3. Schedule of Values
- 12 4. Construction Schedule
- 13 5. Schedule of Payments
- 14 6. Construction Phasing Plan
- 15 7. Hurricane Preparedness Plan
- 16 8. Video Subcontractor and Pre Construction Video
- 17 9. Stormwater Permit NOI
- 18 10. FDEP Groundwater Discharge Permit
- 19 11. Dewatering Plan
- 20 12. Precast Concrete Manhole
- 21 13. Cast-In Place Concrete
- 22 14. Concrete Reinforcement
- 23 15. Concrete Waterstop
- 24 16. Hatch/Hatch Grating
- 25 17. Paint and Coatings
- 26 18. DI Pipe, Fittings, Couplings & Accessories
- 27 19. 316 SS Air Pipe
- 28 20. PVC Pipe (SCH40 and 80)
- 29 21. Pipe Supports
- 30 22. Pumps
- 31 23. Bypass Pumping System and Plan
- 32 24. Large Bubble Mixing Unit (including air compressor unit),
33 including O&M Manual
- 34 25. Spray Nozzle Head
- 35 26. Radar Level Sensor
- 36 27. Magnetic Flow Meter, including O&M Manual
- 37 28. Knife Gate Valves, all sizes, including O&M Manual
- 38 29. Plug Valves, all sizes, including O&M Manual
- 39 30. Check Valves, all sizes, including O&M Manual
- 40 31. Raceways
- 41 32. Electrical Wiring & Cables
- 42 33. Electrical Box, Control Panels & Fittings
- 43 34. Electrical Wiring Devices
- 44 35. Electrical Supporting Devices
- 45 36. Grounding
- 46 37. Disconnect Switches

- 38. Site Lighting and Pole
- 39. Final Shop Drawings and O&M Manuals in Electronic Format
- 40. Contract Closeout Submittals

1.03 CONSTRUCTION SCHEDULE

- A. Before Work is started, Contractor shall submit to Engineer for review a schedule of the proposed construction operations. The construction schedule shall indicate the sequence of the Work, the time of starting and completion of each part, the installation date for each major item of equipment, and the time for making connections to existing piping, structures, or facilities.
- B. At least every 30 days the schedule shall be revised as necessary to reflect changes in the progress of the Work.
- C. Owner may require Contractor to add to his equipment, or construction forces, as well as increase the working hours, if operations fall behind schedule at any time during the construction period.

1.04 PROGRESS REPORTS

- A. A progress report shall be furnished to Engineer with each application for progress payment. If the Work falls behind schedule, Contractor shall submit additional progress reports at such intervals as Engineer may request.
- B. Each progress report shall include sufficient narrative to describe current and anticipated delaying factors, their effect on the construction schedule, and proposed corrective actions. Any Work reported complete, but which is not readily apparent to Engineer, must be substantiated with satisfactory evidence.
- C. Each progress report shall also include three (3) prints of the accepted graphic schedule marked to indicate actual progress.

1.05 SCHEDULE OF VALUES

- A. The Contractor shall submit to the Engineer for review a Schedule of Values after review of the tentative schedule and before submission of the first application for payment. The schedule of values, showing the value of each kind of work in sufficient detail as requested by the Engineer, shall be acceptable to Engineer before any application for payment is prepared or approved.
- B. The sum of the items listed in the Schedule of Values shall equal the Contract

1 Price. Such items as Bond premium, temporary construction facilities, may
2 be listed separately in the schedule of values, provided the amounts can be
3 substantiated. Overhead and profit shall not be listed as separate items.
4 The Schedule of Values shall contain at minimum a complete listing of the
5 various project milestones that are "critical path" items according to the
6 approved construction schedule.
7

8 C. In addition to those items listed in Paragraph B, the O&M manuals, as-built
9 drawings, start-up, training, and any other individualized component that the
10 Contractor or Engineer wants separately itemized for payment shall also be
11 included on the Schedule of Values.
12

13 D. An unbalanced Schedule of Values providing for overpayment of Contractor
14 on items of Work that would be performed first will not be accepted. The
15 Schedule of Values shall be revised and resubmitted until acceptable to
16 Engineer. Final acceptance by Engineer shall indicate only consent to the
17 Schedule of Values as a basis for preparation of applications for progress
18 payments and shall not constitute an agreement as to the value of each
19 indicated item.
20

21 1.06 SCHEDULE OF PAYMENTS
22

23 A. Within thirty (30) days after Notice to Proceed, the Contractor shall furnish
24 to the Engineer a schedule of estimated monthly payments. The schedule
25 shall be revised and resubmitted each time an application for payment
26 varies more than 10 percent from the estimated payment schedule.
27

28 1.07 SURVEY DATA
29

30 A. All field books, notes, and other data developed by Contractor in performing
31 surveys required as part of the Work shall be available to Engineer for
32 examination throughout the construction period. All such data shall be
33 submitted to Engineer with the other documentation required for final
34 acceptance of the Work.
35

36 1.08 SHOP DRAWING SUBMITTALS, WORKING DRAWINGS AND ENGINEERING
37 DATA
38

39 A. Shop drawings, working drawings, and engineering data shall be included
40 in the Schedule of Submittals identifying the dates for the initial submission
41 of shop and working drawings, the beginning of manufacture, testing and
42 installation of materials, supplies and equipment.
43

44 B. The Schedule of Submittals shall show the submittal of each shop drawing
45 sufficiently in advance of performing the related work or other applicable
46 activities, or within the time specified in the individual work sections of the

1 Specifications, so that the installation will not be delayed by processing
2 times including re-review and resubmittal (if required), coordination with
3 other submittals, testing, purchasing, fabrication, delivery, and similar
4 sequenced activities.

5
6 C. The Schedule of Submittals shall indicate those submittals that are critical
7 to the progress schedule and shall show other shop drawing submittals
8 spread out over the contract time as required to minimize the number of
9 concurrent reviews or as directed by the Engineer.

10
11 D. Engineering data covering all equipment and fabricated materials that will
12 become a permanent part of the Work shall be submitted to Engineer, for
13 review. These data shall include drawings and descriptive information in
14 sufficient detail to show the kind, size, arrangement, and operation of
15 component materials and devices; the external connections, anchorages,
16 and supports required; performance characteristics; and dimensions
17 needed for installation and correlation with other materials and equipment.

18
19 1.09 LAYOUT DATA

20
21 A. Contractor shall keep neat and legible notes of measurements and
22 calculations made by him in connection with the layout of the Work. Copies
23 of such data shall be furnished to the Engineer for use in checking

24
25 B. Contractor's layout as provided under Lines and Grades. All such data
26 considered of value to Owner will be transmitted to Owner by Engineer with
27 other records upon completion of the Work.

28
29 1.10 SUBMITTALS FOR COLOR SELECTION

30
31 A. The following is a list of items that must be submitted together for color
32 selection. No single item on this list will be approved without the submittal
33 of all other items.

34
35 1. Paint for piping, valves, valve box covers, meter box covers, etc.

36
37 2. Paint for equipment.

38
39 PART 2 – PRODUCT (NOT USED)

40
41 PART 3 – EXECUTION (NOT USED)

42
43
44 END OF SECTION

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1 SECTION 01310

2
3 CONSTRUCTION SCHEDULES

4
5
6 PART 1 – GENERAL

7
8 1.01 GENERAL

- 9
10 A. Construction under this contract must be coordinated to assure that
11 construction is completed within the time allowed by the Contract Documents.
12 The Contractor will also coordinate his activities with the other contractors to
13 allow orderly and timely completion of all the work.
14
15 B. All construction schedules shall be of the critical path method, bar chart type,
16 and shall be prepared using SURETRACK, PRIMAVERA P3, or equal.
17
18 C. The Contractor is advised that the construction schedule must reflect that no
19 major pieces of equipment or systems may be shut down or started up within
20 one week prior to the toxicity screening and compliance testing events
21 highlighted on the Owner’s TRE Schedule at the end of this section.
22

23 1.02 CONSTRUCTION SCHEDULING GENERAL PROVISIONS

- 24
25 A. Within 15 calendar days after the issuance of the Notice of Award, the
26 Contractor shall prepare and submit to the Engineer a preliminary construction
27 progress schedule. The schedule shall contain a sufficient number of tasks
28 such that no single task has a value that exceeds 2.0% of the total Contract
29 Price. Partial payments will not be approved until an acceptable construction
30 progress schedule has been accepted by the Engineer.
31
32 B. The schedule shall be updated monthly reflecting the baseline schedule and
33 the Contractor’s progress on each activity. No progress payment will be
34 approved until the updated schedule is submitted and accepted by the
35 Engineer.
36
37 C. Night work may be established by the Contractor as regular procedure only
38 with the prior written permission of the Owner. Such permission, however,
39 may be revoked at any time by the Owner if the Contractor fails to maintain
40 adequate equipment and supervision for the proper execution and control of
41 the work at night.
42
43 D. The Contractor shall designate an authorized representative who shall be
44 responsible for development and maintenance of the schedule and of
45 progress and payment reports. This representative of the Contractor shall

1 have direct project control and complete authority to act on behalf of the
2 Contractor in fulfilling the commitments of the Contractor's schedule.

3
4 1.03 PROGRESS OF THE WORK

- 5
6 A. The work shall be executed with such progress as may be required to prevent
7 any delay to the general completion of the work. The work shall be executed
8 at such times and in or on such parts of the project, and with such forces,
9 materials and equipment to assure completion of the work in the time
10 established by the Contract.
11
12 B. If the Contractor, for his convenience and at his own expense, should desire
13 to carry on his work at night or outside regular hours, he shall submit written
14 notice to the Engineer and he shall allow ample time for satisfactory
15 arrangements to be made for inspecting the work in progress. The Contractor
16 shall reimburse the Owner for extra inspection required for work outside
17 regular hours. The Contractor shall light the different parts of the project as
18 required to comply with all applicable Federal and State regulations and with
19 all applicable requirements of the municipality in which the work is being done.
20

21 PART 2 – PROGRESS SCHEDULE SUBMITTALS

22
23 2.01 GENERAL REQUIREMENTS

- 24
25 A. As required within the General Conditions, the Contractor shall submit a
26 critical path progress schedule as described herein. The schedule shall take
27 into considerations all work phasing and restrictions as specified elsewhere in
28 the Contract Documents.
29
30 B. The critical path progress schedule requirement shall consist of a detailed
31 schedule, monthly status reports (Monthly Reports), a start-up schedule, and
32 revisions to the schedules and analyses as described. The planning,
33 scheduling, management and execution of the work are the sole
34 responsibilities of the Contractor. The progress schedule shall allow the
35 Engineer to review Contractor's planning, scheduling, management, and
36 execution of the work; to assist Engineer in evaluating work progress and
37 make progress payments; to allow other contractors to cooperate and
38 coordinate their activities with those of the Contractor; and to provide Owner
39 with information about "construction schedule" and "cumulative outlay
40 schedule."
41
42 C. Engineer's review of the schedule submittals shall not relieve Contractor from
43 the responsibility for any deviations from the Contract Documents unless
44 Contractor has in writing called Engineer's attention to such deviations at the
45 time of submission and Engineer has given written concurrence to the specific

1 deviations, nor shall any concurrence by Engineer relieve Contractor from
2 responsibility for errors and omissions in the submittals.
3

4 D. Float or slack time is not for the exclusive benefit of the Owner, the Engineer
5 or the Contractor. Extensions of time for performance, as specified in the
6 General and Supplementary Conditions, will be granted only to the extent that
7 equitable time adjustments for the network activity, or activities affected,
8 exceed the total float or slack time along the affected network paths, as shown
9 in the precedence diagram and report in effect at the instant of either (a) a
10 notice to proceed with a change, or (b) a notice of suspension of work or
11 possession, or (c) detection of a subsequently acknowledged differing site
12 condition, or (d) occurrence of cause for an excusable delay. Further, use of
13 float time in the schedule, or the allocation of float time to activities by means
14 of special logic restraints or imposed dates, shall be shared to the benefit of
15 Owner, Engineer, Contractor, and his subcontractors and suppliers in
16 proportion of their scope of responsibilities. Excessive use of float time to the
17 detriment of succeeding activities may be cause for denying an extension of
18 time if it can be demonstrated that the float along the network paths affected
19 at the instant of the delaying condition would have been larger than the delay
20 had it not been for the excessive and unreasonable float usage in violation of
21 the sharing concept required by this Specification.
22

23 E. Engineer's review of the schedule submittals shall be only for conformance
24 with the information given in the Contract Documents and shall not extend to
25 the means, methods, sequences and techniques or procedures of
26 construction or to safety precautions or programs incident thereto. Engineer's
27 review of the schedule submittals will be predicated on a Contractor's stamp
28 of approval signed off by Contractor. Contractor's stamp of approval on any
29 schedule submittals shall constitute a representation to Owner and Engineer
30 that Contractor, has either determined or verified all data on the submittal, or
31 assumes full responsibility for doing so, and that Contractor and his
32 subcontractors and suppliers have reviewed and coordinated the sequences
33 shown in the submittal with the requirements of the work under the Contract
34 Documents.
35

36 2.02 SUPPLEMENTARY REQUIREMENTS 37

38 A. Graphic network diagrams shall be on a time-scaled precedence network
39 format. The graphic network diagram shall include the following format:
40

- 41 1. Description of each activity, or restraint, shall be brief but convey the
42 scope of work described.
- 43 2. Activities shall identify all items of work that must be accomplished to
44 achieve Substantial Completion, or any interim substantial completion,
45 such as the major disciplines of work; items pertaining to the approval
46

1 of regulatory agencies; contractor's time required for submittals,
2 fabrication and deliveries; the time required by Engineer to review all
3 submittals as set forth in the Contract Documents; items of work
4 required of Owner to support pre-operational and start-up testing; time
5 required for the relocation of utilities. Activities shall also identify
6 interface milestones with the work of other contract work under
7 separate contracts with Owner.
8

9 3. Any activities not shown on the graphic network diagram shall be
10 considered to have no effect on the Contractor's ability to achieve
11 Substantial Completion, or any interim substantial completion, within
12 the Contract Time. Any delays to activities that do not appear in the
13 concurred detailed schedule shall give rise only to non-prejudicial
14 delays. Attempts to impose after-the-fact logic constraints where none
15 existed previously to justify time extensions will not be permitted.
16

17 4. Activity durations shall be in whole working days.
18

19 5. Graphic diagrams shall be time-scaled and sequenced by work areas.
20 The Diagram of Activities shall show numerical values for total float and
21 be shown on their early schedules. The diagram shall be neat and
22 legible and submitted on sheets no larger than 24 inches by 36 inches
23 on a medium suitable for reproduction.
24

25 B. Printout reports shall contain the following data for each activity or restraint:
26

27 1. Activity identification, activity description, activity duration, activity
28 man-days, computed or specified early start date, computed early
29 finish date, computed late start date, computed or specified late finish
30 date, and total float and free float.
31

32 2. Five separate reports shall be provided, including all activities and
33 restraints, and shall be submitted monthly as follows:
34

- 35 a. Activity, sort by early start dates in order of ascending numbers.
- 36 b. Activity, sort by department.
- 37 c. Float report, in order of ascending total float values.
- 38 d. Successor/predecessor report.
39

40 PART 3 – EXECUTION

41 3.01 DETAILED SCHEDULE SUBMITTAL

42 A. Submittal shall include a time-scaled graphic diagram showing all Contract
43 activities, computer printout reports, and a supporting narrative. The initial
44 Detailed Schedule submittal shall be delivered within 10 calendar days after
45
46

1 the Notice to Proceed and shall use the Notice to Proceed as the "data date".
2 Upon receipt of Engineer's comments, Contractor shall meet with Engineer
3 and discuss an appraisal and evaluation of the proposed work plan.
4 Necessary revisions resulting from this review shall be made by Contractor
5 and the detailed schedule resubmitted within 15 calendar days after the
6 meeting. The re-submittal, if agreed to by the Owner, and unless
7 subsequently changed with the concurrence of or at the direction of Owner,
8 shall be the work plan to be used by the Contractor for planning, scheduling,
9 managing, and executing the work. If Contractor fails to provide an
10 acceptable Detailed Schedule submittal, he will be deemed not to have
11 provided a basis upon which progress may be evaluated, which will further
12 constitute reasons for refusing to recommend payment.
13

14 B. The graphic diagram shall be formatted in accordance with Article 2.02(A)
15 above. The diagram shall include (1) all detailed activities grouped by major
16 areas of work. The critical path activities shall be identified, including critical
17 paths for interim dates, if applicable, by clearly highlighting the path on the
18 graphics diagram.
19

20 C. This submittal shall include five copies of the graphic diagram, the printout
21 reports, and the narrative, in accordance with Article 2.02 of these scheduling
22 requirements.
23

24 D. The narrative shall include sufficient data to explain the basis of Contractor's
25 determination of durations, describe the contract conditions and restraints
26 plugged into the schedule, and provide a "what-if" analysis pertaining to
27 potential problems and practical steps to mitigate them. Should Engineer
28 require additional data, this information shall be supplied by Contractor within
29 ten calendar days.
30

31 3.02 MONTHLY STATUS REPORTS

32

33 A. Beginning with the first month, and every month thereafter, Contractor shall
34 submit to Engineer, with each Application for Payment, a Monthly Status
35 Report (based on the Detailed Schedule) with data as of the last day of the
36 pay period. The monthly Status Report shall include a revised copy of the
37 currently accepted graphic diagram, computer printouts and a narrative. The
38 Monthly Status Report will be reviewed by the Engineer. The Contractor shall
39 address the Engineer's comments in the subsequent Monthly Status Report.
40 If Contractor fails to provide acceptable Monthly Status Reports, he will be
41 deemed not to have provided a basis upon which progress may be evaluated,
42 which will be reason for refusing to recommend progress payments.
43

44 B. The revised diagram shall show, for the currently accepted detailed diagram,
45 percentages of completion for all activities, actual start and finish dates, and
46 remaining durations, as appropriate. Activities not previously included in the

1 currently accepted detailed schedule shall be added, except that contractual
2 dates will not be changed except by Change Order. Review of a revised
3 diagram by the Engineer will not be construed to constitute concurrence with
4 the time frames, duration, or sequencing for such added activities; instead,
5 the corresponding data as ultimately incorporated into an appropriate change
6 order shall govern.
7

8 C. The narrative shall include the information shown in the following outline in a
9 narrative form:

- 10
- 11 1. Construction progress (refer to activity number in the Detailed
12 Schedule) including:
 - 13 a. Activities completed this reporting period;
 - 14 b. Activities in progress this reporting period;
 - 15 c. Activities scheduled to commence next reporting period.
 - 16 2. Description of problem areas
 - 17 3. Current and anticipated delays
 - 18 a. Cause of the delay;
 - 19 b. Corrective action and schedule adjustments to correct the
20 delay;
 - 21 c. Impact of the delay on other activities, on milestones, and on
22 completion dates.
 - 23 4. Changes in construction sequence
 - 24 5. Pending items and status thereof
 - 25 a. Permits
 - 26 b. Change Orders
 - 27 c. Time extensions
 - 28 d. Other
 - 29 6. Contract completion date status
 - 30 a. Ahead of schedule and number of days
 - 31 b. Behind schedule and number of days

32 3.03 REVISIONS

- 33
- 34 A. All revised Detailed Schedule submittals shall be in the same form and detail
35 as the initial submittal and shall be accompanied by an explanation of the
36 reasons for such revisions, all of which shall be subject to review by Engineer.
37

1 The revision shall incorporate all previously made changes to reflect current
2 as-built conditions. Minor changes to the submittal may be reviewed at
3 monthly meetings. Changes to activities having adequate float shall be
4 considered a minor change.
5

6 B. A revised detailed work plan submittal shall be submitted for review, when
7 required by Engineer, for one of the following reasons:
8

9 1. Owner or Engineer directs a change that affects the date(s) specified
10 in the Agreement or alters the length of a critical path.
11

12 2. Contractor elects to change any sequence of activities so as to affect
13 a critical path of the currently accepted detailed schedule documents.
14

15 C. If, prior to agreement on an equitable adjustment to the Contract Time,
16 Engineer requires revisions to the Detailed Schedule in order to evaluate
17 planned progress, Contractor shall provide an interim revised submittal for
18 review with change effect(s) incorporated as directed. Interim revisions to the
19 documents will be incorporated during the first subsequent Monthly Status
20 Report.
21

22 3.04 START-UP SCHEDULE SUBMITTALS 23

24 A. At least 90 calendar days prior to the date of Substantial Completion,
25 Contractor shall submit a time-scaled (days after notice to proceed) graphic
26 diagram detailing the work to take place in the period between 60 days prior
27 to Substantial Completion, together with a supporting narrative. Engineer
28 shall respond within 10 calendar days after receipt of the submittal. Upon
29 receipt of Engineer's comments, Contractor shall make the necessary
30 revisions and submit the revised schedule within ten calendar days. If
31 Contractor fails to provide acceptable Start-up Schedule Submittals, he will be
32 deemed not to have provided a basis upon which progress may be evaluated,
33 which will be reason for refusing to recommend payment.
34

35 B. The Start-up Schedule may not be combined with the Detailed Schedule. The
36 Start-up Schedule is intended to show much greater detail than the Detailed
37 Schedule for start-up activities. Typical information required includes, but is
38 not limited to, the timing of vendor representatives, pre-op testing, individual
39 equipment start-ups, Owner's training, and performance certification testing.
40

41 C. The graphic diagram shall use the currently accepted Detailed Schedule for
42 those activities completed ahead of the last 60 calendar days prior to
43 Substantial Completion, and detailed activities for the remaining 60-day period
44 within the time frames outlined in the currently accepted Detailed Schedule.
45

1 D. Contractor will be required to continue the requirement for monthly reports, as
2 outlined in Articles 3.03 and 3.04 above. In preparing these reports,
3 Contractor must assure that the Detailed Schedule is consistent with the
4 progress noted in the Start-up Schedule.

5
6 E. In addition, Contractor will be required to submit a revised copy of the start-up
7 graphic diagram on a monthly basis with a start-up narrative. This revised
8 diagram shall highlight percentages of completion, actual start and finish
9 dates, and remaining durations as applicable. Activities not previously
10 included in the accepted detailed work plan shall be added in these submittals,
11 except that contractual dates shall not be changed except by Change Order.
12 Reviews of these submittals by Engineer will not be construed to constitute
13 concurrence with the time frames, durations or sequence of work for each
14 added activity.

15
16 3.05 CONSTRUCTION PERIOD

17
18 A. The construction period for this project is four hundred fifty (450) consecutive
19 calendar days until Substantial Completion, followed by an additional thirty
20 (30) consecutive calendar days for Final Completion.

21
22 B. Whenever it becomes apparent from the current monthly progress evaluation
23 and updated schedule data that any milestone and/or Contract completion
24 date will not be met, the Contractor shall take appropriate action to bring the
25 work back on schedule. Actions could include:

26
27 1. Increase construction manpower in such quantities and crafts as to
28 substantially eliminate the backlog of work;

29
30 2. Increase the number of working hours per shift, shifts per work day,
31 work days per week, or the amount of construction equipment, or any
32 combination of the foregoing sufficient to substantially eliminate the
33 backlog of work; and

34
35 3. Reschedule work items to achieve concurrency of accomplishment.

36
37 C. The addition of equipment or construction forces, increasing the working
38 hours or any other method, manner, or procedure to return to the current
39 Detailed Schedule shall be at the Contractor's own cost and shall not be
40 considered justification for a Change Order or treated as an acceleration
41 order.

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1 SECTION 01340

2
3 SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

4
5 PART 1 – GENERAL

6
7 1.01 REQUIREMENTS INCLUDED

- 8
9 A. The Contractor shall submit to the Engineer for review such working
10 drawings, shop drawings, test reports and data on materials and equipment
11 (hereinafter in this Section called data), and material samples (hereinafter
12 in this Section called samples) as are required for the proper control of work,
13 including but not limited to those working drawings, shop drawings, data
14 and samples for materials and equipment specified elsewhere in the
15 Specifications and in the Contract Drawings.
16
17 B. The Contractor shall note that there are specific submittal requirements in
18 other sections of these Specifications, including the requirement to submit
19 and have reviewed a Schedule of Shop Drawing Submittals prior to the
20 submittal of any other shop drawing, as described in Section 01300.

21
22 1.02 SHOP DRAWINGS

- 23
24 A. When used in the Contract Documents, the term "shop drawings" shall be
25 considered to mean Contractor's Drawings for material and equipment that
26 will become an integral part of the Project. These drawings shall be
27 complete and detailed. Shop drawings shall consist of fabrication, erection
28 and setting drawings and schedule drawings, manufacturer's scale
29 drawings, bills of material, wiring and control diagrams, and inspection and
30 test reports including performance curves and certifications as applicable to
31 the Work.
32
33 B. All details on shop drawings submitted for review shall show clearly the
34 elevations of the various parts to the main members and lines of the
35 structure and/or equipment, and where correct fabrication of the work
36 depends upon field measurements, such measurements shall be made and
37 noted on the shop drawings before being submitted for review.

38
39 1.03 PRODUCT DATA

- 40
41 A. Product data as specified in individual sections, include, but are not
42 necessarily limited to, standard prepared data for manufactured products
43 (sometimes referred to as catalog data), such as the manufacturers product
44 specification and installation instructions, availability of colors and patterns,
45 manufacturer's printed statements of compliances and applicability,
46 roughing-in diagrams and templates, catalog cuts, product photographs,

1 standard wiring diagrams, printed performance curves and operational-
2 range diagrams, production or quality control inspection and test reports
3 and certifications, mill reports, product operating and maintenance
4 instructions and recommended spare-parts listing storage instructions, and
5 printed product warranties, as applicable to the work.
6

7 1.04 WORKING DRAWINGS

8

- 9 A. When used in the Contract Documents, the term "working drawings" shall
10 be considered to mean the Contractor's Drawings for temporary structures
11 such as temporary bulkheads, support of open cut excavation, support of
12 utilities, ground water control systems, forming and falsework; for
13 underpinning; and for such other work as may be required for construction
14 but does not become an integral part of the Project.
15
- 16 B. Working drawings shall be signed and sealed by a registered Professional
17 Engineer, currently licensed to practice in the State and shall convey, or be
18 accompanied by, calculations or other sufficient information to completely
19 explain the structure, machine, or system described and its intended
20 manner of use. Prior to commencing such work, working drawings must
21 have been reviewed without specific exceptions by the Engineer. Such
22 review will be for general conformance and will not relieve the Contractor in
23 any way from his responsibility with regard to the fulfillment of the terms of
24 the Contract. All risks of error are assumed by the Contractor. The Owner
25 and Engineer shall have no responsibility for errors on the working drawings
26 or the finished work.
27

28 1.05 SAMPLES

29

- 30 A. The Contractor shall furnish, for review of the Engineer, samples required
31 by the Contract Documents or requested by the Engineer. Samples shall
32 be delivered to the Engineer as specified or directed and in quantities and
33 sizes as specified. A minimum of two samples of each item shall be
34 submitted unless otherwise specified. The Contractor shall prepay all
35 shipping charges on samples. Materials or equipment for which samples
36 are required shall not be used in work until reviewed by the Engineer.
37
- 38 B. Samples specified in individual sections, include, but are not necessarily
39 limited to, physical examples of the work such as sections of manufactured
40 or fabricated work, small cuts or containers of materials, complete units of
41 repetitively-used products, color/texture/pattern swatches and range sets,
42 specimens for coordination of visual effect, graphic symbols, and units of
43 work to be used by the Engineer or Owner for independent inspection and
44 testing, as applicable to the Work.
45

1 C. The Contractor shall prepare a transmittal letter for each shipment of
2 sample, shall enclose a copy of this letter with the shipment, and shall send
3 a copy of this letter to the Engineer. Review of a sample shall be only for
4 the characteristics or use named in such review and shall not be construed
5 to change or modify any Contract requirements.
6

7 1.06 SUBMITTAL REQUIREMENTS
8

9 A. The Contractor shall review, approve, and submit, with reasonable
10 promptness and in such sequence, so as to cause no delay in the Contract
11 Work or in the Work of the Owner or any separate contractor, all shop
12 drawings, product data, working drawings and samples required by the
13 Contract Documents.
14

15 B. It is intended that all shop drawing be submitted electronically by email,
16 however, when electronic submittals cannot be made, the Contractor shall
17 submit to the Engineer five (5) copies of the shop drawing, plus the number
18 of copies he wants returned. The Engineer will review the submittal and
19 electronically return to the Contractor appropriate review comments and/or
20 marked-up copies of the shop drawings if applicable.
21

22 C. Shop drawings, product data, working drawings and samples shall be
23 transmitted using a form provided by the Engineer and furnished with the
24 following information:
25

- 26 1. Number and title of the drawing.
- 27
- 28 2. Date of drawing or revision.
- 29
- 30 3. Name of project building, facility or system.
- 31
- 32 4. Name of contractor, subcontractor, and manufacturer submitting
33 drawing.
- 34
- 35 5. Clear identification of contents, location of the work, and the sheet
36 numbers where the product is found in the contract drawings.
- 37
- 38 6. Contractor Certification Statement.
- 39
- 40 7. Submittal Identification Number.
- 41
- 42 8. Contract Drawing Number Reference.
- 43
- 44 9. Statement indicating any deviations from the Contract Documents.
45

- 1 D. All items specified are not necessarily intended to be a manufacturer's
2 standard product. Variations from specified items will be considered on an
3 "or equal" basis. If submittals show variations from Contract requirements
4 because of standard shop practice or for other reasons, the Contractor shall
5 describe such variations in his letter of transmittal and on the shop drawings
6 along with notification of his intent to seek contract adjustment. If
7 acceptable, proper adjustment in the Contract shall be implemented where
8 appropriate. If the Contractor fails to describe such variations he shall not
9 be relieved of the responsibility for executing the work in accordance with
10 the Contract, even though such drawings have been reviewed. Variations
11 submitted but not described may be cause for rejection. Any variations
12 initiated by the Contractor will not be considered as an addition to the scope
13 of work unless specifically noted and then accepted as such in writing by
14 the Engineer.
15
- 16 E. Data on materials and equipment shall include materials and equipment
17 lists giving, for each item thereon, the name and location of the supplier or
18 manufacturer, trade name, catalog reference, material, size, finish and all
19 other pertinent data.
20
- 21 F. For all mechanical and electrical equipment, the Contractor shall provide a
22 single list that includes the equipment name, and address and telephone
23 number of the manufacturer's representative and service company, so that
24 service and/or spare parts can be readily obtained. In addition, a
25 maintenance and lubrication schedule for each piece of equipment shall be
26 submitted as specified in Section 01730.
27
- 28 G. The Contractor shall use the color "green" to make his remarks on the
29 Submittals. Only the Engineer will utilize the color "red" in marking
30 submittals.
31

32 1.07 CONTRACTOR'S RESPONSIBILITY 33

- 34 A. It is the duty of the Contractor to check, and coordinate with the work of all
35 trades, all drawings, data, schedules and samples prepared by or for him
36 before submitting them to the Engineer for review. Each copy of every
37 drawing or data sheet 11"x17" and larger shall bear Contractor's stamp
38 showing that they have been so checked and approved. Drawings or data
39 sheets 11"x17" and smaller shall be bound together in an orderly fashion
40 and bear the Contractor's stamp on the cover sheet. The cover sheet shall
41 fully describe the packaged data and include a list of all sheet numbers
42 within the package. Shop drawings submitted to the Engineer without the
43 Contractor's stamp will be returned to the Contractor, without review at the
44 Engineer's option.
45

- 1 B. The Contractor shall review shop drawings, product data, and samples prior
2 to submission to determine and verify the following:
3
4 1. Field measurements.
5
6 2. Field construction criteria.
7
8 3. Manufacturer's catalog numbers and similar data.
9
10 4. Conformance with Specifications.
11
12 C. Shop drawings shall indicate any deviations in the submittal from the
13 requirements of the Contract Documents.
14
15 D. No extension of time will be authorized because of the Contractor's failure
16 to transmit complete and acceptable submittals sufficiently in advance of
17 the Work.
18
19 E. The Contractor shall not begin any work affected by a submittal returned,
20 "Confirm" or "Rejected- Resubmit". Before starting this work, all revisions
21 must be corrected by the Contractor. After resubmittal they will be reviewed
22 and returned by the Engineer. If returned marked, "No Exceptions Taken"
23 or "Make Corrections Noted", the Contractor may begin this work. Any
24 corrections made to these shop drawings shall be followed without
25 exception.
26
27 F. The Contractor shall submit to the Engineer all shop drawings and data
28 sufficiently in advance of construction requirements to provide not less than
29 twenty-one (21) calendar days for Engineer's review from the time the
30 Engineer receives them.
31
32 G. The Contractor shall be responsible for and bear all cost that may result
33 from the ordering of any material or from proceeding with any part of work
34 prior to review by the Engineer of the necessary shop drawings.
35
36 H. All shop drawings, product data, working drawings and samples submitted
37 by subcontractors for review shall be sent directly to the Contractor for
38 checking. The Contractor shall be responsible for their submission
39 according to the shop drawing schedule so as to prevent delays in delivery
40 of materials and project completion.
41
42 I. The Contractor shall check all subcontractor's shop drawings, product data,
43 working drawings and samples regarding measurements, size of members,
44 materials, and details to satisfy him that they are in conformance to the
45 Contract Documents. Shop drawings found to be inaccurate or otherwise
46 in error shall be returned to the subcontractors for correction before

1 submission to the Engineer.

2
3 1.08 ENGINEER'S REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING
4 DRAWINGS AND SAMPLES

5
6 A. The Engineer's review is for general conformance with the design concept
7 and contract drawings. Markings or comments shall not be construed as
8 relieving the Contractor from compliance with the Contract Drawings and
9 Specifications or departures thereof. The Contractor remains responsible
10 for details and accuracy, for coordinating the work with all other associated
11 work and trades, for selecting fabrication processes, for techniques of
12 assembly, and for performing work in a safe manner.

13
14 B. The review of shop drawings, data, and samples will be general. The review
15 shall not be construed as:

16
17 1. Permitting any departure from the Contract requirements;

18
19 2. Relieving the Contractor of responsibility for any errors, including
20 details, dimensions, and materials;

21
22 3. Approving departures from details furnished by the Engineer, except
23 as otherwise provided herein.

24
25 C. If the shop drawings, data or samples as submitted describe variations and
26 show a departure from the Contract Documents, which Engineer finds to be
27 in the interest of the Owner and to be so minor as not to involve a change
28 in Contract Price or Time, the Engineer may return the reviewed drawings
29 without noting an exception.

30
31 D. Submittals will be returned to the Contractor under one of the following:

32
33 "NO EXCEPTIONS TAKEN" is assigned when there are no notations or
34 comments on the submittal. When returned under this code the Contractor
35 may release the equipment and/or material for manufacture.

36
37 "MAKE CORRECTIONS NOTED" is assigned when notations or comments
38 have been made on the submittal pointing out minor discrepancies as
39 compared with the Contract Documents. Resubmittal or confirmation is not
40 necessary prior to release for manufacturing.

41
42 "EXCEPTIONS AS NOTED" or "CONFIRM" is assigned when a
43 confirmation of the notations and comments is required from the Contractor.
44 The Contractor may release the equipment or material for manufacture;
45 however, all notations and comments must be incorporated into the final

1 product addressing the omissions and/or nonconforming items that were
2 noted. Only the items to be "confirmed" need to be resubmitted.

3
4 "REJECTED - RESUBMIT" is assigned when the submittal is in
5 noncompliance with the Contract Documents and must be corrected and
6 the entire package resubmitted. This code generally means that the equip-
7 ment or material cannot be released for manufacture unless the Contractor
8 takes full responsibility for providing the submitted items in accordance with
9 Contract Documents.

10
11 "FOR YOUR INFORMATION" is assigned when the package provides
12 information of a general nature that may or may not require a response.
13

14 E. Resubmittals will be handled in the same manner as first submittals. On
15 resubmittals the Contractor shall direct specific attention, in writing, on the
16 transmittal and on resubmitted shop drawings by use of revision triangles
17 or other similar methods, to revisions other than the corrections requested
18 by the Engineer on previous submissions. Any such revisions that are not
19 clearly identified shall be made at the risk of the Contractor. The Contractor
20 shall make corrections to any work done because of this type revision that
21 is not in accordance to the Contract Documents as may be required by the
22 Engineer.
23

24 F. If the Contractor considers any correction indicated on the shop drawings
25 to constitute a change to the Contract Documents, the Contractor shall give
26 written notice thereof to the Engineer at least seven (7) working days prior
27 to release for manufacture.
28

29 G. The number of shop drawings the Engineer will review is limited as
30 described in the General Condition or Supplemental General Conditions,
31 and the Contractor will be back charged for costs incurred by the Engineer
32 due to excessive shop drawing submittals or resubmittals as described
33 therein. This limitations is intended to reduce the number of submittals to
34 be reviewed, but shall not be construed to limit the number of shop drawings
35 required and the Contractor shall submit all shop drawings required as
36 directed by the Engineer.
37

38 H. When the shop drawings have been completed to the satisfaction of the
39 Engineer, the Contractor shall carry out the construction in accordance
40 therewith and shall make no further changes therein except upon written
41 instruction from the Engineer.
42

43 I. Partial submittals may not be reviewed. The Engineer will be the only judge
44 as to the completeness of a submittal. Submittals not complete will be
45 returned to the Contractor. The Engineer may at his option provide a list or
46 mark the submittal directing the Contractor to the areas that are incomplete.
47

1 PART 2 – PRODUCTS

2

3 2.01 SHOP DRAWINGS

4

5 Final shop drawings shall be submitted in electronic format, organized by submittal
6 number, on CD.

7

8 PART 3 – EXECUTION (NOT USED)

9

10

11

END OF SECTION

SECTION 01385

COLOR AUDIO-VIDEO CONSTRUCTION RECORDS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope

The Contractor shall prepare color audio/video DVDs of all work areas within 20 days of the Notice to Proceed. These specifications shall supplement the Owner’s color audio-video construction records requirements, if any, and the more stringent shall apply.

B. Requirements Included

Prior to commencing work, the Contractor shall have a continuous color audio/video DVD recording taken of the entire Project, including access to the site of the work. Streets, easements, rights-of way, lots, or construction sites within the Project must be recorded to serve as a record of pre-construction conditions. One copy of the DVD recordings and video log shall be submitted to the Owner. The Engineer will designate those areas, if any, to be omitted from or added to the audio-visual coverage. All DVDs and written records shall become the property of the Owner.

C. Scheduling

No construction shall begin prior to review of the DVDs covering the Project construction area(s) by the Owner. The Owner will have the authority to reject all or any portion of video DVD not conforming to specifications and order that it be redone at no additional charge. The Contractor shall reschedule unacceptable coverage within seven days after being notified.

D. Videographer Qualifications

The Contractor shall engage the services of a professional videographer known to be skilled and regularly engaged in the business of preconstruction color audio-video DVD documentation. The videographer, through the Contractor, shall furnish to the Engineer a list of all equipment to be used for the audio-video recording, i.e., manufacturer’s name, model number, specifications, and other pertinent information.

Additional information to be furnished by the videographer is the names and addresses of two references that the videographer has performed color audio-video recording on projects of a similar nature within the last 12

1 months. Engineer's review of the selected videographer is required prior to
2 taking first audio-video DVD.

3
4 E. Equipment

5
6 The Contractor shall finish all equipment, accessories, materials and labor
7 to perform this service. The total audio-video system shall reproduce bright,
8 sharp, clear pictures with accurate colors and shall be free from distortion,
9 tearing, rolls or any other form of imperfection. The audio portion of the
10 recording shall reproduce the commentary of the camera operator with
11 proper volume, clarity and be free from distortion and interruptions. In some
12 instances, audio-video coverage may be required in areas not accessible
13 by conventional wheeled vehicles. Such coverage shall be obtained by
14 walking. The color video camera used in the recording shall be of Industrial
15 Grade and shall have EIA Standard NTSC type color - 1.0V 75 OHMS.
16 Video output from camera shall be capable of horizontal resolution of 350
17 lines at center and utilize a minimum of 8:1 zoom with a 2/3 Newvicon tube
18 or CCD pick-up element for optimum color imagery plus minimum lag
19 through of one foot candle. The recording shall be made with Industrial
20 Grade recorder. The recordings shall be high resolution, extended still
21 frame capable, in color. The recorded video DVDs shall be compatible for
22 playback with any American TV Standard DVD player.

23
24 F. Recorded Information, Audio

25
26 Each DVD shall begin with the current date, project name and be followed
27 by the general location, i.e., viewing side and direction of progress.
28 Accompanying the video recording of each video DVD shall be a
29 corresponding and simultaneously recorded audio recording. This audio
30 recording, exclusively containing the commentary of the camera operator or
31 aide, shall assist in viewer orientation and in any needed identification,
32 differentiation, clarification, or objective description of the features being
33 shown in the video portion of the recording. The audio recording shall also
34 be free from any conversations.

35
36 G. Recorded Information, Video

37
38 All video recordings must continuously display transparent digital
39 information to include the date and time of recording. The date information
40 shall contain the month, day and year. The time information shall contain
41 the actual hour, minutes and seconds of the day. Additional information
42 shall be displayed periodically. Such information shall include, but not be
43 limited to, project name, contract number, direction of travel and the viewing
44 side. This transparent information shall appear on the extreme upper left
45 hand third of the screen. Camera pan, tilt, zoom-in and zoom-out rates shall
46 be sufficiently controlled such that recorded objects are clearly viewed

1 during video DVD playback. In addition, all other camera and recording
2 system controls, such as lens focus and aperture, video level, pedestal,
3 chrome, white balance, and electrical focus shall be properly controlled or
4 adjusted to maximize picture quality. The construction documentation shall
5 be recorded in SP mode.
6

7 H. Viewer Orientation
8

9 The audio and video portions of the recording shall maintain viewer
10 orientation. To this end, overall establishing views of all visible house and
11 business addresses shall be utilized. In areas where the proposed
12 construction location will not be readily apparent to the video DVD viewer,
13 highly visible yellow flags shall be placed, by the Contractor, in such a
14 fashion as to clearly indicate the proposed centerline of construction. When
15 conventional wheeled vehicles are used as conveyances for the recording
16 system, the vertical distance between the camera lens and the ground shall
17 not exceed 10 feet. The camera shall be firmly mounted such that transport
18 of the camera during the recording process will not cause an unsteady
19 picture.
20

21 I. Lighting
22

23 All recording shall be done during time of good visibility. No recording shall
24 be done during precipitation, mist or fog. The recording shall only be done
25 when sufficient sunlight is present to properly illuminate the subjects of
26 recording and to produce bright, sharp video recordings of those subjects.
27

28 J. Speed of Travel
29

30 The average rate of travel during a particular segment of coverage shall be
31 directly proportional to the number, size, and value of the surface features
32 within that construction areas zone of influence. The rate of speed in the
33 general direction of travel of any vehicle used during recording of a linear
34 project site shall not exceed 44 feet per minute.
35

36 K. Video Log/Index
37

38 All video DVDs shall be permanently labeled and shall be properly identified
39 by video DVD number and project title. Each video DVD shall have a log of
40 that video DVD's contents. The log shall describe the various segments of
41 coverage contained on the video DVD in terms of the names of the streets
42 or location of easements, coverage beginning and end, directions of
43 coverage, video unit counter numbers, engineering survey or coordinate
44 values (if reasonably available) and the date.
45

46 L. Area of Coverage

1
2 DVD coverage shall include all surface features located within the zone of
3 influence of construction supported by appropriate audio coverage. Such
4 coverage shall include, but not be limited to, existing driveways, sidewalks,
5 curbs, pavements, drainage system features, mailboxes, landscaping,
6 culverts, fences, signs, Contractor staging areas, adjacent structures, etc.,
7 within the area covered by the project. Of particular concern shall be the
8 existence of any faults, fractures, or defects. DVD coverage shall be limited
9 to one side of the site, street, easement, or right-of-way at any one time.

10
11 PART 2 – PRODUCTS
12 (NOT USED)

13
14 PART 3 – EXECUTION

15
16 3.01 GENERAL

- 17
18 A. Prior to requesting Substantial Completion, the Contractor shall review the
19 pre-construction video with the Owner/Engineer and identify any work
20 needed to restore the site to pre-construction conditions.
21

22
23 END OF SECTION

1 SECTION 01410

2
3 TESTING AND TESTING LABORATORY SERVICES

4
5 PART 1 – GENERAL

6
7 1.01 REQUIREMENTS INCLUDED

8
9 A. Contractor shall employ and pay for the services of an Independent Testing
10 Laboratory to perform that geotechnical testing (concrete, compaction)
11 specifically indicated on the Contract Documents or specified in the
12 Specifications or at any other time Contractor elects to have materials and
13 equipment tested for conformity with the Contract Documents.

14
15 1. Contractor shall coordinate with the laboratory to facilitate the
16 execution of its required services.

17
18 2. Employment of the laboratory shall in no way relieve Contractor's
19 obligations to perform the Work of the Contract.

20
21 B. Contractor shall perform and pay for all other testing (pressure, torque, etc.)
22 required in the specifications.

23
24 1.02 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

25
26 A. Laboratory is not authorized to:

27
28 1. Release, revoke, alter or enlarge on requirements of Contract
29 Documents.

30 2. Approve or accept any portion of the Work.

31
32 3. Perform any duties of the Contractor.

33
34 1.03 CONTRACTOR'S RESPONSIBILITIES

35
36 A. Coordinate with laboratory personnel, provide access to Work, to
37 Manufacturer's operations.

38
39 B. Secure and deliver to the laboratory adequate quantities of representational
40 samples of materials proposed to be used and which require testing.

41
42 C. Provide to the laboratory the preliminary design mix proposed to be used
43 for concrete, and other materials mixes, which require control by the testing
44 laboratory.

- 1 D. Materials and equipment used in the performance of work under this
2 Contract are subject to inspection and testing at the point of manufacture or
3 fabrication. Standard specifications for quality and workmanship are
4 indicated in the Contract Documents. The Engineer may require the
5 Contractor to provide statements or certificates from the manufacturers and
6 fabricators that the materials and equipment provided by them are
7 manufactured or fabricated in full accordance with the standard
8 specifications for quality and workmanship indicated in the Contract
9 Documents. All costs of this testing and providing statements and
10 certificates shall be a subsidiary obligation of the Contractor, and no extra
11 charge to the Owner shall be allowed on account of such testing and
12 certification.
13
- 14 E. Furnish incidental labor and facilities:
15
- 16 1. To provide access to work to be tested.
 - 17
 - 18 2. To obtain and handle samples at the Project site or at the source of
19 the product to be tested.
 - 20
 - 21 3. To facilitate inspections and tests.
 - 22
 - 23 4. For storage and curing of test samples.
- 24
- 25 F. The Contractor shall be responsible for notifying the laboratory sufficiently
26 in advance (minimum 48 hours) of operations to allow for laboratory
27 assignment of personnel and scheduling of tests.
28
- 29 G. Employ and pay for the services of the same or a separate, equally qualified
30 independent testing laboratory to perform additional inspections, sampling
31 and testing required for the Contractor's convenience and as reviewed by
32 the Engineer.
33

34 PART 2 – PRODUCTS (NOT USED)

35
36 PART 3 – EXECUTION (NOT USED)

37
38
39 END OF SECTION
40

1 SECTION 01500

2
3 TEMPORARY FACILITIES

4
5 PART 1 – GENERAL

6
7 1.01 SANITARY FACILITIES

- 8
9 A. The Contractor shall furnish temporary sanitary facilities at the site, as
10 provided herein, for the needs of all construction workers and others
11 performing work or furnishing services on the Project.
12
13 B. Sanitary facilities shall be of reasonable capacity, properly maintained
14 throughout the construction period, and obscured from public view to the
15 greatest practical extent. If toilets of the chemically treated type are used,
16 at least one toilet will be furnished for each 20 persons. The Contractor
17 shall enforce the use of such sanitary facilities by all personnel at the site.
18

19 1.02 MAINTENANCE OF TRAFFIC

- 20
21 A. Contractor shall conduct his work to interfere as little as possible with public
22 travel, whether vehicular or pedestrian. Whenever it is necessary to cross,
23 obstruct, or close roads, driveways, and walks, whether public or private,
24 Contractor shall provide and maintain suitable and safe bridges, detours, or
25 other temporary expedients for the accommodation of public and private
26 travel, and shall give reasonable notice to owners of private drives before
27 interfering with them. Driveway access to commercial properties shall be
28 maintained at all times. Such maintenance of traffic shall not be required
29 when Contractor has obtained permission from the owner and tenant of
30 private property, or from the authority having jurisdiction over public
31 property involved, to obstruct traffic at the designated point. At all times,
32 the Contractor shall perform the Work in accordance with the permits and
33 easement agreements.
34
35 B. Traffic control shall be in accordance with DOT Roadway and Traffic Design
36 Standards for Traffic Control Through Work Zones. All local Traffic
37 Regulations shall be followed.
38
39 C. In making open-cut street crossings, the Contractor shall not block more
40 than one-half of the street at a time. Whenever possible, Contractor shall
41 widen the shoulder on the opposite side to facilitate traffic flow. Temporary
42 surfacing shall be provided as necessary on shoulders.
43

44 1.03 BARRICADES AND LIGHTS

- 45
46 A. All streets, roads, highways, and other public thoroughfares that are closed

1 to traffic shall be protected by effective barricades on which shall be placed
2 acceptable warning signs. Barricades shall be located at the nearest
3 intersecting public highway or street on each side of the blocked section.
4

5 B. All open trenches and other excavations shall have suitable barricades,
6 signs, and lights to provide adequate protection to the public. Obstructions
7 such as material piles and equipment shall be provided with similar warning
8 signs and lights. Contractor shall be responsible for public safety within the
9 construction area.

10
11 C. All barricades and obstructions shall be illuminated with warning lights from
12 sunset to sunrise. Material storage and conduct of the Work on or alongside
13 public streets and highways shall cause the minimum obstruction and
14 inconvenience to the traveling public. All barricades, signs, lights and other
15 protective devices shall be installed and maintained in conformity with
16 applicable statutory requirements and, where within railroad and highway
17 rights-of-way, as required by the authority having jurisdiction thereof.
18

19 D. Open trenches and other excavations shall not be left open over weekends
20 and holidays, or greater than one calendar day, except during extreme
21 weather conditions.
22

23 1.04 PROTECTION OF PUBLIC AND PRIVATE PROPERTY
24

25 A. Contractor shall protect, shore, brace, support, and maintain all
26 underground pipes, conduits, drains, and other underground construction
27 uncovered or otherwise affected by his construction operations. All
28 pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy
29 wires, fences, and other surface structures affected by construction
30 operations, together with all sod and shrubs in yards and parking areas,
31 shall be restored to their original condition, whether within or outside the
32 easement. All replacements shall be made with new materials.
33

34 1.05 PARKING
35

36 A. Contractor shall provide and maintain suitable parking areas for the use of
37 all construction workers and others performing work or furnishing services
38 in connection with the Project, as required to avoid any need for parking
39 personal vehicles where they may interfere with public traffic, Owner's
40 operations, or construction activities, where indicated on the drawings or
41 directed by the Engineer.
42

43 1.06 DUST CONTROL
44

45 A. Contractor shall take reasonable measures to prevent unnecessary dust.
46 Earth surfaces subject to dusting shall be kept moist with water or by

1 application of a chemical dust suppressant. Dusty materials in piles or in
2 transit shall be covered when practicable to prevent blowing.

- 3
- 4 B. Buildings or operating facilities that may be adversely affected by dust shall
- 5 be adequately protected from dust. Existing or new machinery, motors,
- 6 instrument panels or similar equipment, shall be protected by suitable dust
- 7 screens. Proper ventilation shall be included with dust screens.
- 8

9 1.07 SWEEPING

- 10
- 11 A. The Contractor shall sweep loose material from all pavement at the end of
- 12 each workday.
- 13

14 1.08 POLLUTION CONTROL

- 15
- 16 A. Contractor shall prevent the pollution of drains and watercourses by sanitary
- 17 wastes, sediment, debris, and other substances resulting from construction
- 18 activities. No sanitary wastes will be permitted to enter any drain or
- 19 watercourse other than sanitary sewers. No sediment, debris or other
- 20 substance will be permitted to enter sanitary sewers and reasonable
- 21 measures will be taken to prevent such materials from entering any drain or
- 22 watercourse.
- 23

24 PART 2 – PRODUCTS (NOT USED)

25

26 PART 3 – EXECUTION (NOT USED)

27

28

29 END OF SECTION

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1 SECTION 01505

2 MOBILIZATION

3
4
5 PART 1 – GENERAL

6
7 1.01 DEFINITION AND SCOPE

8
9 A. Mobilization shall include the obtaining of all permits, insurance, and bonds;
10 moving onto the site of all plant and equipment; furnishing and erecting
11 plants, temporary facilities, and other construction facilities; all as required
12 for the proper performance and completion of the Work. Mobilization shall
13 include, but not be limited to, the following principal items:

- 14 1. Move onto the site all plant and equipment required for first month's
15 operations.
- 16 2. Install temporary construction power, wiring, and lighting facilities.
- 17 3. Establish fire protection plan and safety program.
- 18 4. Secure construction water supply.
- 19 5. Provide on-site sanitary facilities and potable water facilities.
- 20 6. Arrange for and erect Contractor's work and storage yard and
21 employees' parking facilities.
- 22 7. Submit all required insurance certificates and bonds.
- 23 8. Obtain all required permits.
- 24 9. Post all OSHA, Environmental Protection Agency, Department of
25 Labor, and all other required notices.
- 26 10. Have superintendent at the job site full time.
- 27 11. Submit a detailed construction schedule acceptable to the Engineer.
- 28 12. If required, erect project construction sign(s).
- 29 13. Submit a finalized schedule of values and schedule of payments
30 acceptable to the Owner.
- 31 14. Submit a finalized schedule of submittals.

1 SECTION 01510

2
3 TEMPORARY UTILITIES

4
5 PART 1 – GENERAL

6
7 1.01 REQUIREMENTS INCLUDED

- 8
9 A. Furnish, install, and maintain temporary utilities required for construction,
10 remove on completion of Work.

11
12 1.02 REQUIREMENTS OF REGULATORY AGENCIES

- 13
14 A. Comply with National Electric Code.
15
16 B. Comply with Federal, State, and local codes and regulations and with utility
17 company requirements.
18
19 C. Comply with Local City and County Health Department Regulations.
20

21 PART 2 – PRODUCTS

22
23 2.01 MATERIALS, GENERAL

- 24
25 A. Materials may be new or used but must be adequate in capacity for the
26 required usage, must not create unsafe conditions, and must not violate
27 requirements of applicable codes and standards.
28

29 2.02 TEMPORARY ELECTRICITY AND LIGHTING

- 30
31 A. Arrange with utility company and Owner to provide service required for
32 power and lighting, and pay all costs for service and for power used in the
33 construction, testing and trial operation prior to final acceptance of the work
34 by the Owner. All cost associated with obtaining temporary and permanent
35 power shall be at Contractor expense.
36
37 B. Provide adequate artificial lighting for all areas of work when natural light is
38 not adequate for work, and for areas accessible to the public.
39

40 2.03 TEMPORARY TELEPHONE SERVICE

- 41
42 A. Arrange with local telephone service-company to provide direct line
43 telephone service or mobile phone service at the construction site for the
44 use by personnel and employees.
45
46 B. Pay all costs for installation, maintenance and removal, and service

1 charges.

- 2
3 C. In lieu of direct telephone service, provide cellular phone service for site
4 superintendent(s).

5
6 2.04 TEMPORARY WATER

- 7
8 A. The Contractor shall install at each connection to the local water supply
9 system a backflow preventer and meter meeting local utility requirements.

- 10
11 B. The Contractor shall pay for all temporary water facilities, including the
12 backflow preventers and meters, and the actual amount of water used
13 during construction.

14
15 2.05 TEMPORARY SANITARY FACILITIES

- 16
17 A. Provide sanitary facilities in compliance with laws and regulations.

- 18
19 B. Service, clean and maintain facilities and enclosures.

20
21 PART 3 – EXECUTION

22
23 3.01 GENERAL

- 24
25 A. Maintain and operate systems to assure continuous service.

- 26
27 B. Modify and extend systems as work progress requires.

- 28
29 C. Allow the Owner and Engineer reasonable use of all temporary utilities.

30
31 3.02 REMOVAL

- 32
33 A. Completely remove temporary materials and equipment when their use is
34 no longer required as determined by the Engineer.

- 35
36 B. Clean and repair damage caused by temporary installations or use of
37 temporary facilities.

38
39
40 END OF SECTION

1 SECTION 01600

2
3 MATERIAL AND EQUIPMENT

4
5 PART 1 – GENERAL

6
7 1.01 REQUIREMENTS INCLUDED

8 A. Material and equipment incorporated into the Work shall:

- 9
10 1. Conform to applicable specifications and standards.
11
12 2. Comply with size, make, type and quality specified, or as specifically
13 identified in writing by the Engineer.
14

15 B. Manufactured and Fabricated Products:

- 16
17 1. Design, fabricate and assemble in accord with the best engineering
18 and shop practices.
19
20 2. Manufacture like parts of duplicate units to standard sizes and
21 gauges, to be interchangeable.
22
23 3. Two or more items of the same kind shall be identical, by the same
24 manufacturer.
25
26 4. Products shall be suitable for service conditions.
27
28 5. Equipment capacities, sizes and dimensions shown or specified shall
29 be adhered to unless variations are specifically identified in writing.
30

31 C. Do not use material or equipment for any purpose other than that for which
32 it is designed or is specified.
33

34
35 1.02 REVIEW OF MATERIALS

36 A. All materials and equipment furnished by the Contractor shall be subject to
37 the inspection and review of the Engineer. No material shall be delivered
38 to the work without prior review of the Engineer.
39

40 B. Facilities and labor for handling and inspection of all materials and
41 equipment shall be furnished by the Contractor. If the Engineer requires,
42 either prior to beginning or during the progress of the work, the Contractor
43 shall submit samples of materials for such special tests as may be
44 necessary to demonstrate that they conform to the specifications. Such
45 samples shall be furnished, stored, packed, and shipped as directed at the
46

1 Contractor's expense. Except as otherwise noted, the Owner will make
2 arrangements for and pay for the tests.

3
4 C. The Contractor shall submit data and samples sufficiently early to permit
5 consideration and review before materials are necessary for incorporation
6 in the work. Any delay resulting from the Contractor's failure to submit
7 samples or data promptly shall not be used as a basis of claims against the
8 Owner or the Engineer.

9
10 D. The materials and equipment used on the work shall correspond to the
11 accepted samples or other data previously submitted to the Engineer for
12 review.

13
14 1.03 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

15
16 A. When Contract Documents require that installation of work shall comply with
17 manufacturer's printed instructions, obtain, and distribute copies of such
18 instructions to parties involved in the installation, including four copies to the
19 Engineer.

20
21 1. Maintain one set of complete instructions at the job site during
22 installation and until completion.

23
24 B. Handle, install, connect, clean, condition and adjust products in strict accord
25 with such instructions and in conformity with specified requirements.

26
27 1. Should job conditions or specified requirements conflict with
28 manufacturer's instructions, consult with Engineer for further
29 instructions.

30
31 2. Do not proceed with work without clear instructions.

32
33 C. Perform work in accord with manufacturer's instructions. Do not omit any
34 preparatory step or installation procedure unless specifically modified or
35 exempted by Contract Documents.

36
37 1.04 TRANSPORTATION AND HANDLING

38
39 A. Arrange deliveries of Products in accord with construction schedules,
40 coordinate to avoid conflict with work and conditions at the site.

41
42 1. Deliver Products in undamaged condition, in manufacturer's original
43 containers or packaging, with identifying labels intact and legible.

1 2. Immediately on delivery, inspect shipments to assure compliance
2 with requirements of Contract Documents and submittals, and that
3 Products are properly protected and undamaged.
4

5 B. Provide equipment and personnel to handle Products by methods to
6 prevent soiling or damage to Products or packaging.
7

8 1.05 STORAGE AND PROTECTION
9

10 A. The Contractor shall furnish a covered, weather-protected storage structure
11 providing a clean, dry, non-corrosive environment for all mechanical
12 equipment, valves, architectural items, electrical and instrumentation
13 equipment, and special equipment to be incorporated into this project.
14 Storage of equipment shall be in strict accordance with the "instructions for
15 storage" of each equipment supplier and manufacturer including connection
16 of heaters, placing of storage lubricants in equipment, etc. The Contractor
17 shall furnish a copy of the manufacturer's instructions for storage to the
18 Engineer prior to storage of all equipment and materials. Corroded,
19 damaged or deteriorated equipment and parts shall be replaced before
20 acceptance of the project. Equipment and materials not properly stored will
21 not be included in a payment estimate.
22

23 B. Store Products in accord with manufacturer's instructions, with seals and
24 labels intact and legible.
25

26 1. Store products subject to damage by the elements in weather tight
27 enclosures.
28

29 2. Maintain temperature and humidity within the ranges required by
30 manufacturer's instructions.
31

32 3. Store fabricated products above the ground, on blocking or skids,
33 prevent soiling or staining. Cover products which are subject to
34 deterioration with impervious sheet coverings, provide adequate
35 ventilation to avoid condensation.
36

37 4. Store loose granular materials in a well-drained area on solid
38 surfaces to prevent mixing with foreign matter.
39

40 C. All materials and equipment to be incorporated in the work shall be handled
41 and stored by the Contractor before, during, and after shipment in a manner
42 to prevent warping, twisting, bending, breaking, chipping, rusting, and any
43 injury, theft, or damage of any kind whatsoever to the material or equipment.
44

45 D. Cement, sand, and lime shall be stored under a roof and off the ground and
46 shall be kept completely dry at all times. All miscellaneous steel and

1 reinforcing steel shall be stored off the ground or otherwise to prevent
2 accumulations of dirt or grease, and in a position to prevent accumulations
3 of standing water and to minimize rusting. Precast concrete sections shall
4 be handled and stored in a manner to prevent accumulations of dirt,
5 standing water, staining, chipping, or cracking. Brick, block, and similar
6 masonry products shall be handled and stored in a manner to reduce
7 breakage, chipping, cracking, and spilling to a minimum.
8

9 E. All materials that, in the opinion of the Engineer, have become so damaged
10 as to be unfit for the use intended or specified shall be promptly removed
11 from the site of the work, and the Contractor shall receive no compensation
12 for the damaged material or its removal.
13

14 F. Arrange storage in a manner to provide easy access for inspection. Make
15 periodic inspections of stored Products to assure that Products are
16 maintained under specified conditions, and free from damage or
17 deterioration.
18

19 G. Protection After Installation:
20

21 1. Provide substantial coverings as necessary to protect installed
22 products from damage from traffic and subsequent construction
23 operations. Remove covering when no longer needed.
24

25 H. The Contractor shall be responsible for all material, equipment, and
26 supplies sold and delivered to the Owner under this Contract until final
27 inspection of the work and acceptance thereof by the Owner. In the event
28 any such material, equipment, and supplies are lost, stolen, damaged, or
29 destroyed prior to final inspection and acceptance, the Contractor shall
30 replace same without additional cost to the Owner.
31

32 I. Should the Contractor fail to take proper action on storage and handling of
33 equipment supplied under this Contract within seven days after written
34 notice to do so has been given, the Owner retains the right to correct all
35 deficiencies noted in previously transmitted written notice and deduct the
36 cost associated with these corrections from the Contractor's Contract.
37 These costs may be comprised of expenditures for labor, equipment usage,
38 administrative, clerical, engineering and any other costs associated with
39 making the necessary corrections.
40

41 1.06 SUBSTITUTIONS AND PRODUCT OPTIONS 42

43 A. Contractor's Options:
44

45 1. For products specified only by reference standard, select any
46 product meeting that standard.

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- 2. For products specified by naming several products or manufacturers, submit the products or manufacturers named in the Proposal, which complies with the specifications.
- 3. For products specified by naming one or more products or manufacturers and "or equal", Contractor shall submit a request as for substitutions for any product or manufacturer not specifically named.

B. Substitutions:

- 1. After the Effective Date of the Agreement, the Engineer will consider written requests from Contractor for substitution of products.
- 2. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including:
 - a. Comparison of the qualities of the proposed substitution with that specified.
 - b. Changes required in other elements of the work because of the substitution.
 - c. Effect on the construction schedule.
 - d. Cost data comparing the proposed substitution with the product specified.
 - e. Any required license fees or royalties.
 - f. Availability of maintenance service, and source of replacement materials.
- 3. The Engineer will be the judge of the acceptability of the proposed substitution.

C. Contractor's Representation:

- 1. A request for a substitution constitutes a representation that Contractor:
 - a. Has investigated the proposed Product and determined that it is equal to or superior in all respects to that specified.

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- b. Shall provide the same warranties or bonds for the substitution as for the product specified.
- c. Will coordinate the installation of an accepted substitution into the Work and make such other changes as may be required to make the Work complete in all respects.
- d. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

1 SECTION 01625

2
3 START-UP SYSTEMS TESTING

4
5 PART 1 – GENERAL

6
7 1.01 REQUIREMENTS INCLUDED

- 8
9 A. Prior to requesting issuance of the Certificate of Substantial Completion, the
10 Contractor shall perform start-up testing services as specified herein.
11
12 B. Start-up of the facilities and appurtenances will require completion of all
13 structures, installation of all equipment, and all connections to existing
14 systems. All components of the new system shall be installed as if each
15 were ready for use by the Owner for their intended purposes. The
16 Contractor shall provide a written startup plan, for review by the Engineer,
17 for individual facilities and systems. As applicable, the startup plan shall be
18 in accordance with the construction phasing plan described in the
19 Contractor’s Schedule described in Section 01310.
20

21 PART 2 – PRODUCTS (NOT USED)

22
23 PART 3 – EXECUTION

24
25 3.01 PRELIMINARY MATTERS

- 26
27 A. General Requirements:
28
29 1. Successfully execute the start-up of the system and demonstrate
30 satisfactory performance of the intended use thereof. The start-up
31 and performance demonstration shall be successfully executed prior
32 to the Engineer’s issuance of Substantial Completion.
33
34 2. Field acceptance tests shall be witnessed by the Engineer. At least thirty
35 (30) calendar days prior to testing, Contractor shall submit details of
36 all test procedures to the Engineer for review and comment. Test
37 procedures shall be submitted to the Engineer in accordance with
38 Specification Section 01340. This notification shall be shown on the
39 Progress Schedule.
40
41 3. The Contractor shall be responsible for furnishing and installing all
42 necessary valves, whether shown on the Drawings or not, in order to
43 facilitate testing of pumping systems, tanks, and all other system
44 start-up testing, at no additional cost to the Owner.
45
46 B. Preparation for Systems Start-Up:
47

- 1 1. All mechanical and electrical equipment shall be checked to ensure
2 that each component is in good working order and properly installed
3 and connected. All systems shall be purged as required. All sumps,
4 tanks, basins, chambers, wet wells, and pipelines that are
5 hydraulically checked shall be drained and returned to their original
6 condition once the water testing is complete. All pipelines that have
7 been filled and flushed shall be drained clean.
8
- 9 2. No testing or equipment operation shall occur until the Engineer has
10 confirmed that all specified safety equipment has been installed and
11 is in good working order.
12
- 13 3. No testing or equipment operation shall occur until the Contractor
14 has submitted and the Engineer has reviewed the Certificate of
15 Proper Installation.
16

17 3.02 PRESSURE TESTS

- 18
- 19 A. Field pressure tests shall be made to confirm compliance with the Contract
20 Documents. The Contractor shall perform field tests as herein specified.
21 All tanks, water mains, piping and equipment shall be tested in the field in
22 the presence of the Engineer or his authorized agent.
23
- 24 B. Hydrostatic and leakage tests shall be performed in accordance with the
25 applicable sections of the American Water Works Association Standard for
26 Installation of Cast Iron/Ductile Iron Water Mains, AWWA C-600, Concrete
27 Pressure Pipe, AWWA M9, and Underground Installation of Polyvinyl
28 Chloride (PVC) Pressure Pipe and Fittings for Water Mains, AWWA C-605,
29 except as herein modified.
30
- 31 C. The Contractor shall submit his plan for pressure testing to the Engineer for
32 review at least ten (10) days before starting the work. The Contractor shall
33 remove and adequately dispose of all blocking material and equipment after
34 completion and acceptance of the field hydrostatic test, unless otherwise
35 directed by the Engineer. Any damage to the pipe shall be repaired by the
36 Contractor.
37
- 38 D. After completion of all work and before final acceptance, a hydrostatic and
39 leakage test shall be conducted. Water required for testing new pipelines
40 will be provided by the Contractor at the Contractor's expense. Water mains
41 shall be tested with potable water and force mains and storm water lines
42 shall be tested with reclaimed water, if available. Where applicable, the
43 Contractor shall coordinate the development of the water supply with the
44 pipeline work in order that water will be available to meet these
45 requirements. At no time are valves on the water supply system to be
46 operated without the prior authorization of the Engineer.

- 1
- 2 E. Each newly installed pressure main shall be tested at a pressure equal 1.5
- 3 times the pipeline design pressure or 150 psi; whichever is greater. The
- 4 duration of each test shall be a minimum of two (2) hours.
- 5
- 6 F. Any test pump(s), piping connections, taps, fittings, pressure gauges,
- 7 compressors, and all necessary components thereof which might be
- 8 required for the hydrostatic tests, shall be furnished by the Contractor at no
- 9 additional cost to the Owner.
- 10
- 11 G. All exposed pipe, fittings, valves, air valves, blow-offs and joints shall be
- 12 carefully examined during the test, and all joints showing a visible leakage
- 13 shall be made tight. All defective pipe, fittings, valves, hydrants, and
- 14 accessories shall be removed from the line and replaced by the Contractor
- 15 with new components at no additional cost to the Owner.
- 16
- 17 H. The Contractor may backfill the trench before testing the line, but he shall
- 18 open up the trench at his own expense to repair any leaks.
- 19
- 20 I. All visible leaks shall be corrected regardless of the total leakage revealed
- 21 by the test as compared to the allowable calculated losses. All lines that
- 22 fail to meet the test shall be repaired and retested as necessary, until test
- 23 requirements are complied with. All repairs and retests shall be performed
- 24 at the Contractor's own expense with no additional cost to the Owner.
- 25
- 26 J. The installation will not be accepted until the leakage is equal to or less than
- 27 the allowable leakage as determined by the formula below:
- 28
- $$29 \quad L = \frac{SD(P)^{0.5}}{133,200}$$
- 30
- 31
- 32 in which "L" equals the allowable leakage, in gallons per hour; "S" is the
- 33 length of the pipe tested, in feet; "D" is the nominal pipe diameter, in inches;
- 34 and "P" is the average test pressure during the leakage test, in pounds per
- 35 square inch, gauge.
- 36 K. All tests shall be made under the supervision of the Engineer or authorized
- 37 agents thereof. No additional compensation will be paid to the Contractor
- 38 for performing the above required tests; the cost of all labor, materials,
- 39 lubricants, fuels, power, necessary appliances, and the coordination for
- 40 testing purposes shall be included in the unit price or prices bid for the
- 41 various items of work.
- 42
- 43 L. The Contractor shall provide the Engineer a minimum of 72 hours advance
- 44 notice for scheduling hydrostatic and leakage tests.
- 45

46 3.03 LEAKAGE TEST – GRAVITY SEWERS AND OTHER PIPELINES

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- A. All gravity sewer will be tested by the Contractor prior to final acceptance of the work. All tests will be conducted in a manner to minimize any interference with the Contractor's work or progress. The Contractor shall notify the Engineer 72 hours in advance of such tests and, at his option, the Engineer shall witness such tests.

- B. The Contractor shall notify the Engineer when the work is ready for testing, and tests shall be made as soon thereafter as practicable, under the observation of the Engineer. Reading meters, gauges or other measuring devices shall be new and furnished by the Contractor. The Contractor shall furnish all other labor, materials, services, and equipment including power, fuel, meters and gauges; water and other items and apparatus necessary for making leakage tests, preparing guidelines for testing, assembling, placing, and removing testing equipment and placing in service.

- C. Air Leakage Test
 - 1. Tests by this method shall be limited to sewers 36 inches in diameter and smaller. The maximum allowable air leakage is based on pre-wetted pipe walls. The Contractor may therefore fill the pipe with clear water and then empty the pipe prior to air testing. When pipe walls are pre-wetted, air leakage tests shall be completed within 24 hours after filling the sewer section to be tested.

 - 2. Air pressure tests shall be made by placing the sewer under 3.0 psig air pressure and measuring the volume of air required to maintain this pressure. The rate of air leakage shall be determined when the system reaches an equilibrium state and air flow shall be read by means of an approved rotometer.

 - 3. The maximum rate of air loss shall be 0.003 cfm per square foot of interior pipe surface and the maximum air flow shall not exceed 2.0 cfm when the total pressure on the sewer is maintained at 3.0 psig. When the groundwater level is above the invert of the sewer, but below a level adequate for infiltration testing, the maximum air loss shall be reduced 6 percent for each foot of groundwater above the sewer invert.

 - 4. Air testing equipment shall be arranged so that compressors, valving, gauges, and other test devices are located at the ground surface. Air testing equipment shall have an approved air relief arrangement to prevent the sewer from being pressurized to greater than 10.0 psig.

1 D. Manhole Vacuum Tests: Each manhole shall be visually inspected for
2 leakage or evidence thereof after assembly, installation, and backfilling
3 activities have been completed. This inspection shall occur by the Engineer
4 or the Engineer's authorized agent. The Contractor shall demonstrate the
5 integrity of the installed materials and construction procedures by
6 conducting a vacuum test in accordance with ASTM C1244-93. If the
7 manhole shows signs of leakage, it shall be repaired to the satisfaction of
8 the Engineer at no additional cost to the Owner.
9

10 E. Repairing Leaks: When leakage occurs in excess of the specified amount,
11 defective manholes, pipe, pipe joints, or other appurtenances shall be
12 located and repaired at the expense of the Contractor. If the defective
13 portions cannot be located, the Contractor shall remove, reconstruct, and
14 retest as much of the original work as necessary to obtain satisfactory test
15 results.
16

17 3.05 SYSTEM START-UP

18 A. Contractor Responsibilities

- 19 1. The Contractor shall provide the Engineer ten (10) days' notice in writing
20 of his intent to perform systems start-up.
- 21 2. The Contractor shall provide sufficient personnel to test equipment,
22 monitor and record data, as directed by the Engineer.
- 23 3. The Contractor shall obtain, install, calibrate and operate all test
24 equipment, gauges, pressure recorders, communications systems, etc.,
25 as directed by the Engineer.
- 26 4. The Contractor shall cooperate with the Engineer, provide access to the
27 work, provide all incidental labor and facilities, and provide any
28 temporary utilities or construction aids required.
- 29 5. The Contractor shall ensure that all equipment, subsystems, and other
30 separable parts of the Work have been adjusted and balanced and that
31 any and all field tests have been conducted and demonstrated to be in
32 proper operating condition to the satisfaction of the Engineer.
33
34
35
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38
39

40 B. Start-Up Tests

- 41 1. Start-Up Systems Testing shall include, but not be limited to the
42 following:
43
44 a. The Contractor shall verify that all valves (new and existing,
45 manual and automatic) are in their proper operating position in
46

1 accordance with the specific operating scenario being tested.

2
3 b. The Contractor shall fill the pipes with water, in an approved
4 manner, taking care to allow the gradual release of air from all
5 high points.

6
7 c. In the presence of the Engineer, the Contractor shall demonstrate
8 the operation of all equipment and facilities including all
9 instrumentation and controls and all manual and automatic
10 control systems. The Contractor shall be responsible for
11 calibrating and verifying the accuracy of all new instruments. The
12 Contractor shall demonstrate the proper operation of all auto-
13 shutdown features and standby power systems or devices.

14
15 d. The Contractor shall demonstrate proper operation of all aspects
16 of the Control System, PLC's, Operator Interface Terminals, and
17 all hardware and software furnished. If applicable, the Contractor
18 shall also demonstrate the full integration of the SCADA System
19 with the Owner's existing network. The Contractor shall make
20 modifications to the existing HMI screens as required or as
21 directed by the Engineer for a fully functional system.

22
23 e. Following the successful completion of these tests, the
24 Contractor shall demonstrate automatic controlled operation of
25 the equipment and facilities over a period of not less than 72
26 hours of continuous successful operation.

27
28 f. The Contractor shall also be responsible for performing all tests
29 outside of those previously described as may be required by the
30 manufacturers for all equipment, pumps and control valves.

31
32 g. Data records shall be kept by the Contractor. This information
33 shall be submitted to the Engineer for review at the end of the test
34 period.

35
36 2. Should the Contractor fail to demonstrate satisfactory performance on
37 the first and any subsequent attempt, he shall make all necessary altera-
38 tions, adjustments, repairs, and replacements. When the facility is again
39 ready for operation, it shall be brought on line and new tests shall be
40 started. This procedure shall be repeated as often as necessary until
41 the facility has operated continuously to the satisfaction of the Engineer,
42 for the specified test duration.

43
44
45
END OF SECTION

1 SECTION 01640

2
3 QUALITY CONTROL

4
5 PART 1 – GENERAL

6
7 1.01 SECTION INCLUDES

- 8
9 A. Quality assurance and control of installation
- 10
11 B. References
- 12
13 C. Field samples
- 14
15 D. Mock-up
- 16
17 E. Inspection and testing laboratory services
- 18
19 F. Manufacturers' field services and reports

20
21 1.02 RELATED SECTIONS

- 22
23 A. Section 01090 - Reference Standards
- 24
25 B. Section 01300 - Submittals: Submission of Manufacturers' Instructions and
- 26
27 Certificates
- 28
29 C. Section 01410 - Testing Laboratory Services

30 1.03 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- 31
32 A. Monitor quality control over suppliers, manufacturers, products, services,
- 33
34 site conditions, and workmanship, to produce Work of specified quality.
- 35
36 B. Comply fully with manufacturers' instructions, including each step in
- 37
38 sequence.
- 39
40 C. Should manufacturers' instructions conflict with Contract Documents,
- 41
42 request clarification from Engineer before proceeding.
- 43
44 D. Comply with specified standards as a minimum quality for the Work except
- 45
46 when more stringent tolerances, codes, or specified requirements indicate
- higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce workmanship of specified quality.

1
2 F. Secure Products in place with positive anchorage devices designed and
3 sized to withstand stresses, vibration, physical distortion, or disfigurement.
4

5 1.04 REFERENCES
6

7 A. Conform to reference standard by date of issue current on date of Owner
8 Bids.
9

10 B. Should specified reference standards conflict with Contract Documents,
11 request clarification for Engineer before proceeding.
12

13 C. The contractual relationship of the parties to the Contract shall not be
14 altered from the Contract Documents by mention or inference otherwise in
15 any reference document.
16

17 1.05 FIELD SAMPLES
18

19 A. Install field samples at the site as required by individual specifications
20 Sections for review.
21

22 B. Acceptable samples represent a quality level for the Work.
23

24 C. Where field sample is specified in individual Sections to be removed, clear
25 area after field sample has been accepted by Engineer.
26

27 1.06 MOCK-UP
28

29 A. Tests will be performed under provisions identified in this section.
30

31 B. Assemble and erect specified items, with specified attachment and
32 anchorage devices, flashings, seals, and finishes.
33

34 C. Where mock-up is specified in individual Sections to be removed, clear area
35 after mock-up has been accepted by Engineer.
36

37 1.07 INSPECTION AND TESTING LABORATORY SERVICES
38

39 A. Owner will appoint, employ, and pay for services of an independent firm to
40 perform inspection and testing.
41

42 B. The independent firm will perform inspections, tests, and other services
43 specified in individual specification Sections and as required by the
44 Engineer.
45

46 C. Reports will be submitted by the independent firm to the Engineer, in

1 duplicate, indicating observations and results of tests and indicating
2 compliance or non-compliance with Contract Documents.

3
4 D. Cooperate with independent firm; furnish samples of materials, design mix,
5 equipment, tools, storage, and assistance as requested.

6
7 1. Notify Engineer and independent firm 48 hours prior to expected time
8 for operations requiring services.

9
10 2. Make arrangements with independent firm and pay for additional
11 samples and tests required for Contractor's use.

12
13 E. Retesting required because of non-conformance to specified requirements
14 shall be performed by the same independent firm on instructions by the
15 Engineer. Payment for retesting will be charged to the Contractor by
16 deducting inspection or testing charges from the Contract Price.

17
18 1.08 MANUFACTURERS' FIELD SERVICES AND REPORTS

19
20 A. Submit qualifications of observer to Engineer 30 days in advance of
21 required observations. Observer shall be subject to review of Engineer and
22 Owner.

23
24 B. When specified in individual specification Sections, require material or
25 Product suppliers or manufacturers to provide qualified staff personnel to
26 observe site conditions, conditions of surfaces and installation, quality of
27 workmanship, start-up of equipment, test, adjust, and balance of equipment
28 as applicable, and to initiate instructions when necessary.

29
30 C. Individuals to report observations and site decisions or instructions given to
31 applicators or installers that are supplemental or contrary to manufacturers'
32 written instructions.

33
34 D. Submit report in duplicate within 30 days of observation to Engineer for
35 review.

36
37 PART 2 – PRODUCTS (NOT USED)

38
39 PART 3 – EXECUTION (NOT USED)

40
41
42 END OF SECTION
43

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1 SECTION 01670

2
3 SUBSTITUTIONS AND PRODUCT OPTIONS

4
5 PART 1 – GENERAL

6
7 1.01 DESCRIPTION

8
9 A. General:

- 10
11 1. This section covers furnishing of all labor, materials, tools,
12 equipment, and performing all work and services for furnishing,
13 submission, processing, and handling of requests for substitution
14 and product options. See items as indicated on drawings and as
15 specified. Any substitution or option shall be in accord with
16 provisions of Contract Documents, and completely coordinated with
17 work of other trades.
18
19 2. Although such work is not specifically indicated, furnish all
20 supplementary or miscellaneous items, appurtenances, and devices
21 incidental to or necessary for a sound, secure and complete
22 installation.
23
24 3. See appropriate sections for specific items specified. See General
25 Conditions for additional information.
26

27 B. Procedure:

- 28
29 1. For products, equipment, and materials that are named on drawings
30 or in specifications for which a request for substitution is made,
31 observe procedures outlined in these specifications.
32

33 C. Costs: Cost incurred by requester in providing information, catalogs, and
34 samples - including but not limited to labor, materials, freight postage, and
35 transportation - are sole cost of "Requestor" with no cost assessed Owner
36 or Engineer.
37

38 1.02 REQUESTS FOR SUBSTITUTION - GENERAL:

39
40 A. Base all bids on materials, equipment and procedures specified.

41
42 B. Certain types of equipment and kinds of material are described in
43 specifications by means of trade names and catalog numbers and/or
44 manufacturer's names. Where this occurs, it was not intended to exclude
45 from consideration such types of equipment and kinds of material bearing
46 other trade names, catalog numbers and/or manufacturer's names, capable

1 of accomplishing purpose of types of equipment or kinds of material
2 specifically indicated.

3
4 C. Other types of equipment and kinds of material may be acceptable to Owner
5 and Engineer.

6
7 D. Types of equipment, kinds of material and methods of construction, if not
8 specifically indicated must be accepted in writing by Engineer and be
9 agreed upon by Owner.

10
11 E. Conditional bids will not be accepted.

12
13 1.03 SUBMISSION OF REQUESTS FOR SUBSTITUTION:

14
15 A. Within no more than 30 days after award of the Contract, the Engineer will
16 consider requests for substitutions of products, materials, systems, or other
17 items. Requests must be received by Engineer within 30 calendar days
18 after the date of Contract award. All requests for substitution shall be
19 completed as specified below.

20
21 B. Substitute items must comply with color and pattern of base specified items
22 unless specifically approved otherwise.

23
24 C. Submit two (2) copies of request for substitution. Include in request:

25
26 1. Name of product located by Drawing No. or Specification No.,
27 followed by a detail or line number the particular item(s) for which
28 request for substitution is initiated.

29
30 2. Complete data substantiating compliance of proposed substitution
31 with Contract Documents.

32
33 3. For Products:

34
35 a. Product identification by schedule or tag no., including
36 manufacturer's name.

37
38 b. Manufacturer's literature, marked to indicate specific model,
39 type, size, and options to be considered:

- 40
41 1) Product Description
42 2) Performance and test data
43 3) Reference standards
44 4) Difference in power demand
45 5) Dimensional differences for specified unit
46

- 1 c. Submit samples, full size if so required. Engineer reserves
- 2 right to impound sample until physical units are installed on
- 3 project for comparison purposes. All costs of furnishing and
- 4 return of samples shall be paid by requester. Engineer is not
- 5 responsible for loss of or damage to samples.
- 6
- 7 d. Name and address of similar projects where product was
- 8 used, date of installation, and field performance data on
- 9 installation.
- 10
- 11 4. For construction methods:
- 12
- 13 a. Detailed description of proposed method
- 14
- 15 b. Drawings illustrating methods
- 16
- 17 5. Itemized comparison of proposed substitution with product or
- 18 method specified.
- 19
- 20 6. Data relating to changes in construction schedule.
- 21
- 22 7. Accurate cost data on proposed substitution in comparison with
- 23 product or method specified.
- 24
- 25 8. Include with any request a specific statement defining changes in
- 26 contract time or amount.
- 27
- 28 D. In making request for substitution, or in using an approved substitute item,
- 29 Supplier/Manufacturer represents:
- 30
- 31 1. He has personally investigated proposed product or method and has
- 32 determined that it is equal or superior in all respects to that specified,
- 33 and that it will perform function for which it is intended.
- 34
- 35 2. Will provide same or better warranty for substitute item as for product
- 36 or method specified.
- 37
- 38 3. Will coordinate installation of accepted substitution into work, to
- 39 include but not be limited to the following:
- 40
- 41 a. Building and structure modifications as necessary;
- 42
- 43 b. Additional ancillary equipment to accommodate change;
- 44
- 45 c. Piping, valving, mechanical, electrical, or instrumentation
- 46 changes, and

1
2 d. All other changes required for work to be complete in all
3 respects to permit incorporation of substitution into project.
4

5 4. Waives all claims for additional costs related to substitution which
6 subsequently become apparent.
7

8 E. Written acceptance or rejection of items presented for alternative
9 consideration will be given within two weeks after request is received.
10

11 F. In the event the acceptance of an alternate results in a change in contract
12 price or time, or is a deviation from the Contract Documents, a change order
13 will be issued to reflect such change. In the event the acceptance of an
14 alternate does not result in a change in Contract price or time, a field order
15 shall be issued.
16

17 G. Alternates may be rejected for the following reasons:
18

19 1. Acceptance will require substantial revision of Contract Documents
20 or building spaces.
21

22 2. If they are, in Engineer's opinion, not equal to base product specified,
23 or will not adequately perform function for which intended.
24

25 3. If request is not initiated by the Contractor in accordance with this
26 specification section.
27

28 4. If request will require will, in the opinion of the Engineer, excessive
29 time and/or engineering resources to evaluate.
30

31 1.04 SUBSTITUTION DUE TO UNAVAILABILITY 32

33 A. Unavailability of specified item due to strikes, lockouts, bankruptcy,
34 discontinuance of production, proven shortage, or similar occurrences are
35 reasons for substitution after Contract award.
36

37 B. Notify Engineer in writing as soon as condition of unavailability becomes
38 apparent; include substantiating data. Submit request for substitution
39 sufficiently in advance to avoid delays.
40

41 C. Submit data as required in paragraph 1.03 above.
42

43 PART 2 – PRODUCTS (NOT USED) 44

45 PART 3 – EXECUTION (NOT USED) 46

END OF SECTION

1 SECTION 01700

2
3 CONTRACT CLOSEOUT

4
5 PART 1 – GENERAL

6
7 1.01 REQUIREMENTS INCLUDED

- 8
9 A. Comply with requirements stated in General Conditions and in
10 Specifications for administrative procedures in closing out the Work.
11
12 B. Electronic Shop Drawings and O&M Manuals
13
14 1. The Contractor shall furnish final Shop Drawings and Operations and
15 Maintenance Data in electronic “.pdf” format for all equipment
16 furnished under all Specification Sections in Divisions 13 and 15.
17
18 2. The Contractor shall organize all electronic Shop Drawings and
19 Operations and Maintenance Data by specification division and
20 section number and submit two (2) copies on compact disk media
21 (CDROM).
22

23 1.02 SUBSTANTIAL COMPLETION

- 24
25 A. When Contractor considers the Work, or portion thereof, to be substantially
26 complete, he shall submit to the Engineer:
27
28 1. A written notice that the Work, or designated portion thereof, is
29 substantially complete.
30
31 2. A list of items to be completed or corrected.
32
33 B. Within a reasonable time after receipt of such notice, the Engineer will make
34 an inspection to determine the status of completion.
35
36 C. Should the Engineer determine that the Work is not substantially complete:
37
38 1. The Engineer will promptly notify the Contractor, in writing, giving the
39 reasons therefore.
40
41 2. Contractor shall remedy the deficiencies in the Work, and send a
42 second written notice of substantial completion to the Engineer.
43
44 3. The Engineer will re-inspect the Work.
45
46 D. When the Engineer finds that the Work is substantially complete, he will:

- 1
- 2
- 3 1. Prepare and deliver to Owner a tentative Certificate of Substantial
- 4 Completion with a tentative list of items to be completed or corrected
- 5 before final payment.
- 6
- 7 2. After consideration of any objections made by the Owner as provided
- 8 in General Conditions, and when the Engineer considers the Work
- 9 substantially complete, he will execute and deliver to the Owner and
- 10 the Contractor a definite Certificate of Substantial Completion with a
- 11 revised tentative list of items to be completed or corrected.

12 1.03 FINAL INSPECTION

- 13
- 14 A. When Contractor considers all the Work to be complete, he shall submit
- 15 written certification that:
- 16
- 17 1. Contract Documents have been reviewed.
- 18
- 19 2. Work has been inspected for compliance with Contract Documents.
- 20
- 21 3. Work has been completed in accordance with Contract Documents.
- 22
- 23 4. Equipment and systems have been tested in the presence of the
- 24 Owner's representative and are operational.
- 25
- 26 5. Work is completed and ready for final inspection.
- 27
- 28 B. The Engineer will make an inspection to verify the status of completion with
- 29 reasonable promptness after receipt of such certification.
- 30
- 31 C. Should the Engineer consider that the Work is incomplete or defective:
- 32
- 33 1. The Engineer will promptly notify the Contractor in writing, listing the
- 34 incomplete or defective work.
- 35
- 36 2. Contractor shall take immediate steps to remedy the stated
- 37 deficiencies and send a second written certification to the Engineer
- 38 that the Work is complete.
- 39
- 40 3. The Engineer will re-inspect the Work.
- 41
- 42 D. When the Engineer finds that the Work is acceptable under the Contract
- 43 Documents, he shall request the Contractor to make closeout submittals.
- 44

45 1.04 RE-INSPECTION FEES

- 1 A. Should the Engineer perform re-inspections, due to failure of the Work, to
2 comply with the claims of status of completion made by the Contractor:
3
4 1. Owner will compensate the Engineer for such additional services.
5
6 2. Owner will deduct the amount of such compensation from the final
7 payment to the Contractor.
8

9 1.05 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER

- 10 A. Evidence of compliance with requirements of governing authorities.
11
12 B. Project Record Documents.
13
14 C. Operating and Maintenance Data, Instructions to Owner's Personnel.
15
16 D. Warranties and Bonds.
17
18 E. Keys and Keying Schedule.
19
20 F. Spare Parts and Maintenance Materials.
21
22 G. Evidence of Payment and Release of Liens.
23
24 H. Certificate of Insurance for Products and Completed Operations.
25
26 I. Contractor's Final Affidavit.
27
28 J. Lien Waivers from Subcontractors and Suppliers.
29
30 K. Consent of Surety from the bonding company.
31
32 L. Contractor's Guarantee.
33
34

35 1.06 FINAL ADJUSTMENT OF ACCOUNTS

- 36 A. Submit a final statement of accounting to the Engineer.
37
38 B. Statement shall reflect all adjustments to the Contract Sum:
39
40 1. The original Contract Sum.
41
42 2. Additions and deductions resulting from:
43
44 a. Previous Change Orders.
45
46

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- b. Unit Prices.
- c. Deductions for uncorrected Work.
- d. Penalties and Bonuses.
- e. Deductions for liquidated damages.
- f. Deductions for re-inspection payments.
- g. Other adjustments.

3. Total Contract Sum, as adjusted.

4. Payments.

5. Sum remaining due.

C. Engineer will prepare a final Change Order, reflecting adjustments to the Contract Sum, which were not previously made by Change Orders.

1.07 FINAL APPLICATION FOR PAYMENT

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

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

1 SECTION 01710

2
3 CLEANING

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. The Contractor shall execute cleaning during progress of Work and at
10 completion of the Work as required by the General Conditions.

11
12 1.02 DISPOSAL REQUIREMENTS

- 13
14 A. The Contractor shall conduct cleaning and disposal operations to comply
15 with all applicable Laws and Regulations.
16
17 B. Disposal of waste materials shall be in accordance with the Section III, 17.7
18 and local Ordinances.

19
20 PART 2 – MATERIALS

21
22 2.01 MATERIALS

- 23
24 A. The Contractor shall use only those cleaning materials which do not create
25 hazards to health or property, and which do not damage surfaces.
26
27 B. The Contractor shall use only those cleaning materials and methods
28 recommended by the Manufacturer of the surface material to be cleaned.
29
30 C. The Contractor shall use cleaning materials only on surfaces so
31 recommended by cleaning material Manufacturer.

32
33 PART 3 – EXECUTION

34
35 3.01 CLEANING DURING CONSTRUCTION

- 36
37 A. The Contractor shall execute daily cleaning to keep the Work, the site and
38 adjacent properties free from accumulations of waste materials, water,
39 eroded material, rubbish and windblown debris resulting from construction
40 operations.
41
42 B. The Contractor shall provide suitable on-site containers for the daily
43 collection of all waste materials, debris and rubbish.
44
45 C. The Contractor shall remove waste materials, debris and rubbish from site
46 containers periodically and dispose of in accordance with Section 1.02.

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D. The Contractor shall schedule operations so that dust and other contaminants resulting from the cleaning process do not fall on wet or newly-coated surfaces.

E. The Contractor shall remove from the site all surplus materials and temporary structures when no further need therefore develops and as approved by the Engineer. The Contractor shall be responsible and liable for all spillage and shall incur all associated costs including, but not limited to, costs related to repair and maintenance resulting from any such damage.

3.02 FINAL CLEANING

A. The Contractor shall employ skilled workmen for final cleaning.

B. The Contractor shall remove all grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels and all other foreign materials from sight-exposed interior and exterior surfaces.

C. Prior to Final Completion, the Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all Work areas, to verify that the entire Work and the entire construction area of the Work are clean.

END OF SECTION

1 SECTION 01720

2 PROJECT RECORD DOCUMENTS

3
4
5 PART 1 – GENERAL

6
7 1.01 REQUIREMENTS INCLUDED

- 8
9 A. Maintain at the site for the Owner one record copy of:
- 10 1. Drawings
 - 11 2. Specifications
 - 12 3. Addenda
 - 13 4. Change Orders and other Modifications to the Contract
 - 14 5. Engineer's Field Orders or written instructions
 - 15 6. Accepted Shop Drawings, Working Drawings and Samples
 - 16 7. Field Test Records
 - 17 8. Construction Photographs, if provided
 - 18 9. Detailed progress schedule

19
20
21 1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

- 22
23
24
25
26
27
28
29 A. Store documents and samples in Contractor's field office apart from
- 30 documents used for construction.
- 31 1. Provide files and racks for storage of documents.
 - 32 2. Provide locked cabinet of secure storage space for storage of
 - 33 samples.
- 34
35
36
37
38 B. File documents and samples in accordance with CSI format.
- 39
40
41 C. Maintain documents in a clean, dry, legible condition and in good order. Do
- 42 not use record documents for construction purposes.
- 43
44 D. Make documents and samples available at all times for inspection by the
- 45 Engineer.
- 46

1 E. As a pre-requisite for monthly progress payments, the Contractor shall
2 exhibit the updated "record documents" for review by the Engineer and
3 Owner.
4

5 1.03 MARKING DEVICES
6

7 A. Provide felt tip marking pens for recording information in the color code
8 designated by the Engineer.
9

10 1.04 RECORDING
11

12 A. Label each document "PROJECT RECORD" in neat large printed letters.
13

14 B. Record information concurrently with construction progress.
15

16 1. Do not conceal any work until required information is recorded.
17

18 C. Drawings: Legibly mark to record actual construction:
19

20 1. Depths of various elements of foundation in relation to finish first floor
21 datum.
22

23 2. Denote all underground piping elevations and dimensions; all
24 changes to piping location; horizontal and vertical locations of
25 underground utilities and appurtenances, all referenced to
26 permanent surface improvements. Actual installed pipe material,
27 class, etc.
28

29 3. Locations of internal utilities and appurtenances concealed in the
30 construction, referenced to visible and accessible features of the
31 structure.
32

33 4. Field changes of dimension and detail.
34

35 5. Changes made by Field Order or by Change Order.
36

37 6. Details not on original Contract Documents.
38

39 7. Equipment and piping relocations.
40

41 8. Major architectural and structural changes including relocation of
42 doors, windows, etc.
43

44 9. Architectural schedule changes according to Contractor's records
45 and shop drawings.
46

1 D. Specifications and Addenda; legibly mark each Section to record:
2

3 1. Manufacturer, trade name, catalog number, and supplier of each
4 product and item of equipment actually installed.
5

6 2. Changes made by Field Order or by Change Order.
7

8 E. Shop Drawings (after final review):
9

10 1. Five (5) sets of shop drawings for each piece of process equipment,
11 piping, electrical and instrumentation system.
12

13 1.05 SUBMITTAL
14

15 A. At contract close-out, deliver Record Documents to the Engineer for the
16 Owner.
17

18 B. Accompany submittal with transmittal letter in duplicate, containing:
19

20 1. Date
21

22 2. Project title and number
23

24 3. Contractor's name and address
25

26 4. Title and number of each Record Document
27

28 5. Signature of Contractor or his authorized representative
29

30
31 PART 2 – PRODUCTS (NOT USED)
32

33 PART 3 – EXECUTION (NOT USED)
34

35
36 END OF SECTION
37

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1 SECTION 01730

2
3 OPERATING AND MAINTENANCE DATA

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. Compile product data and related information appropriate for Owner's
10 maintenance and operation of new equipment and processes furnished and
11 or installed by the Contractor.
12
13 1. Prepare operating and maintenance data as specified in this Section
14 and as referenced in other pertinent sections of Specifications.
15
16 2. The information in the O&M Manual shall be specific and targeted for
17 the equipment and processes supplied for this project.
18
19 3. Incorporate operating and maintenance data furnished by the
20 Owner, if previously defined in the scope of work.
21
22 B. Furnish all labor, equipment, materials, and all other items required to
23 supply and deliver to the Engineer, O&M Manuals for the work, mechanical
24 equipment, instrumentation equipment, electrical equipment, process
25 control equipment, and software on a facility wide, system by system, and
26 individual equipment basis as pertinent to the project.
27
28 C. Five (5) draft O&M Manuals for each piece of equipment shall be submitted
29 to the Engineer upon delivery of the equipment. The draft O&M Manuals
30 will include the manufacturer's test results and specification and may be
31 used as a training aid.
32
33 D. Furnish the Owner five (5) complete hardcopy sets of operation and
34 maintenance data and two (2) complete set of operation and maintenance
35 data in electronic "pdf" format on a CD as specified herein for the project.
36
37 1. Any modifications required after final O&M submission shall be made
38 to the manuals by issuance of all new manuals with the revised or
39 additional information included and clearly identified.
40

41 1.02 QUALITY ASSURANCE

- 42
43 A. Preparation of data shall be done by personnel:
44
45 1. Trained and experienced in maintenance and operation of described
46 products.

2. Familiar with requirements of this Section.
3. Skilled and technical writer to the extent required to communicate essential data.
4. Skilled as draftspersons competent to prepare required Drawings.

1.03 FORM OF SUBMITTALS

- A. Prepare data in form of an instructional manual for use by Owner's personnel.
- B. Format:
 1. Size: 8-1/2 inches x 11-inches.
 2. Paper: 20 pound minimum white, for typed pages.
 3. Text: Manufacturer's printed data, or neatly typewritten.
 4. Drawings:
 - a. Provide reinforced punched binder tabs, bind in with text.
 - b. Reduce larger Drawings to 11-inches x 17-inches and fold to size of text pages and printed only on one side.
 5. Provide tabbed fly-leaf for each separate product, or each piece of operating equipment.
 - a. Provide typed description of the product, and of each major component part of equipment.
 - b. Provide indexed tabs.
 6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS." List:
 - a. Title of Project
 - b. Identity of separate structure as applicable.
 - c. Identity of general subject matter covered in the manual.
- C. Binders:
 1. Commercial quality three-post binders with durable and cleanable plastic covers.

1 2. Maximum post width: 2-inches. Each binder filled to not more than
2 75% capacity.

3
4 3. When multiple binders are used, correlate the data into related
5 consistent groupings.

6
7 D. Refer to Specification Section 01300 for additional submittal requirements.
8

9 1.04 GENERAL CONTENT OF MANUAL

10
11 A. Neatly typewritten table of contents for each volume, arranged in systematic
12 order. If more than one volume is required, the table of contents of each
13 volume shall be included with all volumes.

14
15 B. The contact information, address, and phone number for the Contractor and
16 the responsible principal shall be included.

17
18 C. A list of each product included, indexed to content of the volume.

19
20 D. A list, with each product, name, address, and telephone number of:

21
22 a. Manufacturer

23 b. Subcontractor or installer.

24 c. Maintenance contractor, as appropriate.

25 d. Local source of supply for parts and replacement.
26

27 E. Identify each product by product name and other identifying symbols as set
28 forth in Contract Documents.

29
30 F. Product Data:

31
32 1. Include only those sheets which are pertinent to the specific product.

33
34 2. Annotate each sheet to:

35
36 a. Clearly identify specific product or part installed.

37 b. Clearly identify data applicable to installation.

38 c. Delete references to inapplicable information.
39

40 G. Drawings:

41
42 1. Supplement product data with Drawings as necessary to clearly
43 illustrate:

44
45 a. Relations of component parts of equipment and systems.

46 b. Control and flow diagrams.

- 1 c. Owner Tag Numbers.
- 2 d. Exploded views with part numbers listed and identified.
- 3
- 4 2. Coordinate drawings with information in Project Record Documents
- 5 to assure correct illustration of completed installation.
- 6
- 7 H. Written text, as required to supplement product data for the particular
- 8 installation:
- 9
- 10 1. Organized in consistent format under separate headings for different
- 11 procedures.
- 12
- 13 2. Provide logical sequence of instructions of each procedure.
- 14
- 15 3. Provide an overview of how the complete system should operate.
- 16
- 17 I. Provide a copy of each warranty, bond, and service contract issued.
- 18
- 19 1. Provide information sheet for Owner's personnel with the following
- 20 information:
- 21
- 22 a. Proper procedures in event of failure.
- 23 b. Circumstances and events that may affect validity of
- 24 warranties or bonds.
- 25

26 1.05 CONTENT OF MANUAL FOR ARCHITECTURAL PRODUCTS, MOISTURE-
 27 PROTECTED, WEATHER-EXPOSED, AND APPLIED MATERIALS, AND
 28 FINISHES

- 30 A. Manufacturer's data, giving full information on products.
- 31
- 32 1. Catalog number, size, and composition.
- 33 2. Applicable Standards
- 34 3. Chemical Composition
- 35 4. Details of Installation or Application
- 36 5. Color and texture designations.
- 37 6. Information required for re-ordering special-manufactured products.
- 38 7. Storage instructions and shelf life information.
- 39
- 40 B. Instructions for care and maintenance.
- 41
- 42 1. Manufacturer's recommendation for types of cleaning agents and
- 43 methods.
- 44
- 45 2. Cautions against cleaning agents and methods that are detrimental
- 46 to product.

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3. Recommended schedule for cleaning and maintenance.

4. Instructions for inspection, maintenance, and repair.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

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1 SECTION 01740

2
3 WARRANTIES AND BONDS

4
5 PART 1 – GENERAL

6
7 1.01 REQUIREMENTS INCLUDED

- 8
9 A. Compile warranties and bonds, as specified in the General Conditions.
10
11 B. Co-execute submittals when so specified.
12
13 C. Review submittals to verify compliance with Contract Documents.
14
15 D. Submit to the Engineer for review and transmittal to Owner.
16

17 1.02 SUBMITTAL REQUIREMENTS

- 18
19 A. Assemble warranties, bonds, and service and maintenance contracts, executed
20 by each of the respective manufacturers, suppliers, and subcontractors.
21
22 B. Number of original signed copies required. Two each.
23
24 C. Table of Contents. Neatly typed in orderly sequence. Provide complete
25 information for each item.
26
27 1. Product or work item.
28
29 2. Firm, with name of principal, address, and telephone number.
30
31 3. Scope.
32
33 4. Date of beginning warranty, bond or service and maintenance contract.
34
35 5. Duration of warranty, bond, or service maintenance contract.
36
37 6. Provide information for Owner's personnel:
38
39 a. Proper procedure in case of failure.
40
41 b. Instances which might affect the validity of warranty or bond.
42
43 7. Contractor, name of responsible principal, address, and telephone
44 number.
45
46

1 1.03 WARRANTY SUBMITTAL REQUIREMENTS

- 2
- 3 A. For all major pieces of equipment, submit a warranty from the equipment
4 manufacturer. The manufacturer's warranty period shall be concurrent with the
5 Contractor's for one (1) year, unless otherwise specified, commencing at the
6 time of substantial completion and/or final acceptance by the Owner, whichever
7 is later.
8
- 9 B. The Contractor shall be responsible for obtaining certificates for equipment
10 warranty for all major equipment that has a 1 HP motor or that has a list price of
11 more than \$1,000. The Engineer reserves the right to request warranties for
12 equipment not classified as major. The Contractor shall still warrant equipment
13 not considered to be "major" in the Contractor's one-year warranty period even
14 though certificates of warranty may not be required.
15
- 16 C. In the event that the equipment manufacturer or supplier is unwilling to provide
17 a one-year warranty commencing at the time of Owner acceptance, the
18 Contractor shall obtain from the manufacturer a three (3) year warranty
19 commencing at the time of equipment delivery to the job site. The two-year
20 warranty from the manufacturer shall not relieve the Contractor of the one-year
21 warranty starting at the time of Owner acceptance of the equipment.
22

23 1.04 WARRANTY START DATE

- 24
- 25 A. No warranty shall start until the Engineer has issued a "Notice of Substantial
26 Completion".
27

28 PART 2 – PRODUCTS (NOT USED)

29
30 PART 3 – EXECUTION (NOT USED)

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33 END OF SECTION
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1 SECTION 02062

2
3 REMOVAL OF EXISTING EQUIPMENT

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. Furnish all labor, tools, equipment, materials, and incidentals required to
10 remove all existing structures, equipment, pipe, fittings, valves, electrical,
11 instrumentation and controls, and all appurtenances as noted on the
12 Contract Drawings, as reasonably inferred and as required in order to
13 perform the work as described in the Contract Documents.
14

15 PART 2 – PRODUCTS (NOT USED)

16
17 PART 3 – EXECUTION

18
19 3.01 GENERAL

- 20
21 A. The Contractor shall not proceed with the removal of any equipment without
22 specific approval from the Owner. Any facilities removed without proper
23 authorization shall be replaced to the satisfaction of the Owner at the
24 Contractor's expense.
25
26 B. All existing equipment, valves, hardware, tubing, insulation, hangers, and
27 supports not required to be reused and not designated as being turned over
28 to the Owner, shall become the property of the Contractor immediately upon
29 removal from their present locations. The Contractor shall remove such
30 material from the plant site at his own expense and it shall not be reused.
31
32 C. All existing equipment, valves, hardware, tubing, insulation, hangers, and
33 supports designated as being turned over to the Owner, shall be identified,
34 cleaned, protected, crated or boxed and stored at the plant site.
35
36 D. Pieces of equipment weighing 150 lbs or more shall be provided with
37 suitable skids before storing.
38
39 E. Wherever piping is removed for disposition, adjacent pipe, and headers that
40 are to remain in service shall be blanked off or plugged and then supported
41 or anchored.
42
43 F. The Contractor shall take all necessary precautions against damaging the
44 material and equipment to be stored and reused. The Contractor shall
45 repair any damage resulting from his operations, as directed by and to the

1 satisfaction of the Engineer. Itemized lists of materials removed and stored
2 shall be given to the Resident Project Representative daily. A final typed
3 itemized list shall be furnished to the Engineer in 6 copies at the completion
4 of construction. The list shall include items, method of packaging, and place
5 of storage.

6
7 3.02 EQUIPMENT TO BE RETAINED

- 8
9 A. All equipment removed shall remain the property of the Owner unless
10 designated otherwise by the Owner.
11
12 B. If the Owner elects not to retain ownership of a certain item, the item shall
13 become the property of the Contractor and shall be removed from the plant
14 site at the Contractor's expense.
15
16 C. If the Owner requests that the Contractor utilize a specific hauling service
17 for the removal of existing equipment or facilities, the Contractor shall utilize
18 that service at no additional cost to the Owner.
19
20
21

END OF SECTION

1 SECTION 02064

2
3 MODIFICATIONS TO EXISTING STRUCTURES, PIPING AND EQUIPMENT

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. Furnish all labor, materials, equipment, and incidentals required to modify,
10 alter and/or convert existing structures as shown or specified and as
11 required for the installation of new mechanical equipment, piping, and
12 appurtenances. Existing piping and equipment shall be removed and
13 dismantled as necessary for the performance of structural alterations in
14 accordance with the requirements herein specified.

15
16 1.02 DEWATERING FOR STRUCTURES

- 17
18 A. The Contractor shall take any and all precautions necessary to assure that
19 the structures affected by this project and all connecting structures,
20 pipelines, and conduits do not become buoyant and are not damaged in any
21 way as a result of the work specified herein.

- 22
23 B. The Contractor shall furnish, install, maintain, operate, and remove a
24 temporary dewatering system, in accordance with Section 02140, if
25 provided, as required to lower and control the groundwater level, such that
26 there is no danger of any structure becoming buoyant. In no event shall
27 ground water rise to such a level to cause unbalanced pressure on
28 structures. Flotation shall be prevented by maintaining a positive and
29 continuous operation of the dewatering system. The Contractor shall be
30 fully responsible and liable for all damages to existing structures, piping or
31 equipment that may result from failure of the groundwater dewatering
32 system.

33
34 C. Dewatering System

- 35
36 1. The dewatering system shall be adequate to lower the groundwater
37 levels to required levels. The dewatering system must maintain the
38 lowered water table at all times until no longer needed.
39
40 2. The Contractor shall provide and have ready on-site for immediate
41 use at all times standby pumping and/or power systems to serve the
42 dewatering system in case of failure of the primary pumping/power
43 systems.
44

1 3. The Contractor shall be responsible for creating and implementing a
2 dewatering plan and a groundwater disposal plan. The plans shall
3 be submitted to the Engineer and shall be reviewed prior to initiating
4 any dewatering activities. The Contractor shall also comply with the
5 requirements of the Florida Department of Environmental Protection
6 (FDEP) Generic Permit for the Discharge of Produced Groundwater
7 from any Non-Contaminated Site Activity (rule 62-621.300) for all
8 discharges to surface waters or systems that flow into surface
9 waters.

10
11 4. Removal of the dewatering system shall be accomplished after the
12 dewatering system is no longer required.

13
14 PART 2 – PRODUCTS (NOT USED)

15
16 PART 3 – EXECUTION

17
18 3.01 GENERAL

19
20 A. The Contractor shall cut, repair, reuse, excavate, demolish, or otherwise
21 remove parts of the existing structures or appurtenances, as indicated on
22 the Contract Drawings, herein specified, or necessary to permit completion
23 of the work under this Contract. He shall dispose of surplus materials
24 resulting from the above work. The work shall include all necessary cutting
25 and bending of reinforcing steel, structural steel, or miscellaneous metal
26 work found embedded in the existing structures. Any item called for to be
27 removed shall be assumed to include connecting conduit, wiring and
28 supports, unless as otherwise directed by the Engineer.

29
30 B. The Contractor shall dismantle and remove all existing equipment, piping
31 and other appurtenances required for the completion of the work. Where
32 called for or required, the Contractor shall cut existing pipelines for the
33 purpose of making connections thereto. Anchor bolts for equipment and
34 structural steel removed shall be cut off one inch below the concrete
35 surface. Surface shall be finished as specified in Specification 03740.

36
37 C. At the time that a new connection is made to an existing pipeline, additional
38 new piping, extending to and including a new valve, shall be installed.

39
40 D. No existing structure, equipment, or appurtenance shall be shifted, cut,
41 removed, or otherwise altered except as directed by the Engineer.

42
43 E. When removing materials or portions of existing structures and when
44 making openings in walls and partitions, the Contractor shall take all
45 precautions and use all necessary barriers and other protective devices so

1 as not to damage the structures beyond the limits necessary for the new
2 work, and not to damage the structures or contents by falling or flying debris.
3 Unless otherwise permitted, line drilling will be required in cutting existing
4 concrete.

- 5
- 6 F. Materials and equipment removed in the course of making alterations and
7 additions shall remain the property of the Owner, except that item not
8 salvageable, as determined by the Engineer and the Owner, shall become
9 the property of the Contractor to be disposed of by him off the work site at
10 his own place of disposal. Operating equipment shall be thoroughly
11 cleaned, lubricated, and greased for protection during prolonged storage.
12
- 13 G. All alterations to existing structures shall be done at such time and in such
14 manner as will comply with the time schedule. So far as possible before
15 any part of the work is started, all tools, equipment and materials shall be
16 assembled and made ready so that the work can be completed without
17 delay.
18
- 19 H. All workmanship and new materials involved in constructing the alterations
20 shall conform to the General Specifications for the classes of work insofar
21 as such specifications are applicable.
22
- 23 I. All cutting of existing concrete or other material to provide suitable bonding
24 to new work shall be done in a manner to meet the requirements of the
25 respective section of these Specifications covering the work. When not
26 covered, the work shall be carried on in the manner and to the extent
27 directed by the Engineer.
28
- 29 J. Surfaces of seals visible in the completed work shall be made to match as
30 nearly as possible the adjacent surfaces.
31
- 32 K. Non-shrink grout shall be used for setting wall castings, sleeves, leveling
33 pump bases, doweling anchors into existing concrete and elsewhere as
34 shown.
35
- 36 L. Where necessary or required for the purpose of making connections, the
37 Contractor shall cut existing pipelines/couplings in a manner to provide a
38 typical joint. Where required, the Contractor shall weld beads, flanges, or
39 provide Dresser Couplings or equal, all as required.
40
- 41 M. The Contractor shall provide flumes, hoses, piping, and other related items
42 to divert or provide suitable plugs, bulkheads, or other means to hold back
43 the flow of water or other liquids, all as required in the performance of the
44 work under this Contract.
45

1 N. Blasting will not be permitted to complete any work under this Contract.
2 Care shall be taken not to damage any part of existing buildings or
3 foundations or outside structures.
4

5 3.02 CONNECTING TO EXISTING PIPING AND EQUIPMENT
6

7 A. The Contractor shall verify the exact location, material, alignment, joint, etc.,
8 of existing piping and equipment prior to making the connections called out
9 in the Drawings. These verifications shall be performed with adequate time
10 to correct any alignment issues prior to the actual time of connection.
11

12
13 3.03 CLEANING EXISTING STRUCTURES
14

15 A. After dewatering and before commencing work on any tank, structure,
16 channels, conduit or other structures, the Contractor shall remove and
17 dispose of the grit and other solids remaining in such structures in a lawful
18 manner.
19

20 B. If the Owner requests that the Contractor utilize a specific hauling service
21 for the removal of existing equipment or facilities, the Contractor shall utilize
22 that service at no additional cost to the Owner.
23

24 END OF SECTION
25
26
27

1 SECTION 02140

2
3 TEMPORARY DEWATERING

4
5 PART 1 – GENERAL

6
7 1.01 DESCRIPTION

- 8
9 A. The Work to be performed includes the furnishing of all equipment,
10 materials and labor necessary to design, furnish, install, operate, and
11 maintain temporary dewatering systems to remove subsurface ground
12 waters as required by local conditions in accordance with all applicable
13 laws, the requirements set forth and as shown on the Drawings, as specified
14 herein, or as required for the completion of the work.
15
16 B. The Contractor shall conduct groundwater quality sampling and testing as
17 required and shall obtain a permit to discharge groundwater and stormwater
18 as described in Section 01065.
19
20 C. It is anticipated that ground water dewatering will be required for the
21 installation of the new influent sewer structure and at all times when other
22 structures or utilities are susceptible to becoming buoyant in order to
23 perform the rehabilitation work of this project.
24
25 D. It shall be the Contractor's responsibility to conduct the necessary soil
26 testing required to design a dewatering system for this project, and to retain
27 the services of a Geotechnical Engineer to design the dewatering system.
28 Submit the geotechnical engineer's signed and sealed plan for review. The
29 Contractor shall be required to dispose of the product water from dewatering
30 activities in accordance with all laws applicable thereto.
31
32 E. The Contractor will be responsible for all costs associated with both
33 dewatering and with disposing of product water from dewatering activities.
34
35 F. The Contractor shall be solely responsible for the sizing, design, and
36 construction of the dewatering system and for the disposal of product water
37 from dewatering. The Contractor may utilize the existing stormwater
38 collection and treatment system for disposal of produced groundwater.
39

40 1.02 QUALITY ASSURANCE

- 41
42 A. Groundwater dewatering and disposal of product water from dewatering
43 shall be in strict accordance with the latest revision of all Laws and
44 Regulations; with the local, State and Federal permits for the project; and,
45 with the Contractor's Storm Water Pollution Prevention Plan (SWPPP) and
46 the Contractor's Dewatering Plan.

1
2 1.03 DEWATERING PLAN
3

- 4 A. Prior to commencing any excavations, the Contractor shall submit a written
5 Dewatering Plan to the Engineer for review. The Contractor shall make any
6 and all field investigations and tests necessary to properly design and
7 construct a temporary dewatering system and temporary disposal or
8 infiltration/percolation system.
9
- 10 B. The Dewatering Plan shall include calculations based on field measured
11 geotechnical/hydrogeological data identifying the amount of water that will
12 be produced from dewatering. The Plan shall indicate the rate at which
13 product water from dewatering is produced as well as the length of time it
14 will be produced for each distinct construction phase applicable to each
15 dewatering activity identified below:
16
- 17 C. Those times when any structure is prone to buoyancy, including those times
18 when the installation or replacement of ground water relief valves and
19 installation of internal structural and rotating components.
20
- 21 D. The Dewatering Plan shall be in conformity with the overall construction
22 plan and shall itemize all pumping equipment, ground penetration
23 equipment and piping. The pumping and piping arrangement, the volume
24 of proposed discharge, and the location of the proposed discharge shall be
25 identified in the Dewatering Plan.
26
- 27 E. The Dewatering Plan shall be signed and sealed by a Florida Registered
28 Professional Engineer.
29

30 1.04 UPLIFT AND FLOTATION
31

- 32 A. Uplift of a structure could occur if the groundwater elevation is higher than
33 the elevation of water inside the structure. The Contractor shall monitor the
34 groundwater elevation, by constructing piezometers where necessary, at all
35 times when any structure is susceptible to uplift.
36
- 37 B. The Contractor shall be fully responsible for ensuring that ground water
38 levels are controlled as required to prevent flotation and shall be fully
39 responsible and liable for all damages to structures and or pipes that may
40 result from the operation and/or failure of the dewatering system.
41

42 PART 2 – PRODUCTS (Not Applicable)
43

44 PART 3 – EXECUTION
45

46 3.01 TEMPORARY DEWATERING

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- A. The Contractor shall provide adequate equipment for the removal of surface or subsurface waters that may accumulate in the tanks or in the excavation. The Contractor shall prevent flotation and migration of fines by maintaining a positive and continuous operation of the dewatering system.

- B. If subsurface water is encountered, the Contractor shall utilize suitable equipment to adequately dewater the tanks or the excavation so that it will be dry to the bottom or to a depth of 12-inches below the subgrade compaction level or over-excavation level, as appropriate. A well point system, trench drain, sump pump operation, or other dewatering method selected by the Contractor shall be utilized to maintain the work area in a dry condition for preparation of the bottom and until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. No water shall be allowed to contact masonry or concrete within 24 hours after being placed.

- C. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the proposed bottom of excavations and to preserve the integrity of adjacent structures and utilities. Well or sump installations shall be constructed and operated continuously with proper sand filters to prevent drawing of finer grained soil from the surrounding ground.

- D. In the event that satisfactory dewatering cannot be accomplished due to subsurface conditions, or where dewatering could damage existing structures, the Contractor shall notify the Engineer before commencing construction.

- E. Engine-driven dewatering pumps shall be equipped with residential type mufflers. Where practical and feasible, electrical "power drops" and electric motor-driven equipment shall be used in lieu of portable generators.

- F. The Contractor shall take all additional precautions to prevent uplift of any structure during construction, including the installation of piezometers for water level monitoring.

- G. The Contractor shall take all precautions to preclude the accidental discharge of fuel, oil, etc. to prevent adverse effects on groundwater quality. All costs associated with any such adverse effects shall be borne by the Contractor.

- H. The Contractor shall, at no expense to the Owner, be required to excavate below grade and refill with fill material if the Engineer determines that adequate drainage has not been provided.

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3.02 DISPOSAL

- A. The Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities and shall leave the facilities unrestricted and as clean as originally found. Any damage to existing facilities shall be repaired or restored as directed by the Engineer or the authority having jurisdiction, at no cost to the Owner.
- B. The Contractor shall be responsible for acquiring and complying with all permits required to dispose of the product water from dewatering and shall protect adjacent waterways from product water run-off and turbidity while the system is in operation.
- C. In areas where adequate disposal sites are not available, partially backfilled trenches may be used for water disposal. The Contractor's plan shall include temporary culverts, barricades, and other protective measures to prevent damage to property or injury to any person or persons.
- D. No flooding of streets, roadways, driveways, or private property shall be permitted.

3.03 EQUIPMENT REMOVAL AND AREA RESTORATION

- A. Removal of dewatering equipment shall be accomplished after the system is no longer required. All materials and equipment constituting the system shall be removed by the Contractor.
- B. All sock drains shall be filled with flowable fill when no longer needed and abandoned in place.
- C. All areas shall be restored in accordance with Specification Section 02485.

END OF SECTION

1 SECTION 02221

2
3 EXCAVATION, BACKFILL, FILL, AND GRADING FOR PIPES

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

8
9 A. This section includes, except as elsewhere provided, all excavation for
10 pipelines and appurtenances including drainage, filling, backfilling, grading,
11 disposal of surplus material and restoration of trench surfaces.

12
13 B. Excavation shall provide suitable room for installing pipe, structures and
14 appurtenances. Pavement shall be cut with pneumatic chisels along
15 straight lines before excavating.

16
17 C. The Contractor shall furnish and place all sheeting, bracing and supports,
18 and shall remove from the excavation all materials which the Engineer may
19 deem unsuitable for backfilling. The bottom of the excavation shall be firm,
20 dry and in all respects, acceptable. The length of open trench shall be
21 related closely to the rate of installing pipe. All excavation shall be made in
22 open trenches.

23
24 D. All pipe and fittings shall be clearly marked with the name or trademark of
25 the manufacturer, the batch number, the location of the plant and strength
26 designation, as applicable. All pipe shall be laid with a 2-inch metallic tape,
27 appropriately color-coded and imprinted with the type of service, 12-inches
28 below final grade, directly above the utility for identification and ease of
29 location. The appropriate tape color codes are as follows:

- 30
31 Grey - Gravity Sewer
32 Green - Sanitary force main
33 Blue - Potable water
34 Lavender - Reclaimed water

35
36 PART 2 – PRODUCTS

37
38 2.01 MATERIALS

39
40 A. General

41
42 1. Materials for use as fill shall be described below. For each material,
43 the Contractor shall notify the Testing Lab of the source of the
44 material at least ten calendar days prior to the date of anticipated use
45 of such material.

- 1 2. Materials shall be furnished as required from off-site sources and
2 hauled to the site.
3 3. Disposal of unsuitable material is specified in this Section. See
4 Paragraph 3.10.
5

6 B. Common Fill
7

- 8 1. Common fill shall consist of mineral soil, free of organic material,
9 loam, wood, trash and other objectionable material which may be
10 compressible, or which cannot be compacted properly. Common fill
11 shall not contain stones larger than 10-in. in any dimension, broken
12 concrete, masonry, rubble, or other similar materials. It shall have
13 physical properties such that it can be readily spread and compacted
14 during filling.
15
16 2. Material falling within the above specification, encountered during
17 the excavation, may be stored in segregated stockpiles for reuse. All
18 material, which, in the opinion of the Engineer, is not suitable for
19 reuse, shall be spoiled as specified herein for disposal of unsuitable
20 materials.
21

22 C. Crushed Stone
23

- 24 1. Crushed stone shall be used for manhole bases, as a drainage layer
25 below structures with underdrains and at other locations indicated on
26 the Drawings.
27
28 2. Crushed stone for pipe bedding shall be size No. 67 with gradation
29 as defined in Table 1 of Section 901 of Florida Department of
30 Transportation Standard Specifications for Road & Bridge
31 Construction.
32

33 D. Select Fill
34

- 35 1. Select fill shall be non-cohesive, non-plastic material free of all
36 debris, lumps or clods. Fill material shall be clean earth fill composed
37 of sand or a mixture of clay and sand. Backfill material placed within
38 one foot of piping and appurtenances shall not contain any stones or
39 rocks larger than 2 inches in diameter, or 3/4-inch in diameter for
40 PVC pipe.
41

42 PART 3 – EXECUTION
43

44 3.01 DISPOSAL OF MATERIALS
45

- 1 A. Excavated material shall be stacked without excessive surcharge on the
2 trench bank. Inconvenience to traffic and abutters shall be avoided as much
3 as possible. Excavated material shall be segregated for use in backfilling
4 as specified below.
5
6 B. Surplus excavated material which, in the opinion of the Engineer, is suitable
7 for use in backfilling or for replacing rock and boulders shall be stockpiled
8 at a satisfactory site to be obtained by the Contractor to be used as required.
9 Unsatisfactory surplus material including paving, rock or boulders, muck,
10 stumps and other material, as directed by the Engineer, shall be disposed
11 of by the Contractor.
12
13 C. It is expressly understood that no excavated material shall be removed from
14 the site of the work or disposed of by the Contractor except as directed by
15 the Engineer. When removal of surplus material has been directed by the
16 Engineer, the Contractor shall dispose of such surplus material.
17
18 D. Should conditions make it impracticable or unsafe to stack material adjacent
19 to the trench, the material shall be hauled and stored at a location provided
20 by the Contractor. When required, it shall be rehandled and used in
21 backfilling the trench. No extra compensation will be made for rehandling
22 material.

23
24 3.02 SHEETING AND BRACING

- 25
26 A. The Contractor shall furnish, put in place, and maintain sheeting and
27 bracing required to support the sides of the excavation and prevent loss of
28 ground which could damage or delay the work or endanger adjacent
29 structures. If the Engineer is of the opinion that at any point sufficient or
30 proper supports have not been provided, he may order additional supports
31 placed at the expense of the Contractor from his responsibility for the
32 sufficiency of such supports. Care shall be taken to prevent voids outside
33 of the sheeting, but if voids are formed, they shall be immediately filled and
34 rammed.
35

36 3.03 TEST PITS

- 37
38 A. The Contractor may be required to excavate test pits for the purpose of
39 locating underground utilities or structures as an aid in establishing the
40 precise location of new work. Test pits shall be backfilled as soon as the
41 desired information has been obtained. The backfilled surface shall be
42 maintained in a satisfactory condition for travel until resurfaced as
43 hereinafter specified.
44
45 B. Excavation of test pits shall be considered work incidental to the project and
46 shall be done at the Contractor's expense.

- 1
2 C. If, for any reason, a test pit is left open for any period of time, it shall be
3 properly barricaded and lighted by the Contractor, when directed by the
4 Engineer, in accordance with State and Local laws.
5

6 3.04 DRAINAGE
7

- 8 A. The Contractor shall furnish all materials and equipment and perform all
9 incidental work required to install and maintain the drainage system he
10 proposes for handling ground water or surface water encountered. He shall
11 assume all responsibility for the adequacy of the methods, materials, and
12 equipment employed. Construction shall not begin until the Engineer is
13 assured that the proposed method will be satisfactory. The requirements
14 for a stable subgrade are indicated below, and the Contractor must alter his
15 drainage methods, if, in the opinion of the Engineer, the trench bottom is
16 unsatisfactory.
17
- 18 B. The Contractor shall provide pumping equipment and devices to properly
19 remove and dispose of all water entering the trench and excavation. The
20 grade shall be maintained acceptably dry until structures and pipe to be
21 constructed therein are completed. All drainage shall be performed without
22 damage to the trench, pavements, pipes, electrical conduits, or other
23 utilities.
24
- 25 C. Pipe and masonry shall not be laid in water or submerged within 24 hours
26 after being placed. Water shall not flow over new masonry within four days
27 after placement.
28
- 29 D. In no event shall water rise to cause unbalanced pressure on structures until
30 the concrete or mortar has set at least 24 hours. The Contractor shall
31 prevent flotation of the pipe promptly placing backfill.
32
- 33 E. If the Contractor elects to use underdrains for handling water, he shall
34 furnish and install pipe and crushed stone graded from course to fine and
35 shall furnish and install all pumps and equipment necessary to maintain the
36 water level continuously at the required elevation. Pipe underdrains shall
37 be laid with open joints and bedded in crushed stone for the full width of
38 trench, and to a depth of 6-in. below the invert of underdrain.
39
- 40 F. The invert of underdrain shall be 12-in. below the normal subgrade. Pipe
41 underdrains shall have no permanent outlet and shall be sealed at the
42 completion of the work. The length of continuous underdrain to be used
43 shall be limited as conditions require. An impervious bulkhead of clay or
44 concrete shall be constructed in the trench bottom between 100 ft. lengths
45 of the underdrain system to obstruct the free flow of ground water after
46 construction is completed. All excavation below normal grade for the

1 purpose of installing underdrains, the crushed stone and underdrain pipe
2 shall be considered a part of the drainage work to be done under the pipe
3 items. The Contractor shall continuously guard against the loss of earth
4 through subbase or the underdrain. Should loss of either take place, the
5 Contractor shall alter the stone size to provide a satisfactory barrier or filter.
6

7 G. Where other methods of handling water prove inadequate, the Contractor
8 shall furnish, install, operate, and remove proper well point facilities.
9

10 H. The Contractor shall submit a dewatering plan to the Engineer prior to
11 commencement of work in accordance with Section 02140.
12

13 3.05 TRENCH EXCAVATION

14
15 A. Excavation shall be made for all trenches which are required for the
16 installation of pipes, culverts, manholes and drainage structures.
17

18 B. Trench width at the ground surface may vary depending on depth, type of
19 soil, and position of surface structures. The minimum clear width of the
20 trench, sheeted or unsheeted, measured at the springline of the pipe should
21 be 1 foot greater than the outside diameter of the pipe. The maximum
22 recommended clear width of the trench at the top of the pipe is equal to the
23 pipe outside diameter plus 2 feet. If the maximum recommended trench
24 width must be exceeded or if the pipe is installed in a compacted
25 embankment, then pipe embedment should be compacted to a point of at
26 least 2-1/2 pipe diameters from the pipe on both sides of the pipe or to the
27 trench walls, whichever is less.
28

29 C. The trench may be excavated by machinery to, or just below the designated
30 subgrade provided that the material remaining in the bottom of the trench is
31 no more than slightly disturbed.
32

33 D. Rock shall be removed to a minimum of 8-in. clearance around the bottom
34 and sides of the pipe being laid.
35

36 E. The trench bottom should be constructed to provide a firm, stable and
37 uniform support for the full length of the pipe. Bell holes should be provided
38 at each joint to permit proper assembly and pipe support. Any part of the
39 trench bottom excavated below grade should be backfilled to grade and
40 should be compacted as required to provide firm pipe support. When an
41 unstable subgrade condition is encountered that could provide inadequate
42 pipe support, additional trench depth should be excavated and refilled with
43 suitable foundation material. Ledge rock, boulders, and large stones should
44 be removed to provide 4-inches of soil cushion of all sides of the pipe and
45 accessories.
46

1 3.06 PIPE BEDDING

- 2
- 3 A. The Contractor shall furnish and install pipe on the type of bedding shown
- 4 on the Drawings or as specified by the Engineer but shall be Type 4 bedding
- 5 at a minimum. Regardless of the type of bedding used by the Contractor,
- 6 holes in the trench shall be provided to receive the pipe bell. The hole
- 7 excavated shall be sufficient to relieve pipe bells of all loads and yet provide
- 8 support over the total length of the pipe barrel.
- 9
- 10 B. Pipe shall be installed with proper bedding providing uniform longitudinal
- 11 support under the pipe. Backfill material shall be worked under the sides of
- 12 the pipe to provide satisfactory support under the haunches of the pipe. All
- 13 bedding material shall be select fill. Sharp stones and crushed rock (larger
- 14 than 3/4-in.), which could cause significant scratching or abrasion of the
- 15 pipe, shall be excluded from the embedment material. Proper compaction
- 16 procedures shall be exercised.
- 17
- 18 C. Where required to provide a firm bedding for the pipe crushed stone
- 19 bedding shall be provided from a depth of 12" below the pipe up to the pipe
- 20 haunches.
- 21

22 3.07 BACKFILLING

- 23
- 24 A. As soon as practicable after the pipe has been laid, joined, and bedded,
- 25 backfilling shall begin and thereafter be prosecuted expeditiously.
- 26
- 27 B. Select backfill material, free from stones and other foreign material, shall be
- 28 placed to a depth of 12-inches over the top of the pipe. Backfill shall be
- 29 thoroughly compacted by hand-tamping as placed. The remainder of the
- 30 trench shall be backfilled in loose 12-inch lifts of common or structural fill as
- 31 applicable.
- 32
- 33 C. Any space remaining between the pipe and side of the trench shall be
- 34 packed full by hand shovel with selected earth, free from stones having a
- 35 diameter greater than 2-inch, and thoroughly compacted with a tamper as
- 36 fast as placed up to a level of 12-inches above the top of the pipe.
- 37
- 38 D. Backfilling shall be carried up evenly on both sides with at least one person
- 39 tamping for each person shoveling material into the trench.
- 40
- 41 E. The remainder of the trench above the compacted backfill, as just described
- 42 shall be filled thoroughly compacted by rolling, ramming, as the Engineer
- 43 may direct, sufficiently to prevent subsequent settling.
- 44

1 F. Backfill around manholes shall be selected material and thoroughly
2 compacted. All backfill shall be compacted, especially under and over pipes
3 connected to the structures.

4
5 G. All fill shall be placed in a dry condition.
6

7 3.08 COMPACTION

8
9 A. Gravel and crushed stone in open areas, shall be placed in layers not to
10 exceed eight (8) inches in depth as measured before compaction. Each
11 layer shall be compacted by a minimum of four (4) coverages. Incidental
12 compaction due to traffic by construction equipment will not be credited
13 toward the required minimum four (4) coverages.
14

15 B. Fill shall be placed in loose lifts not exceeding 12-inches and should be
16 compacted to a minimum of 98% of the maximum modified Proctor dry
17 density, as established in accordance with ASTM D-1557. Density tests
18 should be performed in each fill lift to confirm compaction before the next
19 lift is placed.
20

21 C. Areas adjacent to structures and other confined inaccessible to the roller or
22 truck shall be compacted with hand guided mechanical compaction
23 equipment.
24

25 D. Backfill and compaction for manholes and drainage structures shall be in
26 accordance with the requirements of Section 02220.
27

28 E. It is the intention that the fill materials, with respect to moisture, be used in
29 the condition they are excavated insofar as this is practicable. Material that
30 is too wet shall be spread on the fill area and permitted to dry, assisted by
31 harrowing if necessary, until the moisture content is reduced enough to
32 allow for proper compaction as determined by the Engineer. Muck, mud, or
33 organic material shall not be utilized as trench fill. Such matter shall be
34 removed from the trench and replaced with suitable fill material.
35

36 3.09 GRADING

37
38 A. Grading shall be performed at such places as are indicated on the
39 Drawings, to the lines, grades, and elevations shown or as directed by the
40 Engineer and shall be made in such a manner that the requirements for
41 formation of embankments can be followed. All unacceptable material
42 encountered, or whatever nature within the limits indicated, shall be
43 removed and disposed of as directed. During the process of excavation,
44 the grade shall be maintained in such condition that it will be well drained at
45 all times. When directed, temporary drains and drainage ditches shall be

1 installed to intercept or divert surface water which may affect the progress
2 or condition of the work.

- 3
- 4 B. The right is reserved to make small adjustments or revisions in lines or
5 grades if found necessary as the work progresses, due to discrepancies on
6 the Drawings of in order to obtain satisfactory construction.
- 7
- 8 C. Stones or rock fragments larger than 4-in. in their greatest dimensions will
9 not be permitted in the top 6-inches of the subgrade.
- 10
- 11 D. All fill slopes shall be uniformly dressed to the slope, cross-section and
12 alignment shown on the Drawings or as directed by the Engineer.
- 13
- 14 E. In cuts, all loose or protruding rocks on the back slopes shall be jarred loose
15 or otherwise removed to line or finished grade of slope. All cut and fill slopes
16 shall be uniformly dressed to the slope, cross-section and alignment shown
17 on the Drawings or as directed by the Engineer.

18

19 3.10 DISPOSAL OF UNSUITABLE SURPLUS MATERIAL

20

- 21 A. Unsuitable and surplus excavated materials and pavement shall become
22 the property of the Contractor and removed and disposed of by him off the
23 project site.
- 24
- 25 B. Suitable excavated materials may be used for fill or backfill if it meets the
26 Specification for common fill and has been reviewed by the Engineer.
27 Excavated material shall be neatly stockpiled at the site where designated
28 by the Engineer provided there is an area available that will not interfere
29 with the operation of the plant or inconvenience traffic or adjoining property
30 owners. If space limitations do not permit stockpiling on the site, the
31 Contractor will be required to make arrangements for off-site stockpiling.
32 Transport of such material from and to the immediate site including any
33 stockpiling agreements shall be entirely at the Contractor's expense and
34 shall not constitute grounds for additional payment.
- 35
- 36 C. Surplus excavated material shall be used to fill depressions or other
37 purposes as the Engineer may direct.
- 38

39 3.11 DISPOSAL AND REPLACING OF ROCK

40

- 41 A. The Contractor shall remove and dispose of all pieces of rock which are not
42 suitable for use in other parts of the work. Rock disposed of by hauling
43 away to spoil areas is to be replaced with surplus excavation obtained
44 elsewhere on the site, insofar as it is available. Any deficiency in the backfill
45 material shall be made up with acceptable material from outside sources.
- 46

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B. Rock may be used in fill only after review by the Engineer.

END OF SECTION

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1 SECTION 02222

2
3 EXCAVATION AND BACKFILL FOR STRUCTURES

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. The Contractor shall furnish all labor, materials, equipment, and incidentals
10 necessary to perform all excavation, backfill, and grading for structures
11 required to complete the work shown on the Drawings and specified herein.
12 The work shall include, but not necessarily be limited to, excavation for
13 structures, footings, all backfilling and fill; embankment grading for
14 structures; disposal of waste and surplus materials; and all related work
15 such as sheeting, bracing and dewatering.
16
17 B. Structures and structural elements shall be installed at such places as
18 indicated by the drawings at the elevations shown or as directed by the
19 Engineer.
20
21 C. Excess topsoil and fill generated during construction of the project shall be
22 stockpiled on site for the Contractor's use. All unused excess fill shall be
23 salvaged/disposed of by the Contractor at no expense to the Owner.
24
25 D. During the process of grading, the subgrade shall be maintained in such
26 condition that it will be well drained at all times. Temporary drains and
27 drainage ditched shall be installed by the Contractor as required to intercept
28 or divert surface water at no additional cost to the Owner.
29
30 E. If, during the excavation sequence, any earth material that could be used
31 as fill is encountered that cannot be directly placed, it shall be stockpiled for
32 later use. No extra payment will be made for stockpiling or double handling
33 of material.
34
35 F. No grading is to be done in areas where there are existing utilities that may
36 be uncovered or damaged until such utilities have been located. Prior to
37 relocating lines, all service must be stopped, including closing required
38 valves, electrical circuits, etc. Pipeline to be abandoned must be plugged
39 and sealed according to these drawings and specifications.
40

41 1.02 QUALITY ASSURANCE

- 42
43 A. Soil Testing
44

- 1 1. Prior to the general placement of fill, and during such placement, the
2 Engineer may select areas within the limits of the fill for testing the
3 degree of compaction obtained. The Contractor shall cooperate fully
4 in obtaining the information desired.
5
- 6 2. Payment for testing shall be made by the Owner. If test results are
7 unsatisfactory, all costs involved in correcting deficiencies in
8 compacted materials to the satisfaction of the Engineer, shall be
9 borne by the Contractor. Repeated testing cost due to construction
10 deficiencies shall be paid by the Contractor.
11

12 B. Reference Standards (American Society For Testing and Materials (ASTM,
13 latest edition):
14

- 15 1. ASTM C136 – Sieve or Screen Analysis of Fine and Course
16 Aggregates.
17
- 18 2. ASTM D1556 (1974) – Density of Soil in Place by the Sand-Cone
19 Method.
20
- 21 3. ASTM D1557 – Moisture-Density Relations of Soils using 10-lb. (4.5-
22 kg) Rammer and 18-in. (457-mm) Drop.
23
- 24 4. ASTM D422 – Particle Size Analysis for Soils.
25
- 26 5. ASTM D2216 – Laboratory Determination of Water Content of Soil &
27 Rock.
28
- 29 6. ASTM D2487 – Classification of Soils for Engineering Purposes.
30
- 31 7. ASTM D2937 – Density of Soil in Place by the Drive-Cylinder
32 Method.
33
- 34 8. ASTM D2972 – Density of Soil in Place by the Nuclear Method.
35
- 36 9. ASTM D4643 – Determination of Water Content of Soil & Rock by
37 the Microwave Oven Method
38
- 39 10. ASTM D4959 – Determination of Water Content of Soil by Direct
40 Heating Method
41

42 1.03 SUBMITTALS
43

- 44 A. Testing laboratory reports that material for controlled fill meets requirements
45 of this Section.

1
2 1.04 JOB CONDITIONS
3

4 A. Lateral Support of Excavation for Structures
5

6 Furnish, put in place, and maintain sheeting and bracing required to support
7 the sides of the excavations, to prevent any movement which could in any
8 way diminish the width of the excavation below that necessary for proper
9 construction, and to protect structures, pipe, and utilities from damage due
10 to lateral movement or settlement of ground. If the Engineer is of the opinion
11 that at any point sufficient or proper supports have not been provided, he
12 may order additional supports put in at the expense of the Contractor, and
13 compliance with such order shall not relieve or release the Contractor from
14 his responsibility for the sufficiency of such supports.
15

16 B. Dewatering for Structures
17

18 Furnish, install, maintain, operate, and remove a temporary dewatering
19 system, as required to lower, and control the groundwater level, so that the
20 structures may be constructed in the dry. The Contractor shall, at his own
21 expense, correct all damage resulting from inadequacy of the dewatering
22 system or from flooding or the construction site from other causes.
23

24 C. Dewatering System
25

26 1. The dewatering system shall be adequate to drain any excavated
27 area, to maintain the water at such a level at least 2 feet below the
28 lowest subgrade within the structure, including utilities. The
29 dewatering system must maintain the lowered water table 24 hours
30 per day, 7days per week until the structure has been completed to
31 the required stages.
32

33 2. Continuously maintain excavation in a dry condition so as to prevent
34 damage to the subsoil or fill during interruptions due to weather, labor
35 strikes, power failures or other delays. Provide and have ready for
36 immediate use at all times diesel or gasoline powered standby
37 pumping units to serve the system in case of failure of the normal
38 pumping units.
39

40 3. Piping and boiling, or any form of uncontrolled seepage, in the
41 bottom or sides of the excavation shall be prevented at all times. If
42 for any reason the dewatering system is found to be inadequate to
43 meet the requirements set forth herein, the Contractor shall, at his
44 own expense, make such additions, changes and/or replacements
45 as necessary to provide a satisfactory dewatering system.

- 1
2 4. Contractor shall be responsible for creating and implementing a
3 dewatering plan that shall be submitted to the Engineer for
4 submission to FDEP as specified in the Environmental Resource
5 Permit. The plan should be approved prior to initiating any
6 construction activities.
7

8 D. Control of Groundwater Level
9

- 10 1. Maintain the groundwater level at or below subgrade of the structure
11 until the concrete structures are up high enough to: (1) prevent
12 flooding the structure, (2) support both bottom and top levels of walls,
13 and (3) prevent flotation.
14
15 2. After the structure has been completed in its entirety, backfill as
16 described hereinafter.
17
18 3. Flotation shall be prevented by maintaining a positive and continuous
19 operation of the dewatering system. The Contractor shall be fully
20 responsible and liable for all damages, which may result from failure
21 of this system.
22
23 4. Disposal of drainage water shall be in an area approved by the
24 Engineer. Precautions shall be taken to prevent the flow or seepage
25 of drainage back into the drainage area. Particular care shall be
26 taken to prevent the discharge of unsuitable drainage to a water
27 supply or surface water body.
28
29 5. Removal of the dewatering system shall be accomplished after the
30 dewatering system is no longer required.
31

32 PART 2 – PRODUCTS
33

34 2.01 MATERIAL FOR CONTROLLED FILL
35

36 A. General
37

- 38 1. Materials for use as fill shall be as described below:
39
40 2. For each material, the Contractor shall notify the Owner's designated
41 representative of the source of the material at least ten (10) calendar
42 days prior to the date of anticipated use of such material, so that
43 necessary laboratory classification testing can be performed.
44
45 3. Structural fill shall be used to provide support for building

foundations, structure foundations and the reject pond embankments. Common fill shall be used to as backfill over pipes.

B. Structural Fill

1. Compacted granular fill, which will provide support for building or structure foundations, will be referred to as "structural fill." Backfill, which is placed against the exterior side of the building walls or structures, or as fill over pipelines, will be referred to as "common fill."
2. Materials for compacted structural granular fill shall be gravel, sandy gravel, or gravely sand free of organic material, loam, wood, trash, and other objectionable material and shall be well-graded within the following limits:

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
6-in.	100
No. 4	20 - 95
No. 40	0 - 60
No. 200	0 - 8

C. Common Fill

1. Common fill shall consist of mineral soil, free of organic material, loam, wood, trash and other objectionable material which may be compressible, or which cannot be compacted properly. Common fill shall not contain stones larger than 10-in. in any dimension, broken concrete, masonry, rubble or other such materials. It shall have physical properties such that it can be readily spread and compacted during filling.
2. Material falling within the above Specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the Engineer is not suitable for reuse, shall be spoiled as specified herein for disposal of unsuitable materials.

D. Crushed Stone

1. Crushed stone shall be used for structure bases where indicated on the drawings or directed by the Engineer. Crushed stone shall be used for manhole bases, as a drainage layer below structures with underdrains and at other locations indicated on the Drawings.

- 1
2 2. Crushed stone shall be size No. 57 with gradation as noted in Table
3 1 of Section 901 of Department of Transportation, Construction of
4 Roads and Bridges.
5

6 2.02 UNSUITABLE MATERIAL
7

- 8 A. Unsuitable material will be designated as highly organic soil ASTM D 2487
9 Group PT, topsoil, roots, vegetable matter, trash and debris. All unsuitable
10 material shall be removed in its entirety as to provide adequate bearing
11 capacity for proposed structures, buildings, manholes, pipelines, etc.
12

13 PART 3 – EXECUTION
14

15 3.01 STRUCTURE EXCAVATION AND COMPACTION PROCEDURES - GENERAL
16

- 17 A. Excavation shall be made to such widths as will give suitable room for
18 construction of the structures, for bracing and supporting, pumping and
19 drainage; and the bottom of the excavations shall be rendered firm and dry
20 and in all respects acceptable to the Engineer.
21
22 B. Excavation and dewatering shall be accomplished by methods which
23 preserve the undisturbed state of subgrade soils. Subgrade soil which
24 becomes soft, loose, "quick," or otherwise unsatisfactory for support of
25 structures as a result of inadequate excavation, dewatering or other
26 construction methods shall be removed and replaced by structural fill as
27 required by the Engineer at the Contractor's expense.
28
29 C. Dewatering shall be such as to prevent boiling or detrimental under-
30 seepage at the base of the excavation as specified herein. The Contractor
31 shall install such means as required to preserve the stability of the base of
32 the operation.
33
34 D. Excavating equipment shall be satisfactory for carrying out the work in
35 accordance with the Specifications. In no case shall the earth be ploughed,
36 scraped, or dug with machinery so near to the finished subgrade as to result
37 in excavation of, or disturbance of material below grade, the last of the
38 excavated material being removed with pick and shovel just before placing
39 of concrete or working mat thereon.
40
41 E. During final excavation to subgrade level, take whatever precautions are
42 required to prevent disturbance and remolding of the subgrade. Material
43 which has become softened and mixed with water shall be removed. Hand
44 excavation of the final 3 to 6-in. will be required as necessary to obtain a

1 satisfactory undisturbed bottom. The Engineer will be the sole judge as to
2 whether the work has been accomplished satisfactorily.

- 3
- 4 F. All structure areas shall be stripped, cleared and grubbed of all surface
5 vegetation and root laden topsoils.
- 6
- 7 G. After stripping, the structure areas should be leveled sufficiently to permit
8 equipment traffic and then proof-rolled. Careful observations should be
9 made during proof-rolling of the stripped subgrade area to identify any areas
10 of soft yielding soils that may require over excavation and replacement.
- 11
- 12 H. Compaction should continue until a minimum density of 95% of the
13 maximum modified Proctor dry density, as established in accordance with
14 ASTM D-1557, is achieved for a minimum depth of 2 feet below the
15 subgrade surface.
- 16

17 3.02 BACKFILLING AND COMPACTION

- 18
- 19 A. Following satisfactory proof-rolling of the stripped subgrade, the structure
20 areas may be brought up to finished subgrade level. Structural fill shall be
21 placed in loose lifts not exceeding 12-inches and should be compacted to a
22 minimum of 95% of the maximum modified Proctor dry density, as
23 established in accordance with ASTM D-1557. Density tests should be
24 performed in each fill lift to confirm compaction before the next lift is placed.
- 25
- 26 B. Common fill may be used as backfill against the exterior walls of the
27 structures, including manholes and storm structures, or in other areas as
28 designated by the Engineer. Common fill shall be placed in loose lifts not
29 exceeding 12-inches and should be compacted to a minimum of 95% of the
30 maximum modified Proctor dry density, as established in accordance with
31 ASTM D-1557. Density tests should be performed in each fill lift to confirm
32 compaction before the next lift is placed. Common fill material in place shall
33 be compacted with such mechanical compaction equipment as approved
34 by the Engineer.
- 35
- 36 C. Materials placed in fill areas shall be deposited to the lines and grades
37 shown on the Drawings making due allowance for settlement of the material
38 and for the placing of topsoil thereon.
- 39
- 40 D. The surfaces of filled areas shall be grades to smooth true lines, strictly
41 conforming to grades indicated on the paving and grading Drawings, and
42 no soft spots or uncompacted areas will be allowed in the work.
- 43
- 44 E. No compacting shall be done when the material is too wet either from rain
45 or from excess application of water. At such times, work shall be suspended

1 until the previously placed and new materials have dried sufficiently to
2 permit proper compaction.

3
4 3.04 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

- 5
6 A. Unsuitable excavated materials and pavement shall become the property
7 of the Contractor and removed and disposed of by him off the project site.
8
9 B. Suitable excavated material may be used for fill or backfill if it meets the
10 Specifications for common fill and is approved by the Engineer. Excavated
11 materials so approved may be neatly stockpiled at the site, where there is
12 an area available that will not interfere with the operation of the plant or
13 inconvenience traffic or adjoining property owners. If space limitations do
14 not permit stockpiling on the site, the Contractor will be required to make
15 arrangements for off-site stockpiling. Transport of such material from and
16 to the immediate site, including any stockpiling agreements, shall be entirely
17 at the Contractor's expense and shall not constitute grounds for additional
18 payment.
19
20 C. Surplus excavated material shall be used to fill depressions or other
21 purposes as the Engineer may direct. Otherwise, it shall become the
22 property of the Contractor and shall be removed and disposed of by him off
23 the project site.
24

25
26 3.05 GRADING

- 27
28 A. Grading in preparation for placing of topsoil, planting areas, paved walks
29 and drives, and appurtenances shall be performed at all places that are
30 indicated on the Drawings, to the lines, grades, and elevations shown and
31 otherwise as directed by the Engineer. Such work shall be performed in a
32 manner that the requirements for formation of slopes, lines, and grades can
33 be followed. All material encountered, of whatever nature, within the limits
34 indicated, shall be removed, and disposed of as directed. During the
35 process of grading, the subgrade shall be maintained in such condition that
36 it will be well drained at all times. When directed, temporary drains and
37 drainage ditches shall be installed to intercept or divert surface water which
38 may affect the progress or condition of the work.
39
40 B. If, at the time of grading, it is not possible to place any material in its proper
41 section of the permanent structure, it shall be stockpiled for later use. No
42 extra payment will be made for the stockpiling or double handling of
43 excavated material.
44

- 1 C. The right is reserved to make minor adjustments or revisions in lines or
- 2 grades, if found necessary as the work progresses, due to discrepancies on
- 3 the Drawings or in order to obtain satisfactory construction.
- 4
- 5 D. Stones or rock fragments larger than 4-in. in their greatest dimensions will
- 6 not be permitted in the top 6-in. of the finished subgrade of all fills or
- 7 embankments.
- 8
- 9 E. In cuts, all loose or protruding rocks on the back slopes shall be barred
- 10 loose or otherwise removed to line or finished grade of slope. All cut and
- 11 fill slopes shall be uniformly dressed to the slope, cross section, and
- 12 alignment shown on the Drawings or as directed by the Engineer.
- 13
- 14 F. No grading is to be done in areas where there are existing pipe lines that
- 15 may be uncovered or damaged until such lines have been located and it
- 16 has been determined if such lines must be maintained are relocated, or
- 17 where lines are to be abandoned, all required valves are closed and
- 18 remaining pipes are plugged.
- 19
- 20

21 END OF SECTION

22

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1 SECTION 02485

2
3 SURFACE RESTORATION AND SIDEWALKS

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. Furnish all labor, materials, and equipment necessary to satisfactorily return
10 all construction areas to their original conditions or better.
11
12 B. Work includes furnishing and placing seed, sod, fertilizer, gravel, concrete,
13 asphalt, planting, watering, and maintenance until acceptance by the
14 Owner.
15
16 C. The restoration of grassed areas under this project shall be by sodding.

17
18 1.02 QUALITY ASSURANCE

- 19
20 A. The Contractor shall provide a satisfactory stand of grass as specified. If
21 necessary, the Contractor shall repeat any or all of the work, including
22 grading, fertilizing, watering, and seeding or sodding at no additional cost
23 to the Owner until a satisfactory stand is obtained.
24
25 B. A satisfactory stand of grass is defined herein as a full lawn cover over areas
26 to be seeded or sodded, with grass free of weeds, alive and growing,
27 leaving no bare spots larger than 3/4 sq. yd. within a radius of 10 ft.

28
29 1.03 SUBMITTALS

- 30
31 A. Provide technical data as required for shop drawings on all materials or
32 installation procedures required under this Section and in accordance with
33 the contract documents.
34
35 B. Submit representative topsoil samples for analysis by a private laboratory
36 to determine nutrient deficiencies and outline a proper fertilization program.

37
38 PART 2 – PRODUCTS

39
40 2.01 MATERIALS

- 41
42 A. Fertilizer shall be a complete fertilizer, the elements of which are derived
43 from organic sources. Fertilizer shall be a standard product complying with
44 State and Federal fertilizer laws.
45

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44
1. Percentages of nitrogen, phosphorus and potash shall be based on laboratory tests on soils outlined in Paragraph 1.03B. For purpose of bidding, assume 6% nitrogen, 6% phosphorus and 6% potash by weight. At least 50% of the total nitrogen shall contain no less than 3% water-insoluble nitrogen.
 2. Fertilizer shall be delivered to the site, mixed as specified, in the original unopened standard size bags showing weight, analysis and name of manufacturer. Containers shall bear the manufacturer's guaranteed statement of analysis, or a manufacturer's certificate of compliance covering analysis shall be furnished to the Engineer. Store fertilizer in a weatherproof place and in such a manner that it will be kept dry and its effectiveness will not be impaired.
 3. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes containing not less than 20% available phosphoric acid.
- B. Grass seed shall be the same as existed prior to construction and shall be 99 percent minimum purity, 80 percent minimum germination and 1 percent maximum weed seed, labeled in accordance with U.S. Department of Agriculture Rules and Regulations under Federal Seed Act in effect. Seed which has become wet, moldy, or otherwise damaged in transit or storage shall not be acceptable.
- C. All disturbed areas with the limits of construction shall receive vegetative treatment after final grading in accordance with these plans or landscaping plans. Disturbed areas not specifically designated with a vegetative cover shall be vegetated as follows:
- Side slopes constructed at 4:1 (H to V) shall be sodded with argentine Bahia or seeded and then covered with an erosion control blanket. The blanket shall be the S75BN blanket as manufactured by North America Green or equal.
- Side slopes less than 4:1 (H to V) shall be seeded and mulched.
- D. Sodding
1. Sod shall be Argentine Bahia of firm texture having a compacted growth and good root development.
 2. Sod shall be certified to meet Florida State Plant Board Specifications, absolutely true to varietal type, and free from weeds

1 or other objectionable vegetation, fungus, insects and disease of any
2 kind.

3
4 3. Before being cut and lifted the sod shall have been mowed 3 times
5 with the final mowing not more than a week before cutting into
6 uniform dimensions.
7

8 E. Mulch shall be fresh hay. Rate of application specified herein shall
9 correspond to depth not less than 1 inch or more than 3 inches according
10 to texture and moisture content of mulch material.
11

12 F. It is the Contractor's responsibility to water the site, as required during
13 seeding and sodding operations and through the maintenance period and
14 until the work is accepted. The Contractor shall make whatever
15 arrangements may be necessary to ensure an adequate supply of water to
16 meet the needs for his work. The Contractor shall also furnish all necessary
17 hose, equipment, attachments and accessories for the adequate irrigation
18 of lawns and planted areas as may be required.
19

20 G. Asphaltic concrete surface shall consist of either Type S-1 or Type S-3
21 asphaltic concrete meeting the specified criteria outlined by the Florida
22 Department of Transportation Specifications, and Placement & Compaction
23 Procedures.
24

25 H. Base material shall consist of either limerock or shell material complying
26 with FDOT specifications and meeting a minimum LBR of 100.
27

28 PART 3 – EXECUTION

29 3.01 INSTALLATION

30
31
32 A. Following the subgrade preparation, the Contractor shall commence work
33 on lawns and grassed areas. Areas to be seeded or sodded shall be free
34 from soft spots and uneven grades. Apply 20 lbs. of 12-3-6 fertilizer per
35 1,000 sq. ft.
36

37 B. Seeded and sodded areas shall be protected from traffic or other use by
38 placing warning signs or erecting barricades as necessary. Any areas
39 damaged prior to actual acceptance by the Owner shall be repaired by the
40 Contractor as directed by the Engineer.
41

42 3.02 LAWN BED PREPARATION

43
44 A. Areas to be sodded shall be cleared of all rough grass, weeds, and debris
45 and the ground brought to an even grade.

- 1
2 B. The soil shall then be thoroughly tilled to a minimum 8-inch depth.
3
4 C. Superphosphate at a rate for bidding purposes of 5 pounds per 1,000
5 square foot and complete fertilizer at a rate for bidding purposes of 16
6 pounds per 1000 square foot shall be evenly distributed over entire area
7 and cross-disked into a depth of 4-6 inches.
8
9 D. The areas shall then be brought to proper grade, free of sticks, stones, or
10 other foreign matter over 1-inch in diameter of dimension. The surface shall
11 conform to finish grade, less the thickness of sod, free of water-retaining
12 depressions, the soil friable and of uniformly fill texture.
13

14 3.03 SOD HANDLING AND INSTALLATION

- 15
16 A. A one-foot wide strip of sod shall be provided around all structures, except
17 fencing, along the edges of slabs and along the edge of pavement.
18
19 B. During delivery, prior to planting, and during the planting of the lawn areas,
20 the sod panels at all times be protected from excessive drying and
21 unnecessary exposure of the roots to the sun. All sod shall be stacked
22 during construction and planting so as not to be damaged by sweating or
23 excessive heat and moisture.
24
25 C. After completion of soil conditioning as specified above, sod panels shall be
26 laid tightly together so as to make a solid sodded lawn area. On mounds
27 and other slopes, the long dimension of the sod shall be laid perpendicular
28 to the slope. Immediately following sod laying the lawn areas shall be rolled
29 with a lawn roller customarily used for such purposes, and then thoroughly
30 watered.
31
32 D. Bring the sod edge in a neat, clean manner to the edge of all paving and
33 shrub areas. Top dressing with clean, weed free, sand may be required at
34 no additional cost to the Owner if deemed necessary by the Engineer.
35

36 3.04 CLEANUP

- 37
38 A. Soil, mulch, seed, or similar materials spilled onto paved areas shall be
39 removed promptly, keeping those areas as clean as possible at all times.
40 Upon completion of seeding and sodding operations, all excess soil, stones,
41 and debris remaining shall be removed from the construction areas.
42

43 3.05 MAINTENANCE

44

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

3
4 B. Maintain landscape work until Owner accepts project. Watering, weeding,
5 cultivating, restoration of grade, mowing and trimming grass, protection
6 from insects and diseases, fertilizing and similar operations as needed to
7 ensure normal growth and good health for live plant material shall be the
8 responsibility of the Contractor and at no additional cost to the Owner.
9 Sodded areas shall receive no less than 1.5 inches of water per week.

10
11 3.06 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATIONS

12
13 A. Lawn areas planted under this Contract and all lawn areas damaged by the
14 Contractor's operation shall be repaired by proper soil preparation,
15 fertilizing, and reseeding, in accordance with these Specifications.

16
17 END OF SECTION
18

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1 SECTION 03200

2
3 CONCRETE REINFORCING

4
5 PART 1 - GENERAL

6
7 1.1 SUMMARY

8
9 A. Section Includes:

- 10
11 1. Steel reinforcement bars.
12 2. Welded-wire reinforcement.

13
14 B. Related Requirements:

- 15
16 1. Section 034100 "Precast Structural Concrete" for reinforcing used in
17 precast structural concrete.

18
19 1.2 ACTION SUBMITTALS

20
21 A. Product Data: For the following:

- 22
23 1. Each type of steel reinforcement.
24 2. Bar supports.
25 3. Mechanical splice couplers.

26
27 B. Shop Drawings: Comply with ACI SP-066:

- 28
29 1. Include placing drawings that detail fabrication, bending, and placement.
30 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup
31 spacing, bent bar diagrams, bar arrangement, location of splices, lengths
32 of lap splices, details of mechanical splice couplers, details of welding
33 splices, tie spacing, hoop spacing, and supports for concrete
34 reinforcement.
35 3. For structural thermal break insulated connection system, indicate general
36 configuration, insulation dimensions, tension bars, compression pads,
37 shear bars, and dimensions.

38
39 C. Construction Joint Layout: Indicate proposed construction joints required to
40 build the structure.

- 41
42 1. The location of construction joints is subject to approval of Engineer.

43
44 1.3 QUALITY ASSURANCE

- 1 A. Testing Agency Qualifications: An independent agency, acceptable to
2 authorities having jurisdiction, qualified in accordance with ASTM C1077 and
3 ASTM E329 for testing indicated.
4

5 1.4 DELIVERY, STORAGE, AND HANDLING
6

- 7 A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent
8 bending and damage.
9

- 10 1. Store reinforcement to avoid contact with earth.
11

12 PART 2 - PRODUCTS
13

14 2.1 STEEL REINFORCEMENT
15

- 16 A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
17

- 18 B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain,
19 fabricated from as-drawn steel wire into flat sheets.
20

21 2.2 REINFORCEMENT ACCESSORIES
22

- 23 A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing,
24 supporting, and fastening reinforcing bars and welded-wire reinforcement in
25 place.
26

- 27 1. Manufacture bar supports from steel wire, plastic, or precast concrete in
28 accordance with CRSI's "Manual of Standard Practice," of greater
29 compressive strength than concrete and as follows:
30

- 31 a. For concrete surfaces exposed to view, where legs of wire bar
32 supports contact forms, use CRSI Class 1 plastic-protected steel
33 wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar
34 supports.
35

- 36 B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508
37 inch in diameter.
38

- 39 1. Finish: Plain.
40

41 2.3 FABRICATING REINFORCEMENT
42

- 43 A. Fabricate steel reinforcement according to CRSI's "Manual of Standard
44 Practice."
45

1 PART 3 - EXECUTION

2
3 3.1 PREPARATION

4
5 A. Protection of In-Place Conditions:

- 6
7 1. Do not cut or puncture vapor retarder.
8 2. Repair damage and reseal vapor retarder before placing concrete.
9

10 B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign
11 materials that reduce bond to concrete.
12

13 3.2 INSTALLATION OF STEEL REINFORCEMENT

14
15 A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting
16 reinforcement.
17

18 B. Accurately position, support, and secure reinforcement against displacement.
19

- 20 1. Locate and support reinforcement with bar supports to maintain minimum
21 concrete cover.
22 2. Do not tack weld crossing reinforcing bars.
23

24 C. Preserve clearance between bars of not less than 1 inch, not less than one bar
25 diameter, or not less than 1-1/3 times size of large aggregate, whichever is
26 greater.
27

28 D. Provide concrete coverage in accordance with ACI 318.
29

30 E. Set wire ties with ends directed into concrete, not toward exposed concrete
31 surfaces.
32

33 F. Splices: Lap splices as indicated on Drawings.
34

- 35 1. Bars indicated to be continuous, and all vertical bars to be lapped not less
36 than 36 bar diameters at splices, or 24 inches, whichever is greater.
37 2. Stagger splices in accordance with ACI 318.
38

39 G. Install welded-wire reinforcement in longest practicable lengths.
40

- 41 1. Support welded-wire reinforcement in accordance with CRSI "Manual of
42 Standard Practice."
43

- 44 a. For reinforcement less than W4.0 or D4.0, continuous support
45 spacing to not exceed 12 inches.
46

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

- B. Inspections:

1. Steel-reinforcement placement.

END OF SECTION

1 SECTION 03300

2
3 CAST-IN-PLACE CONCRETE

4
5 PART 1 - GENERAL

6
7 1.1 SUMMARY

8
9 A. Section Includes:

- 10
11 1. Cast-in-place concrete, including concrete materials, mixture design,
12 placement procedures, and finishes.

13
14 B. Related Requirements:

- 15
16 1. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and
17 welded-wire reinforcement.
18 2. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.

19
20 1.2 DEFINITIONS

- 21
22 A. Cementitious Materials: Portland cement alone or in combination with one or
23 more of the following: blended hydraulic cement, fly ash, slag cement, other
24 pozzolans, and silica fume; materials subject to compliance with requirements.

- 25
26 B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious
27 materials.

28
29 1.3 PREINSTALLATION MEETINGS

- 30
31 A. Preinstallation Conference: Conduct conference at Project site.

- 32
33 1. Before submitting design mixtures, review concrete design mixture and
34 examine procedures for ensuring quality of concrete materials. Require
35 representatives of each entity directly concerned with cast-in-place
36 concrete to attend, including the following:

- 37 a. Contractor's superintendent.
38 b. Independent testing agency responsible for concrete design
39 mixtures.
40 c. Ready-mix concrete manufacturer.
41 d. Concrete Subcontractor.
42 e. Special concrete finish Subcontractor.

- 43 2. Review testing and inspecting agency procedures for field quality control,
44 concrete finishes and finishing, cold- and hot-weather concreting
45 procedures, curing procedures, construction contraction and isolation
46 joints, and joint-filler strips, vapor-retarder installation, anchor rod and

1 anchorage device installation tolerances, steel reinforcement installation,
2 concrete repair procedures, and concrete protection.

3
4 1.4 ACTION SUBMITTALS

5
6 A. Product Data: For each of the following.

- 7
8 1. Portland cement.
9 2. Fly ash.
10 3. Slag cement.
11 4. Blended hydraulic cement.
12 5. Silica fume.
13 6. Performance-based hydraulic cement
14 7. Aggregates.
15 8. Admixtures:
16 a. Include limitations of use, including restrictions on cementitious
17 materials, supplementary cementitious materials, air entrainment,
18 aggregates, temperature at time of concrete placement, relative
19 humidity at time of concrete placement, curing conditions, and use of
20 other admixtures.
21 9. Vapor retarders.
22 10. Curing materials.
23 11. Joint fillers.
24 12. Repair materials.

25
26 B. Design Mixtures: For each concrete mixture, include the following:

- 27
28 1. Mixture identification.
29 2. Minimum 28-day compressive strength.
30 3. Durability exposure class.
31 4. Maximum w/cm.
32 5. Slump limit.
33 6. Air content.
34 7. Nominal maximum aggregate size.
35 8. Synthetic micro-fiber content.
36 9. Indicate amounts of mixing water to be withheld for later addition at
37 Project site if permitted.
38 10. Include manufacturer's certification that permeability-reducing admixture is
39 compatible with mix design.
40 11. Include certification that dosage rate for permeability-reducing admixture
41 matches dosage rate used in performance compliance test.
42 12. Intended placement method.
43 13. Submit alternate design mixtures when characteristics of materials,
44 Project conditions, weather, test results, or other circumstances warrant
45 adjustments.
46

- 1 C. Shop Drawings:
2
3 1. Construction Joint Layout: Indicate proposed construction joints required
4 to construct the structure.
5
6 a. Location of construction joints is subject to approval of the Engineer.
7
8 D. Concrete Schedule: For each location of each Class of concrete indicated in
9 "Concrete Mixtures" Article, including the following:
10
11 1. Concrete Class designation.
12 2. Location within Project.
13 3. Exposure Class designation.
14 4. Formed Surface Finish designation and final finish.
15 5. Final finish for floors.
16 6. Curing process.
17 7. Floor treatment if any.
18
- 19 1.5 INFORMATIONAL SUBMITTALS
20
- 21 A. Qualification Data: For the following:
22
23 1. Installer: Include copies of applicable ACI certificates.
24 2. Ready-mixed concrete manufacturer.
25 3. Testing agency: Include copies of applicable ACI certificates.
26
- 27 B. Material Certificates: For each of the following, signed by manufacturers:
28
29 1. Cementitious materials.
30 2. Admixtures.
31 3. Bonding agents.
32 4. Adhesives.
33 5. Vapor retarders.
34 6. Repair materials.
35
- 36 C. Material Test Reports: For the following, from a qualified testing agency:
37
38 1. Portland cement.
39 2. Fly ash.
40 3. Slag cement.
41 4. Blended hydraulic cement.
42 5. Silica fume.
43 6. Performance-based hydraulic cement.
44 7. Aggregates.
45 8. Admixtures:
46

- 1 a. Permeability-Reducing Admixture: Include independent test reports,
2 indicating compliance with specified requirements, including dosage
3 rate used in test.
4
- 5 D. Floor surface flatness and levelness measurements report, indicating
6 compliance with specified tolerances.
7
- 8 E. Research Reports:
9 1. For concrete admixtures in accordance with ICC's Acceptance Criteria
10 AC198.
11 2. For sheet vapor retarder/termite barrier, showing compliance with ICC
12 AC380.
13
- 14 F. Preconstruction Test Reports: For each mix design.
15
- 16 G. Field quality-control reports.
17
- 18 H. Minutes of preinstallation conference.
19

20 1.6 QUALITY ASSURANCE
21

- 22 A. Installer Qualifications: A qualified installer who employs Project personnel
23 qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor
24 who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI
25 Concrete Flatwork Technician.
26
- 27 B. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor
28 Installer.
29
- 30 C. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in
31 manufacturing ready-mixed concrete products and that complies with
32 ASTM C94/C94M requirements for production facilities and equipment.
33
- 34 1. Manufacturer certified in accordance with NRMCA's "Certification of
35 Ready Mixed Concrete Production Facilities."
36
- 37 D. Laboratory Testing Agency Qualifications: A testing agency qualified in
38 accordance with ASTM C1077 and ASTM E329 for testing indicated and
39 employing an ACI-certified Concrete Quality Control Technical Manager.
40
- 41 1. Personnel performing laboratory tests to be an ACI-certified Concrete
42 Strength Testing Technician and Concrete Laboratory Testing Technician,
43 Grade I. Testing agency laboratory supervisor to be an ACI-certified
44 Concrete Laboratory Testing Technician, Grade II.
45

1 E. Field Quality-Control Testing Agency Qualifications: An independent
2 agency, acceptable to authorities having jurisdiction, qualified in accordance
3 with ASTM C1077 and ASTM E329 for testing indicated.
4

- 5 1. Personnel conducting field tests to be qualified as an ACI Concrete Field
6 Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an
7 equivalent certification program.
8

9 1.7 PRECONSTRUCTION TESTING
10

11 A. Preconstruction Testing Service: Engage a qualified testing agency to perform
12 preconstruction testing on each concrete mixture.
13

- 14 1. Include the following information in each test report:
15
16 a. Admixture dosage rates.
17 b. Slump.
18 c. Air content.
19 d. Seven-day compressive strength.
20 e. 28-day compressive strength.
21

22 1.8 DELIVERY, STORAGE, AND HANDLING
23

24 A. Comply with ASTM C94/C94M and ACI 301.
25

26 1.9 FIELD CONDITIONS
27

28 A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
29

- 30 1. Protect concrete work from physical damage or reduced strength that
31 could be caused by frost, freezing actions, or low temperatures.
32 2. When average high and low temperature is expected to fall below 40
33 deg F for three successive days, maintain delivered concrete mixture
34 temperature within the temperature range required by ACI 301.
35 3. Do not use frozen materials or materials containing ice or snow.
36 4. Do not place concrete in contact with surfaces less than 35 deg F, other
37 than reinforcing steel.
38 5. Do not use calcium chloride, salt, or other materials containing antifreeze
39 agents or chemical accelerators unless otherwise specified and approved
40 in mixture designs.
41

42 B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1 , and as follows:
43

- 44 1. Maintain concrete temperature at time of discharge to not exceed 95
45 deg F.

- 1 2. Fog-spray forms, steel reinforcement, and subgrade just before placing
2 concrete. Keep subgrade uniformly moist without standing water, soft
3 spots, or dry areas.
4

5 1.10 WARRANTY
6

- 7 A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet
8 vapor retarder/termite barrier material and accessories for sheet vapor retarder/
9 termite barrier and accessories that do not comply with requirements or that fail
10 to resist penetration by termites within specified warranty period.
11

- 12 1. Warranty Period: 10 years from date of Substantial Completion.
13

14 PART 2 - PRODUCTS
15

16 2.1 CONCRETE, GENERAL
17

- 18 A. ACI Publications: Comply with ACI 301 unless modified by requirements in the
19 Contract Documents.
20

21 2.2 CONCRETE MATERIALS
22

- 23 A. Source Limitations:
24

- 25 1. Obtain all concrete mixtures from a single ready-mixed concrete
26 manufacturer for entire Project.
27 2. Obtain each type or class of cementitious material of the same brand from
28 the same manufacturer's plant.
29 3. Obtain aggregate from single source.
30 4. Obtain each type of admixture from single source from single
31 manufacturer.
32

- 33 B. Cementitious Materials:
34

- 35 1. Portland Cement: ASTM C150/C150M, Type I or Type II.
36 2. Fly Ash: ASTM C618, Class C or F.
37 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
38 4. Silica Fume: ASTM C1240 amorphous silica.
39

- 40 C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or
41 better, graded. Provide aggregates from a single source.
42

- 43 1. Alkali-Silica Reaction: Comply with one of the following:
44

- 45 a. Expansion Result of Aggregate: Not more than 0.04 percent at one-
46 year when tested in accordance with ASTM C1293.

- b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
 - c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
2. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder/Termite Barrier: ASTM E1745, Class A, except with maximum water-vapor permeance of 0.03 perms; 15 mils, complying with ICC AC380. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
 - b. Fortifiber Building Systems Group; Moistop Ultra 15.
 - c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
 - d. Insulation Solutions, Inc.; Viper VaporCheck 16.
 - e. Meadows, W. R., Inc.; Perminator 15 mil.
 - f. Raven Industries Inc.; Vapor Block 15.
 - g. Reef Industries, Inc.; Griffolyn 15 mil Green.
 - h. Stego Industries, LLC; Stego Wrap 15 mil Class A.

2. Low-Temperature Flexibility: Pass at minus 15 deg F; ASTM D146/D146M.
3. Puncture Resistance: 224 lbf minimum; ASTM E154/E154M.
4. Water Absorption: 0.1 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D570.
5. Hydrostatic-Head Resistance: 231 feet minimum; ASTM D5385.

- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.4 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
 1. Color:
 - a. Ambient Temperature Below 50 deg F: Black.
 - b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
 - c. Ambient Temperature Above 85 deg F: White.
- C. Water: Potable or complying with ASTM C1602/C1602M.
- D. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.5 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.
- B. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

- 1
- 2 1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or
- 3 blended hydraulic cement, as defined in ASTM C219.
- 4 2. Primer: Product of underlayment manufacturer recommended for
- 5 substrate, conditions, and application.
- 6 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as
- 7 recommended by underlayment manufacturer.
- 8 4. Compressive Strength: Not less than 4100 psi at 28 days when tested in
- 9 accordance with ASTM C109/C109M.

10

11 B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product

12 that can be applied in thicknesses from 1/4 inch and that can be filled in over a

13 scarified surface to match adjacent floor elevations.

14

- 15 1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or
- 16 blended hydraulic cement, as defined in ASTM C219.
- 17 2. Primer: Product of topping manufacturer recommended for substrate,
- 18 conditions, and application.
- 19 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as
- 20 recommended by topping manufacturer.
- 21 4. Compressive Strength: Not less than 5000 psi at 28 days when tested in
- 22 accordance with ASTM C109/C109M.

23

24 2.7 CONCRETE MIXTURES, GENERAL

25

26 A. Prepare design mixtures for each type and strength of concrete, proportioned

27 on the basis of laboratory trial mixture or field test data, or both, in accordance

28 with ACI 301.

29

- 30 1. Use a qualified testing agency for preparing and reporting proposed
 - 31 mixture designs, based on laboratory trial mixtures.
- 32

33 B. Cementitious Materials: Limit percentage, by weight, of cementitious materials

34 other than portland cement in concrete as follows:

35

- 36 1. Fly Ash or Other Pozzolans: 25 percent by mass.
 - 37 2. Slag Cement: 50 percent by mass.
 - 38 3. Silica Fume: 10 percent by mass.
 - 39 4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50
 - 40 percent by mass, with fly ash or pozzolans not exceeding 25 percent by
 - 41 mass and silica fume not exceeding 10 percent by mass.
 - 42 5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass
 - 43 with fly ash or pozzolans not exceeding 25 percent by mass and silica
 - 44 fume not exceeding 10 percent by mass.
- 45

1 C. Admixtures: Use admixtures in accordance with manufacturer's written
2 instructions.

- 3
- 4 1. Use water-reducing, high-range water-reducing or plasticizing admixture in
5 concrete, as required, for placement and workability.
- 6 2. Use water-reducing and -retarding admixture when required by high
7 temperatures, low humidity, or other adverse placement conditions.
- 8 3. Use water-reducing admixture in pumped concrete, concrete for heavy-
9 use industrial slabs and concrete with a w/cm below 0.50.

10
11 2.8 CONCRETE MIXTURES

12
13 A. Class A: Normal-weight concrete used for footings.

- 14
- 15 1. Exposure Class: ACI 318 F0, S1,W1, C1.
- 16 2. Minimum Compressive Strength: 4000 psi at 28 days.
- 17 3. Maximum w/cm: 0.45.
- 18 4. Slump Limit: 8 inches, plus or minus 1 inch for concrete with verified
19 slump of 3 inches, plus or minus 1 inch before adding high-range water-
20 reducing admixture or plasticizing admixture at Project site.
- 21 5. Air Content:
 - 22 a. 6 percent, plus or minus 1.5 percent at point of delivery for concrete
23 containing 3/4-inch nominal maximum aggregate size.
- 24 6. Limit water-soluble, chloride-ion content in hardened concrete to 0.15
25 percent by weight of cement.

26
27 2.9 CONCRETE MIXING

28
29 A. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete
30 in accordance with ASTM C94/C94M. Mix concrete materials in appropriate
31 drum-type batch machine mixer.

- 32
- 33 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2
34 minutes, but not more than five minutes after ingredients are in mixer,
35 before any part of batch is released.
- 36 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15
37 seconds for each additional 1 cu. yd.
- 38 3. Provide batch ticket for each batch discharged and used in the Work,
39 indicating Project identification name and number, date, mixture type,
40 mixture time, quantity, and amount of water added. Record approximate
41 location of final deposit in structure.

42
43 PART 3 - EXECUTION

44
45 3.1 EXAMINATION

46
47 A. Verification of Conditions:

- 1
2 1. Before placing concrete, verify that installation of concrete forms,
3 accessories, and reinforcement, and embedded items is complete and
4 that required inspections have been performed.
5 2. Do not proceed until unsatisfactory conditions have been corrected.
6

7 3.2 PREPARATION
8

- 9 A. Provide reasonable auxiliary services to accommodate field testing and
10 inspections, acceptable to testing agency, including the following:
11

- 12 1. Daily access to the Work.
13 2. Incidental labor and facilities necessary to facilitate tests and inspections.
14 3. Secure space for storage, initial curing, and field curing of test samples,
15 including source of water and continuous electrical power at Project site
16 during site curing period for test samples.
17 4. Security and protection for test samples and for testing and inspection
18 equipment at Project site.
19

20 3.3 INSTALLATION OF EMBEDDED ITEMS
21

- 22 A. Place and secure anchorage devices and other embedded items required for
23 adjoining Work that is attached to or supported by cast-in-place concrete.
24

- 25 1. Use setting drawings, templates, diagrams, instructions, and directions
26 furnished with items to be embedded.
27 2. Install anchor rods, accurately located, to elevations required and
28 complying with tolerances in Section 7.5 of ANSI/AISC 303.
29 3. Install reglets to receive waterproofing and to receive through-wall
30 flashings in outer face of concrete frame at exterior walls, where flashing
31 is shown at lintels, shelf angles, and other conditions.
32

33 3.4 INSTALLATION OF VAPOR RETARDER
34

- 35 A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in
36 accordance with ASTM E1643 and manufacturer's written instructions.
37

- 38 1. Install vapor retarder with longest dimension parallel with direction of
39 concrete pour.
40 2. Face laps away from exposed direction of concrete pour.
41 3. Lap vapor retarder over footings and grade beams not less than 6 inches,
42 sealing vapor retarder to concrete.
43 4. Lap joints 6 inches and seal with manufacturer's recommended tape.
44 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile
45 caps, sealing entire perimeter to floor slabs, grade beams, foundation
46 walls, or pile caps.

- 1 6. Seal penetrations in accordance with vapor retarder manufacturer's
2 instructions.
3 7. Protect vapor retarder during placement of reinforcement and concrete.
4 a. Repair damaged areas by patching with vapor retarder material,
5 overlapping damages area by 6 inches on all sides, and sealing to
6 vapor retarder.
7

8 3.5 JOINTS
9

- 10 A. Construct joints true to line, with faces perpendicular to surface plane of
11 concrete.
12

13 3.6 CONCRETE PLACEMENT
14

- 15 A. Before placing concrete, verify that installation of formwork, reinforcement,
16 embedded items, and vapor retarder is complete and that required inspections
17 are completed.
18

- 19 1. Immediately prior to concrete placement, inspect vapor retarder for
20 damage and deficient installation, and repair defective areas.
21 2. Provide continuous inspection of vapor retarder during concrete
22 placement and make necessary repairs to damaged areas as Work
23 progresses.
24

- 25 B. Notify Engineer and testing and inspection agencies 24 hours prior to
26 commencement of concrete placement.
27

- 28 C. Do not add water to concrete during delivery, at Project site, or during
29 placement unless approved by Engineer in writing, but not to exceed the
30 amount indicated on the concrete delivery ticket.
31

- 32 1. Do not add water to concrete after adding high-range water-reducing
33 admixtures to mixture.
34

- 35 D. Before test sampling and placing concrete, water may be added at Project site,
36 subject to limitations of ACI 301, but not to exceed the amount indicated on the
37 concrete delivery ticket.
38

- 39 1. Do not add water to concrete after adding high-range water-reducing
40 admixtures to mixture.
41

- 42 E. Deposit concrete continuously in one layer or in horizontal layers of such
43 thickness that no new concrete is placed on concrete that has hardened
44 enough to cause seams or planes of weakness.
45

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
 - b. Remove projections larger than 1 inch.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 Class D.
 - e. Apply to concrete surfaces not exposed to public view.
2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
 - b. Remove projections larger than 1/4 inch.
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 Class B.
 - e. Locations: Apply to concrete surfaces exposed to public view.
3. ACI 301 Surface Finish SF-3.0:
 - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
 - b. Remove projections larger than 1/8 inch.
 - c. Patch tie holes.

- d. Surface Tolerance: ACI 117 Class A.
- e. Locations: Apply to concrete surfaces exposed to public view.

3.8 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.9 CONCRETE CURING

- #### A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

- 1 1. Comply with ACI 301 and ACI 306.1 for cold weather protection during
- 2 curing.
- 3 2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during
- 4 curing.
- 5 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in
- 6 accordance with ACI 305.1, before and during finishing operations.
- 7

8 B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

- 9
- 10 1. Cure formed concrete surfaces, including underside of beams, supported
- 11 slabs, and other similar surfaces.
- 12 2. If forms remain during curing period, moist cure after loosening forms.
- 13 3. If removing forms before end of curing period, continue curing for
- 14 remainder of curing period, as follows:
- 15
- 16 a. Continuous Fogging: Maintain standing water on concrete surface
- 17 until final setting of concrete.
- 18 b. Continuous Sprinkling: Maintain concrete surface continuously wet.
- 19 c. Absorptive Cover: Pre-dampen absorptive material before
- 20 application; apply additional water to absorptive material to maintain
- 21 concrete surface continuously wet.
- 22 d. Water-Retention Sheetting Materials: Cover exposed concrete
- 23 surfaces with sheetting material, taping, or lapping seams.
- 24 e. Membrane-Forming Curing Compound: Apply uniformly in
- 25 continuous operation by power spray or roller in accordance with
- 26 manufacturer's written instructions.
- 27 1) Recoat areas subject to heavy rainfall within three hours after
- 28 initial application.
- 29 2) Maintain continuity of coating and repair damage during curing
- 30 period.
- 31

32 3.10 TOLERANCES

- 33
- 34 A. Conform to ACI 117.
- 35

36 3.11 APPLICATION OF LIQUID FLOOR TREATMENTS

- 37
- 38 A. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing
- 39 compound to hardened concrete by power spray or roller in accordance with
- 40 manufacturer's written instructions.
- 41

42 3.12 JOINT FILLING

- 43
- 44 A. Prepare, clean, and install joint filler in accordance with manufacturer's written
- 45 instructions.
- 46

1. Defer joint filling until concrete has aged at least one month.
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Engineer.
2. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

- a. Limit cut depth to 3/4 inch.
- b. Make edges of cuts perpendicular to concrete surface.
- c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
- d. Fill and compact with patching mortar before bonding agent has dried.
- e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

- a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.

- 1 b. Compact mortar in place and strike off slightly higher than
2 surrounding surface.
3
4 3. Repair defects on concealed formed surfaces that will affect concrete's
5 durability and structural performance as determined by Engineer.
6

7 D. Repairing Unformed Surfaces:
8

- 9 1. Test unformed surfaces, such as floors and slabs, for finish, and verify
10 surface tolerances specified for each surface.
11
12 a. Correct low and high areas.
13 b. Test surfaces sloped to drain for trueness of slope and smoothness;
14 use a sloped template.
15
16 2. Repair finished surfaces containing surface defects, including spalls,
17 popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01
18 inch wide or that penetrate to reinforcement or completely through
19 unreinforced sections regardless of width, and other objectionable
20 conditions.
21
22 3. After concrete has cured at least 14 days, correct high areas by grinding.
23
24 4. Correct localized low areas during, or immediately after, completing
25 surface-finishing operations by cutting out low areas and replacing with
26 patching mortar.
27
28 a. Finish repaired areas to blend into adjacent concrete.
29
30 5. Correct other low areas scheduled to remain exposed with repair topping.
31
32 a. Cut out low areas to ensure a minimum repair topping depth of 1/4
33 inch to match adjacent floor elevations.
34 b. Prepare, mix, and apply repair topping and primer in accordance with
35 manufacturer's written instructions to produce a smooth, uniform,
36 plane, and level surface.
37
38 6. Repair defective areas, except random cracks and single holes 1 inch or
39 less in diameter, by cutting out and replacing with fresh concrete.
40
41 a. Remove defective areas with clean, square cuts, and expose steel
42 reinforcement with at least a 3/4-inch clearance all around.
43 b. Dampen concrete surfaces in contact with patching concrete and
44 apply bonding agent.
45 c. Mix patching concrete of same materials and mixture as original
46 concrete, except without coarse aggregate.

- 1 d. Place, compact, and finish to blend with adjacent finished concrete.
- 2 e. Cure in same manner as adjacent concrete.
- 3
- 4 7. Repair random cracks and single holes 1 inch or less in diameter with
- 5 patching mortar.
- 6
- 7 a. Groove top of cracks and cut out holes to sound concrete, and clean
- 8 off dust, dirt, and loose particles.
- 9 b. Dampen cleaned concrete surfaces and apply bonding agent.
- 10 c. Place patching mortar before bonding agent has dried.
- 11 d. Compact patching mortar and finish to match adjacent concrete.
- 12 e. Keep patched area continuously moist for at least 72 hours.
- 13
- 14 E. Perform structural repairs of concrete, subject to Engineer's approval, using
- 15 epoxy adhesive and patching mortar.
- 16
- 17 F. Repair materials and installation not specified above may be used, subject to
- 18 Engineer's approval.
- 19

20 3.14 FIELD QUALITY CONTROL

- 21
- 22 A. Testing Agency: Contractor shall engage a qualified testing and inspecting
- 23 agency to perform tests and inspections and to submit reports.
- 24
- 25 1. Testing agency to be responsible for providing curing container for
- 26 composite samples on Site and verifying that field-cured composite
- 27 samples are cured in accordance with ASTM C31/C31M.
- 28 2. Testing agency to immediately report to Engineer, Contractor, Owner and
- 29 concrete manufacturer any failure of Work to comply with Contract
- 30 Documents.
- 31 3. Testing agency to report results of tests and inspections, in writing, to
- 32 Owner, Engineer, Contractor, and concrete manufacturer within 48 hours
- 33 of inspections and tests.
- 34
- 35 a. Test reports to include reporting requirements of ASTM C31/C31M,
- 36 ASTM C39/C39M, and ACI 301, including the following as applicable
- 37 to each test and inspection:
- 38
- 39 1) Project name.
- 40 2) Name of testing agency.
- 41 3) Names and certification numbers of field and laboratory
- 42 technicians performing inspections and testing.
- 43 4) Name of concrete manufacturer.
- 44 5) Date and time of inspection, sampling, and field testing.
- 45 6) Date and time of concrete placement.
- 46 7) Location in Work of concrete represented by samples.

- 1 8) Date and time sample was obtained.
- 2 9) Truck and batch ticket numbers.
- 3 10) Design compressive strength at 28 days.
- 4 11) Concrete mixture designation, proportions, and materials.
- 5 12) Field test results.
- 6 13) Information on storage and curing of samples before testing,
- 7 including curing method and maximum and minimum
- 8 temperatures during initial curing period.
- 9 14) Type of fracture and compressive break strengths at seven
- 10 days and 28 days.

11
12 B. Batch Tickets: For each load delivered, submit three copies of batch delivery
13 ticket to testing agency, indicating quantity, mix identification, admixtures,
14 design strength, aggregate size, design air content, design slump at time of
15 batching, and amount of water that can be added at Project site.

16
17 C. Inspections:

- 18 1. Verification of use of required design mixture.
- 19 2. Concrete placement, including conveying and depositing.
- 20 3. Curing procedures and maintenance of curing temperature.
- 21 4. Verification of concrete strength before removal of shores and forms from
- 22 walls.
- 23 5. Batch Plant Inspections: On a random basis, as determined by Engineer.

24
25
26 D. Concrete Tests: Testing of composite samples of fresh concrete obtained in
27 accordance with ASTM C 172/C 172M to be performed in accordance with the
28 following requirements:

- 29 1. Testing Frequency: Obtain one composite sample for each day's pour of
30 each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus
31 one set for each additional 50 cu. yd. or fraction thereof.
32
33 a. When frequency of testing provides fewer than five compressive-
34 strength tests for each concrete mixture, testing to be conducted
35 from at least five randomly selected batches or from each batch if
36 fewer than five are used.
37
38 2. Slump: ASTM C143/C143M:
39
40 a. One test at point of placement for each composite sample, but not
41 less than one test for each day's pour of each concrete mixture.
42 b. Perform additional tests when concrete consistency appears to
43 change.
44
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3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure two sets of three 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
 - b. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
 8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
 9. Additional Tests:
 - a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Engineer.

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1 SECTION 03350

2
3 MULTI-LAYERED WET WELL LINING SYSTEM

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

8
9 A. Description:

10
11 This section covers all workmanship, materials safety and quality
12 requirements for concrete wet well resurfacing and lining work. Provide and
13 apply repair mortar, sealer and primer materials as specified and as
14 indicated on drawings.

15
16 B. A general description of the work to be performed is listed below:

- 17
18 • Power wash the interior surface of the wet well to remove grease and
19 contaminants.
20 • Sand blast the interior surface of the wet well to obtain the correct
21 surface profile and surface mechanical grip properties.
22 • Power rinse the interior surface of the wet well to remove sand blasting
23 debris, dust, and particles
24 • Repair Cracks as needed
25 • Sand Blast and Power Wash Surface
26 • Apply Lining System

27
28 C. Cracks and joints that require additional materials shall be injected with
29 hydrophilic polyurethane grout.

30
31 1.02 RELATED WORK:

32
33 Division 1 - General Requirements

34
35 1.03 REFERENCES:

36
37 A. This section contains references to the documents listed below. They are
38 a part of this section as specified and modified. In case of conflict between
39 the requirements of this section and those of the listed documents, the more
40 stringent of the requirements shall prevail.

41
42 B. Unless otherwise specified, references to documents shall mean the
43 documents in effect at the time of receipt of Bids.

44
45 C. Referenced publications found within this specification shall be the latest

1 revision unless otherwise specified; and applicable parts of the referenced
2 publications shall become a part of this specification as if fully included.
3
4

5 **Reference**

5 **Title**

6
7 **ASTM (American Society of Testing and Materials)**

8 ASTM C 920 Specification for Elastomeric Joint Sealants
9 ASTM D 3960 Practice for Determining Volatile Organic Compound (VOC)
10 Content of Paints and Related Coatings
11 ASTM D 4259 Practice for Abrading Concrete
12 ASTM E 337 Standard Practice Test Method for Measuring Humidity with a
13 Psychrometer
14

15 **Federal Standard Colors**

16 F 595 B Federal Standard Colors
17 Guideline No. 03732 Selecting and Specifying Concrete Surface
18 Preparation for Sealers, Coatings, and Polymer
19 Overlays
20

21 **ICRI (International Concrete Restoration Institute)**

22 Guideline No. 03732 Selecting and Specifying Concrete Surface
23 Preparation for Sealers, Coatings, and Polymer
24 Overlays
25

26 **NACE (National Association of Corrosion Engineers)**

27 Publication 6D-173 "A Manual for Painter Safety"
28 Publication 6G-164 "Surface Preparation Abrasives for Industrial Maintenance
29 Painting"
30 Publication TPC2 Coatings and Linings for Immersion Service:
31 Chapter 1 Safety
32 Chapter 2 Surface Preparation
33 Chapter 3 Curing
34 Chapter 4 Inspection
35 Publication 6F-163 "Surface Preparation of Steel or Concrete Tank Interiors."
36 RP0892-92 Standard Recommended Practice, Lining over Concrete in
37 Immersion Service
38 RP0288-88 Standard Recommended Practice, Inspection of Linings on
39 Steel and Concrete
40

41 **SSPC (Steel Structures Painting Council)**

42 SSPC-SP 12 Surface Preparation and Cleaning of Steel and Other Hard
43 Materials by High and Ultrahigh Pressure Water Jetting Prior
44 to Recoating
45 SSPC-SP 13 Surface Preparation of Concrete

1 SSPC-PA-3 "A Guide to Safety in Paint Application"
2 SSPC-Guide 12 Guide for Illumination of Industrial Painting Project

3
4 **OSHA (Occupational Safety and Health Administration)**

5 1915.35 Standards – 29 CFR – Painting
6
7

8 **ANSI (American National Standards Institute)**

9 ANSI/ASC 29.4 Abrasive Blasting Operations — Ventilation and Safe Practice
10

11 1.04 QUALITY ASSURANCE
12

- 13 A. The manufacturer and/or applicator of the liner system shall be a company
14 that specializes in the design, manufacture, or installation of corrosion
15 protection systems for wet wells. The applicator shall be completely trained
16 in leak repair, surface preparation and corrosion materials application in wet
17 wells.
18
- 19 B. The applicator shall be trained and certified by the manufacturer for the
20 handling, mixing, application, and inspection of the liner system as
21 described herein.
22
- 23 C. To ensure total unit responsibility, all materials and installation thereof shall
24 be furnished and coordinated with/by one supplier/applicator.
25
- 26 D. Requirements:
27
- 28 1. Do not use or retain contaminated, outdated, or diluted materials for
29 resurfacing. Do not use materials from previously opened
30 containers.
 - 31 2. Use only products of the approved Manufacturer(s). Use products
32 of one manufacturer in any one resurfacing system with compatible
33 materials. Provide same material product for touch-up as for original
34 material.
 - 35 3. If any requirements of this specification conflict with a referenced
36 standard, the more stringent requirement shall apply.
 - 37 4. Make all locations and phases of the work available for access by
38 the Engineer. The Contractor shall provide ventilation and egress to
39 safely access the coating work areas for construction and inspection.
 - 40 5. Conduct work so that the resurfacing system is installed as specified
41 herein. Inspect work continually to ensure that the resurfacing
42 system is installed as specified herein. The Contractor shall inspect
43 the work to determine conformance with the specifications and
44 referenced documents. The Contractor shall inform the Engineer of
45 the progress and the quality of the work through daily reports as

1 specified below. Any nonconforming coating system work shall be
2 corrected as specified herein or as recommended by the
3 Manufacturer.

- 4 6. Summarize test data, work progress, areas covered, ambient
5 conditions, quality control inspection test findings, and other
6 information pertinent to the resurfacing system installation in daily
7 reports to be submitted to the Engineer.
- 8 7. The methods of construction shall be in accordance with all
9 requirements of this specification.
- 10 8. Employ only trades people who have at least five years of experience
11 performing resurfacing work of similar size and complexity as the
12 work specified in this Section. Submittals to verify these
13 qualifications are to be made within thirty (30) days of the Notice-to-
14 Proceed and are subject to approval by the Engineer.

15
16 1.05 SUBMITTALS

17
18 A. Submit the following prior to commencing with any phase of the work
19 covered by this Section:

- 20
21 1. Manufacturer's current printed recommendations and product data
22 sheets for all coating system products supplied under this section
23 including performance criteria, surface preparation and applications,
24 volatile organic compound (V.O.C.) data, and safety requirements.
- 25 2. Material Safety Data Sheets (MSDS) for any materials brought on-
26 site including all resurfacing system materials, solvents, and
27 abrasive blast media.
- 28 3. Storage requirements including temperature, humidity, and
29 ventilation for resurfacing system materials.
- 30 4. Manufacturer's requirements, including application procedures for
31 resurfacing materials shall be in writing and shall be followed in
32 detail. All safety precautions recommended by the Manufacturer
33 shall be strictly adhered to at all times when work is in progress.
- 34 5. Color samples for all surfaces to be resurfaced that have been field-
35 matched to existing colors.
- 36 6. Submit applicators' certification that resurfacing materials comply
37 with Federal, State, and Local regulations for VOC (Volatile Organic
38 Compounds).
- 39 7. Submit daily reports that contain the following information: Substrate
40 conditions, ambient conditions, application procedures, work
41 completed and location thereof. Mark-up drawings that show
42 location of work.
- 43 8. Submit letter(s) with associated product data signed by Manufacturer
44 certifying that submitted products are suitable for application on the
45 surfaces to be resurfaced and for the service conditions.

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1.06 WARRANTIES

- A. All patch or filler concrete used below the lining coating shall be warranted for the same length of times as the lining coating.
- B. The Contractor shall warrant the lining coating for a period of 10 years. A coating failure will have occurred if the lining fails to prevent damage or corrosion to the structure, bubbles out from wall or metal, or fails to adhere to concrete or metal. Failure does not include mechanical or chemical abuse. If coatings are deemed to have failed, the Contractor shall at his expense completely repair the damaged area including an expanded area of a minimum of 6-inches in any direction.

1.07 DELIVERIES AND STORAGE

- A. Materials shall be stored in accordance with Manufacturer's recommendations in enclosed structures and shall be protected from weather and adverse temperature conditions. Flammable materials shall be stored in accordance with state and local codes. Materials exceeding storage life recommended by the manufacturer shall be removed from the site.
- B. Store all materials only in area or areas designated by the Engineer solely for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of materials-related debris before authorized disposal, to these areas. All materials are to be stored on pallets or similar storage/handling skids off the ground in sheltered areas in which the temperature is maintained between 70°F and 90°F.
- C. Mix all resurfacing materials in a mixing area supplied by the Contractor. This enclosed area must protect the mixing operation and materials from direct sunlight, inclement weather, freezing, or other means of damage or contamination. Protect all other concrete and metallic surfaces and finishes from any spillage of material(s) within the mixing area.
- D. Do not use floor drains, dikes, or storm drains for disposal of resurfacing systems materials.
- E. The Contractor shall take all precautions and implement all measures necessary to avert potential hazards associated with the resurfacing system materials as described on the pertinent Material Safety Data Sheets or container labels.
- F. Deliver all materials to the job site in their original, unopened containers.

1 Each container shall bear the Manufacturer's name and label.

2
3 1. Labels on all material containers must show the following
4 information:

- 5
6 a. Name or title of product.
7 b. Federal Specification Number if applicable.
8 c. Manufacturer's batch number and date of manufacture.
9 d. Manufacturer's name.
10 e. Generic type of material.
11 f. Application and mixing instructions.
12 g. Hazardous material identification label.
13 h. Shelf life date.
14 i. Storage requirements.

15
16 G. All containers shall be clearly marked indicating any personnel safety
17 hazards associated with the use of or exposure to the materials.

18
19 H. All materials shall be handled and stored to prevent damage or loss of label.

20
21 I. The Contractor shall provide resurfacing material storage and mixing areas.

22
23 J. Do not use or retain contaminated, outdated, prematurely opened, diluted
24 materials, or materials which have exceeded their shelf life.

25
26 1.08 COORDINATION OF WORK

27
28 A. Work Areas:

29
30 The work areas on the job site will be limited to the immediate area around
31 the influent pump station or as designated by the Owner. The Contractor's
32 personnel shall not be permitted in any area other than those expressly
33 designated by the Owner.

34
35 B. Coordination:

36
37 The Contractor shall coordinate with the Engineer and Owner regarding
38 availability of work areas, completion times, safety, access, and other
39 factors, which can impact plant operations.

40
41 1.09 SAFETY

42
43 A. The work is inside a confined space. The Contractor's work forces shall
44 comply with all applicable documentation and safety requirements related
45 to confined spaces and all safety requirements referenced in Section 1.03.

- 1
2 B. The Contractor shall provide personnel with all safety equipment necessary
3 to protect them during any phase of the work. This shall include, but not be
4 limited to safety glasses, goggles, earplugs, hard hats, steel toed work
5 shoes, appropriate personal protective clothing, gloves, and plant approved
6 escape respirators (where required).
7
8 C. Keep any flammable materials such as cleaning solvents, thinners, or
9 resurfacing materials away from open flames, sparks, or temperatures
10 higher than 150°F. Drums containing flammable materials will be grounded.
11 No solvent in any quantity shall be allowed inside containment enclosures
12 or permitted confined spaces at any time during resurfacing work.
13
14 D. Power tools are to be in good working order to avoid open sparking. No
15 spark producing tools shall be utilized in restricted areas as indicated
16 herein.
17
18 E. The Contractor shall fireproof all work areas by maintaining a clean work
19 area and having Underwriter's Laboratories approved fire extinguishers on-
20 hand. The Contractor shall furnish these fire extinguishers.
21
22 F. Workers doing abrasive blasting operations shall wear a fresh air supplied
23 protective helmet and hood and personal protective clothing acceptable to
24 industry standards and all government regulations.
25
26 G. Dispose of rags used for wiping up resurfacing materials, solvents, and
27 thinners by drenching them with water and placing in a metal container with
28 a tight-fitting metal cover. Complete this disposal process at the end of each
29 day. Final disposal of these materials is the Contractor's responsibility.
30
31 H. Matches, smoking, flames, or sparks resulting from any source including
32 welding, must be remote from the work area during coating work. Smoking
33 is permitted only in designated areas of the plant.
34

35 PART 2 – PRODUCTS

36 2.01 MANUFACTURERS

- 37
38
39 A. Materials specified are those that have been evaluated for the specific
40 service. Equivalent materials by other manufacturers may be submitted
41 upon written approval of the Engineer. As part of the proof of equality, the
42 Contractor shall submit certified test reports from a nationally known,
43 reputable, and independent testing laboratory conducting comparative tests
44 between the product specified and the requested substitution.
45

- 1 B. Requests for substitution shall include manufacturer's literature for each
2 product giving name, product number, generic type, descriptive information,
3 solids by volume, recommended dry film thickness and certified lab test
4 reports showing results to equal the performance criteria of the products
5 specified herein. In addition, a list of five projects shall be submitted in
6 which each product has been used and rendered satisfactory service.
7
- 8 C. All requests for product substitution shall be made at least 10 days prior to
9 the bid opening date.
- 10
- 11 D. Any material savings shall be passed to the Owner in the form of a contract
12 dollar reduction.
- 13
- 14 A. Approved manufacturers for this project include products of Sprayroq, Raven
15 Lining Systems and Warren Environmental.

16

17 2.02 REPAIR PRODUCTS

18

- 19 A. Prior to application of the corrosion control coating system, all surfaces shall
20 be cleaned and prepared according to the coating product manufacturer's
21 requirements, at a minimum, and all damage to concrete and/or metal surfaces
22 shall be repaired in accordance with Division 3 of these Specifications. No
23 exceptions to the repair of underlying concrete shall be made, regardless of the
24 coating system used.
- 25
- 26 B. Prior to coating of existing concrete, cracks and spalling in the concrete shall
27 be repaired to provide a uniform bonding surface, provide minimum coverage
28 over structural steel reinforcement elements, and eliminate voids under the
29 coating product. Repair products used shall be those recommended by lining
30 manufacturer based on field investigations of the existing tank conditions
31 described below.
- 32
- 33 C. Repair materials shall be used to; fill voids, bugholes, structurally reinforce
34 and/or rebuild surfaces, etc. as determined necessary by the engineer and
35 protective coating applicator. Repair materials must be compatible with the
36 specified coating and shall be applied in accordance with the manufacturer's
37 recommendations
- 38
- 39 D. The following products may be accepted and approved as compatible repair
40 basecoat materials for approved topcoating for use within the specifications:
- 41
- 42 1. 100% solids, solvent-free grout specifically formulated for approved lining
43 system compatibility. The grout manufacturer shall provide instructions for
44 trowel or spray application procedures.
- 45

- 1 2. Factory blended, rapid setting, high early strength, non-shrink cementitious
2 or epoxy repair mortar that can be troweled or pneumatically spray applied
3 may be approved if specifically formulated to be compatible for approved
4 lining system. Such repair mortars should not be used unless the
5 manufacturer confirms its suitability for the use with the lining system.
6 Project specific submittals should be provided including application, cure
7 time and surface preparation procedures which permit optimum bond
8 strength with the approved coating.
9
- 10 3. In the case of excessive infiltration, a hydraulic cement or plug may be used
11 to stop the flow of the infiltration. The hydraulic cement shall be compatible
12 with the lining system.
13

14 2.03 COATING PRODUCTS

15

- 16 A. Coating product shall be applied to all interior surfaces to protect the host
17 substrate and repair materials from all forms of chemical or bacteriological
18 attack typically found in municipal sanitary sewer systems and to impart a
19 degree of structural enhancement.
20
- 21 B. Coating product physical properties shall be substantiated through submittal of
22 accredited third party testing results and shall be representative of the actual
23 field applied product and cure mechanism(s) to be employed in the field.
24
- 25 C. Coating products selected for application on this project shall be limited to:
26
- 27 1. Influent Pump Station:
28 a. Walls
29 b. Flow Channel
30 c. Floor
31 d. Under Slab
32
- 33 2. Bypass Manhole
34
35

36 2.04 WET WELL LINER SYSTEM

37

38 A. Lining System

39

40 Only materials and products suitable for installation in a severe hydrogen
41 sulfide environment without any deterioration to the liner may be used. The
42 liner is to be applied on the top of the repair mortar. Materials specified
43 herein are the only approved standard coating systems. The approved
44 products are as follows:
45

1. Sprayroq – Spraywall
2. Raven Lining Systems – Raven 405
3. Warren Environmental – 301-14

B. Liner Properties

1. Liner shall be applied on top of the Primer and have been developed for concrete restoration, corrosion protection, and waterproofing.
2. Shall not contain VOC.
3. Liner Properties
 - a. Tensile Strength >7,450 psi
 - b. Tensile Elongation >6%
 - c. Flexural Modulus >15,000 psi
 - d. Compressive Strength >10,500 psi
 - e. Hardness (Shore D) 87
 - f. Adhesion with Concrete >200 psi or Substrate Failure
4. Shall not be applied without first priming surface with approved primer.
5. Final thickness shall be at least 125 mils.

PART 3 - EXECUTION

3.01 GENERAL

A. Hoisting, Scaffolding, Staging, and Planking:

Provide, set-up, and maintain all required hoists, scaffolds, and staging and planking, and perform all access related hoisting work required to complete the work of this section as indicated and specified. Scaffolds shall have solid backs and floors to prevent dropping materials from there to the floors or ground below.

B. Environmental Requirements:

Comply with the Manufacturer's recommendations as to environmental conditions under which resurfacing system materials can be applied. Do not apply resurfacing system materials when dust is in work site. The Contractor shall provide all temporary lighting during the work.

1 C. Protection:

2
3 Cover or otherwise protect finish work or other surfaces not being
4 resurfaced. Erect and maintain protective tarps, enclosures and/or
5 maskings to contain debris (such as dust or airborne particles resulting from
6 surface preparation) generated during any and all work activities. This
7 includes, but is not limited to the use of dust/debris collection apparatus as
8 required.
9

10 D. Initial Inspection Of Surfaces To Be Coated:

11
12 It is the responsibility of the Contractor to inspect and report unacceptable
13 concrete substrate surface conditions to the Engineer prior to the
14 commencement of surface preparation activities. Unacceptable surface
15 conditions are defined as the presence of cracked surfaces or concrete
16 deteriorated to a depth of greater than 1-inch or otherwise unable to
17 withstand surface preparation as specified herein.
18

19 E. Thinners and Solvents:

20
21 The Contractor shall use only solvents and thinners as recommended by
22 the Manufacturer.
23

24 3.02 ACCEPTABLE APPLICATORS

25
26 A. Repair mortar applicators shall be trained to properly apply the cementitious
27 mortar according to manufacturer's recommendations.
28

29 B. Protective coating must be applied by a Certified Applicator of the protective
30 coating manufacturer and according to manufacturer specifications.
31

32 3.03 EXAMINATION

33
34 A. All structures to be coated shall be inspected by the Applicator prior to
35 installation of the lining system.
36

37 B. Any active flows shall be dammed, plugged or diverted as required to ensure
38 that the liquid flow is maintained below the surfaces to be coated. Flows should
39 be totally plugged and/or diverted when coating the invert. All extraneous flows
40 into the manhole or vaults at or above the area coated shall be plugged and/or
41 diverted until the coating has set hard to the touch.
42

43 C. Installation of the protective coating shall not commence until the concrete
44 substrate and any repair materials has properly cured in accordance with the
45 manufacturer's requirements and these specifications.

- 1
2 D. Temperature of the surface to be coated should be maintained between 70 deg
3 F and 110 deg F during application. Prior to and during application, care should
4 be taken to avoid exposure of direct sunlight or other intense heat source to the
5 structure being coated.
6

7 3.04 SURFACE PREPARATION
8

- 9 A. All contaminants including: oils, grease, incompatible existing coatings, waxes,
10 form release, curing compounds, efflorescence, sealers, salts, or other
11 contaminants shall be removed.
12

- 13 B. Surfaces to receive protective coating shall be cleaned and abraded to produce
14 a sound surface with profile to meet as a minimum ICRI CSP3 – CSP6 profile
15 and porosity to provide a strong bond between the lining system and the
16 substrate. Generally, this can be achieved with a high pressure water cleaning
17 using equipment capable of a minimum 4,500 psi at 4.5 gpm with a turbo head
18 jet nozzle. Other methods such as high pressure water jetting (refer to SSPC-
19 SP 13/NACE No.6), abrasive blasting, shotblasting, grinding, scarifying or acid
20 etching may also be used. Detergent water cleaning and hot water blasting
21 may be necessary to remove oils, grease or other hydrocarbon residues from
22 the concrete. Whichever method(s) are used, they shall be performed in a
23 manner that provides a uniform, sound clean neutralized surface that is not
24 excessively damaged.
25

- 26 C. Infiltration shall be stopped by using a material which is compatible with the
27 specified repair mortar and is suitable for topcoating with the specified lining
28 system.
29

- 30 D. The area between any areas that might exhibit movement or cracking due to
31 expansion and contraction, shall be grouted with a flexible grout or gel.
32
33

34 E. Abrasive Blast Cleaning
35

- 36 1. Sand blasting media shall be washed, graded and free of
37 contaminants that might interfere with the adhesion of the
38 resurfacing materials. Used or spent blast abrasive shall not be
39 reused on work covered by this section.
40 2. The compressed air used for blast cleaning will be filtered free of
41 condensed water or oil. Moisture traps will be cleaned at least once
42 every four hours or more frequently as is appropriate.
43 3. Oil separators shall be installed just downstream of compressor
44 discharge valves and at the discharge of the blast pot discharges.
45 Oil separators shall be cleaned at least once every four hours or

1 more frequently as is appropriate.

- 2 4. A paper blotter test shall be performed by the Contractor when
3 requested by the Engineer or the Engineer's representative to
4 determine if the air is sufficiently free of oil and moisture.
5 5. Regulators, gauges, filters, and separators will be in good working
6 order for all of the compressor air lines to blasting nozzles at all times
7 during this work.
8 6. An air dryer or drying unit shall be installed which dries the
9 compressed air prior to blast connections. This dryer shall be used
10 and maintained for the duration of surface preparation work.
11 7. The quality, volume, and velocity of life support and ventilation air
12 used during surface preparation shall be in accordance with
13 applicable safety standards and as required to ensure adequate
14 visibility and proper dissipation of volatiles without impacting the
15 prepared surface or the health of the public or personnel working for
16 the Contractor, Subcontractors, Engineer, Engineer's
17 Representatives, or anyone who may be affected by on-site
18 maintenance coating work activities.
19 8. The abrasive blast nozzles used shall be the venturi or other high
20 velocity type supplied with a minimum of 100-psig air pressure and
21 the necessary volume to obtain the required blast cleaning
22 production rates and specified degree of cleanliness.
23 9. The Contractor must provide adequate ventilation for airborne
24 particulate evacuation and lighting (meeting all pertinent safety
25 standards) to optimize visibility for both blast cleaning and
26 observation of the substrate during surface preparation work.

- 27
28 F. After abrasive blasting, the interior surface shall be power rinsed with
29 potable water to remove all loose materials and other contaminants.

30
31 3.05 APPLICATION OF REPAIR MATERIALS

- 32
33 A. Areas where structural steel has been exposed or removed shall be repaired
34 in accordance with the manufacturer's recommendations.
35
36 B. Repair materials shall meet the specifications herein. The materials shall be
37 trowel or spray applied utilizing proper equipment on to specified surfaces. The
38 material thickness shall be specified by the manufacturer's recommendations.
39
40 C. If using approved cementitious repair materials, such shall be troweled to
41 provide a smooth surface with an average profile equivalent to coarse 60 grit
42 sandpaper or a minimum ICRI CSP3-CSP6 profile to optimally receive the
43 protective coating. No bugholes or honeycomb surfaces should remain after
44 the final trowel procedure of the repair mortar.
45

1 D. The repair materials shall be permitted to cure according to manufacturer
2 recommendations. Curing compounds should not be used unless approved for
3 compatibility with the specified lining system.
4

5 E. After high pressure water blasting and leak repair is performed, all surfaces
6 shall be inspected for remaining laitance prior to protective coating application.
7 Any evidence of remaining contamination or laitance shall be removed by
8 additional abrasive blast, shotblast or other approved method. If repair
9 materials are used, refer to these specifications for surface preparation. Areas
10 to be coated must also be prepared in accordance with these specifications
11 after receiving a cementitious repair mortar and prior to application of the
12 approved lining system.
13

14 F. All surfaces should be inspected during and after preparation and before the
15 protective coating is applied.
16

17 3.06 APPLICATION LINING SYSTEM

18
19 A. Application procedures shall conform to recommendations of the
20 manufacturer, including materials handling, mixing, environmental controls
21 during application, safety and spray equipment.
22

23 B. Spray equipment shall be specifically designed to accurately ratio and apply
24 the liner system.
25

26 C. Application of lining system shall be in strict accordance with manufacturer's
27 recommendation. Finished thickness of the lining system shall be a
28 minimum of 125 mils thick. A permanent identification and date of work
29 performed shall be affixed to the structure in a readily visible location.
30

31 1. All specified surface preparation shall be performed in accordance
32 with the latest version of the SSPC, NACE, ICRI and other standards
33 referenced in this section.
34

35 2. The newly applied mortar and the existing concrete surfaces shall be
36 abraded to produce a minimum surface profile of equal to 40-grit
37 sandpaper with no loose concrete remaining by abrasive blast
38 cleaning. This preparation will be followed by vacuum cleaning to
39 remove all dust, dirt or friable substances leaving clean, dust free
40 surfaces for resurfacing.
41

42 3. Verify that the pH of the concrete surfaces to be coated is within the
43 range of 9 to 11. Application of coating materials outside this range
44 will not be permitted without written approval from the Engineer and
45 Manufacturer.

1
2 D. All phases of surface preparation work specified herein must be inspected
3 by the Engineer before the Contractor proceeds with the subsequent phase
4 of surface preparation.

5
6 E. Observe limitation times and related temperature range restrictions
7 between successive lifts for all products specified herein per Manufacturer's
8 stated requirements.

9
10 F. Coatings must be inspected after application for pinholes.

11
12 G. All equipment and procedures used for the resurfacing system application
13 shall be as recommended by the Manufacturer. Unless specified elsewhere
14 herein, the Contractor shall comply with the Manufacturer's most recent
15 written instructions with respect to the following:

- 16
17 a. Mixing of All Materials
18 b. Protection and Handling of All Materials
19 c. Recoat Limitation and Cure Times
20 d. Minimum Ambient and Substrate Temperatures
21 e. Substrate's Degree of Dryness
22 f. Relative Humidity and Dew Point of Air
23 g. Application.
24 h. Final Curing.
25 i. Use of Proper Application Equipment.

26
27 H. Curing of Resurfacing System:

28
29 The applied lining system shall be protected from damage during curing and
30 shall be cured as recommended by the Manufacturer. Ambient conditions
31 shall be controlled by the Contractor during curing to ensure the minimum
32 air temperature and minimum relative humidity as required by the
33 Manufacturer are maintained.

34
35 I. Safety And Ventilation Requirements:

36
37 Requirements for safety and ventilation shall be in accordance with SSPC
38 Paint Application Guide No. 3.

39
40 3.07 FIELD QUALITY CONTROL INSPECTION AND TESTING

41
42 A. Inspection by the Engineer or others does not limit the Contractor's
43 responsibilities for quality control inspection and testing as specified herein
44 or as required by the Manufacturer's instructions.

45

- 1 B. Perform the quality control procedures listed below in conjunction with the
2 requirements of this Section.
3
- 4 1. Inspect all materials upon receipt to ensure that all are supplied by
5 the Manufacturer.
6
- 7 2. Provide specified storage conditions for the resurfacing system
8 materials, solvents, and abrasives.
9
- 10 3. The pH of the concrete substrate will be measured using pH-
11 indicating papers. pH testing is to be performed once every 50 sq.
12 ft. Acceptable pH values shall be between 9.0 and 11.0 as measured
13 by a full range (1-12) color indicating pH paper with readable color
14 calibrations and a scale at whole numbers (minimum). Use Hydrion
15 Insta-Check Jumbo 0-13 or 1-12 or equal. The paper shall be
16 touched to the surface once using moderate gloved finger pressure.
17 The surface shall not be wiped or moved laterally to disturb the
18 surface during pH testing. Following the one touch, lift the paper
19 vertically to not “wipe” the surface. Compare the color indicated with
20 the scale provided and record the pH.
21
- 22 4. Inspect and record substrate profile (anchor pattern). Surfaces shall
23 be abraded, as a minimum, equal to the roughness of 60 grit sand
24 paper.
25
- 26 5. Measure and record ambient air temperature once every two hours
27 of each shift using a thermometer and measure and record substrate
28 temperature once every two hours using a surface thermometer.
29
- 30 6. Measure and record relative humidity every two hours of each shift
31 using a sling psychrometer in accordance with ASTM E337.
32
- 33 C. Provide correct mixing of resurfacing materials in accordance with the
34 Manufacturer’s instructions.
35
- 36 D. Inspect and record that the “pot life” of resurfacing materials are not
37 exceeded during installation.
38
- 39 E. Verify curing of the resurfacing materials in accordance with the
40 Manufacturer’s instructions.
41
- 42 F. High Voltage Spark Test: After the lining coating has set hard to the touch
43 it shall be inspected with high-voltage holiday detection equipment. Surface
44 shall first be dried, an induced holiday shall then be made on to the coated
45 concrete or metal surface and shall serve to determine the

1 minimum/maximum voltage to be used to test the coating for holidays at
2 that particular area. The spark tester shall be initially set at 100 volts per 1
3 mil (25 microns) of film thickness applied but may be adjusted as necessary
4 to detect the induced holiday (refer to NACE RPO188-99 or D4787
5 Continuity Testing of Liquid or Sheet Liners On Concrete-Holidays). All
6 detected holidays shall be marked and repaired by abrading the coating
7 surface with grit disk paper or other hand tooling method. After abrading
8 and cleaning, additional protective coating material can be hand applied to
9 the repair area. All touch-up/repair procedures shall follow the protective
10 coating manufacturer's recommendations.

- 11
- 12 G. Upon completion of the lining system installation, the lined area shall be
13 cleaned and prepared to permit close visual inspection by the Engineer or
14 the Engineer's Representative. Any and all deficiencies or defective work
15 (not in compliance with this section or related sections) will be marked for
16 repair or removal/replacement by the Contractor at no additional cost to the
17 Owner.

18

19 3.08 ACCEPTANCE CRITERIA

- 20
- 21 A. Acceptance Criteria for Surface Preparation Work: All surfaces shall be
22 prepared in accordance with the specification and referenced standards
23 herein.
- 24
- 25 B. Acceptance Criteria for Coating System Application Work: Acceptable
26 coating work will be based upon the following:
- 27 1. No pockmarks, trowel marks, depressions, unconsolidated areas,
28 waviness or ridges, pinholes or holidays in either size or frequency.
- 29 2. No inter-coat bond failures between lifts.
- 30 3. Proper curing of coatings.
- 31
- 32 C. Resurfaced areas shall pitch to drains. There shall be no areas that puddle
33 when flood tested.
- 34
- 35 D. The Engineer or Owner shall, at their discretion, inspect the following:
- 36
- 37 1. Profile and degree of cleanliness of substrate.
- 38 2. Thickness of materials/coverage rate confirmation.
- 39 3. Ambient temperature and humidity requirements, and substrate
40 temperature.
- 41 4. Curing and recoat times.
- 42 5. Proper curing of the resurfacing materials.
- 43
- 44 E. Rework required on any holidays or any other inadequacies found by the
45 Engineer or the Engineer's representative in the quality of the coating work

1 should be marked. Such areas shall be recleaned and reworked by the
2 Contractor according to these specifications and the manufacturer's
3 recommendations at no additional cost to the Owner.
4

5 F. The Contractor is responsible for keeping the Engineer informed of all
6 progress so that inspection for quality can be achieved.
7

8 G. The Contractor is ultimately responsible for the quality performance of the
9 applied materials and workmanship. Inspections by the Engineer or the
10 Engineer's Representative do not limit this responsibility.
11

12 3.09 FINAL INSPECTION
13

14 A. Perform a final inspection to determine whether the lining system work
15 meets the requirements of the specifications. The Engineer and the Owner
16 will conduct final inspection with the Contractor.
17

18 END OF SECTION
19
20

1 SECTION 03480

2
3 PRECAST CONCRETE

4
5 PART 1 - GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. Scope of Work: This section includes providing all materials, labor and
10 equipment to construct and install the precast concrete sump as described
11 herein and/or shown on the Drawings.

12
13 1.02 SUBMITTALS

- 14
15 A. Materials and Shop Drawings: Submit manufacturer's catalog data on
16 precast concrete structures and accessories. Show all dimensions and
17 materials of construction by ASTM reference and grade.

18
19 PART 2 - PRODUCTS

20
21 2.01 MATERIALS

22
23 A. Precast Sump

- 24
25 1. All precast structures shall be new, unused and manufactured for this
26 project.
27
28 2. Precast concrete structures shall be manufactured in a plant
29 especially designed for that purpose and shall conform to the shapes
30 and dimensions indicated on the drawings.
31
32 3. All precast structures shall be designed by a Professional Engineer
33 retained by the Contractor.
34
35 4. Design loads shall consist of dead load, live load, impact, and loads
36 due to water table, as well as other loads which may be imposed
37 upon the structure.
38
39 5. Forms used for precast concrete shall be of metal and sufficiently
40 designed and braced to maintain their alignment under pressures of
41 the concrete during placing.

42
43 B. Concrete

- 44
45 1. Aggregates: All aggregates, fine and coarse, other than lightweight

1 aggregates, fine and coarse, shall conform to ASTM C-330.
2 Aggregates shall be free of deleterious substances causing reactivity
3 with oxidized hydrogen sulfide. Both types of aggregate shall be
4 graded in a manner so as to produce a homogenous concrete mix.
5 All materials are to be accurately weighed at a central batching
6 facility for mixing.
7

8 2. Precast Structures shall conform to the requirements of ASTM
9 Specification C478. Concrete used in their manufacture shall have
10 a 28-day compressive strength of not less than 4,000 pounds per
11 square inch and the absorption shall not exceed six (6) percent.
12

13 3. Placing: All concrete shall be handled from the mixer or transport
14 vehicle to the place of final deposit in a continuous manner, as rapidly
15 as practicable, and without segregation or loss of ingredients, until
16 the approved unit is completed. Concrete shall be placed in layers
17 not over 2 feet deep. Each layer shall be compacted by mechanical
18 internal or external vibrating equipment. Duration of the vibration
19 cycle shall be limited to the time necessary to produce satisfactory
20 consolidation without causing objectionable segregation.
21

22 4. Curing:

23
24 a. For purposes of early reuse of forms, precast concrete may
25 be steam cured after an initial set has taken place. The steam
26 temperature shall not exceed 160 degrees Fahrenheit (°F),
27 and the temperature shall be raised from normal ambient
28 temperatures at a rate not to exceed 40°F per hour.
29

30 b. The steam cured unit shall not be removed from the forms
31 until sufficient strength is obtained for the unit to withstand any
32 structural strain to which it may be subjected during the form
33 stripping operation. After the stripping of forms, further curing
34 by means of water spraying or a membrane curing compound
35 may be used, and shall be of a clear or white type, conforming
36 to ASTM C-309.
37

38 5. Reinforcing steel shall be sufficiently tied to withstand any
39 displacement during the pouring operation. All bars shall be
40 intermediate or hard grade billet steel conforming to ASTM A-615.
41

42 C. Sealing Compound and Grout: Plastic sealing compound shall comply with
43 Federal Specifications SS-S-02210. Mortar shall comply with ASTM C-387,
44 Type S, or use grout complying with Section 03600: Grout.
45

1 PART 3 – EXECUTION

2

3 3.01 INSPECTION

4

5 A. Earthwork: The Contractor shall prepare an excavation large enough to
6 accommodate the structure and permit sealing of openings.

7

8 B. Excavation and backfill shall be as specified in Section 02222.

9

10

11

12

END OF SECTION

1
2

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SECTION 03600

GROUT

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install grout complete as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

- A. Submit to the Engineer shop drawings and product data showing materials of construction and details of installation for:

- 1. Commercially manufactured non-shrink cementitious grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.
- 2. Commercially manufactured non-shrink epoxy grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.
- 3. Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures and the proposed mix of the grout.
- 4. Concrete grout. The submittal shall include the mix design, constituent quantities per cubic yard, the water/cement ratio, and fiber reinforcement.

B. Laboratory Test Reports

- 1. Submit laboratory test data as requested by the Engineer.

C. Certifications

- 1. Where applicable, certify that commercially manufactured grout products and concrete grout admixtures are suitable for use in contact with potable water after 30 days curing.

D. Qualifications

- 1. Grout manufacturers shall submit documentation that they have at least

1 10 years of experience in the production and use of the proposed grouts
2 to be supplied.

3
4 1.03 REFERENCE STANDARDS

5
6 A. American Society for Testing and Materials (ASTM)

- 7
8 1. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient
9 of Thermal Expansion of Chemical Resistant Mortars, Grouts and
10 Monolithic Surfacing and Polymer Concretes
11
12 2. ASTM C579 - Standard Test Method for Compressive Strength of
13 Chemical Resistant Mortars, Grouts and Monolithic Surfacing and
14 Polymer Concretes
15
16 3. ASTM C827 - Standard Test Method for Change in Height at Early Ages
17 of Cylindrical Specimens from Cementitious Mixtures
18
19 4. ASTM C1107 - Standard Specification for Packaged Dry,
20 Hydraulic-Cement Grout (Non-shrink)
21

22 B. U.S. Army Corps of Engineers Standard (CRD)

- 23
24 1. CRD C-621 - Corps of Engineers Specification for Non-shrink Grout
25

26 C. Where reference is made to one of the above standards, the revision in effect
27 at the time of bid opening shall apply.
28

29 1.04 QUALITY ASSURANCE

30
31 A. Qualifications

- 32
33 1. Grout manufacturer shall have a minimum of 10 years of experience in
34 the production and use of the type of grout proposed for the work.
35

36 B. Pre-installation Conference

- 37
38 1. Where specifically required, and well in advance of grouting, conduct a
39 pre-installation meeting to review the requirements for surface
40 preparation, mixing, placing, and curing procedures for each product
41 proposed for use. Parties concerned with grouting shall be notified of the
42 meeting at least 10 days prior to its scheduled date.
43

44 C. Services of Manufacturer's Representative

- 45
46 1. A qualified field technician of the non-shrink grout manufacturer,
47 specifically trained in the installation of the products, shall attend the

1 pre-installation conference and shall be present for the initial installation
2 of each type of non-shrink grout. Additional services shall also be
3 provided, as required, to correct installation problems.
4

5 D. Field Testing
6

- 7 1. All field testing and inspection services required shall be provided by the
8 Owner. The Contractor shall assist in the sampling of materials and shall
9 provide any ladders, platforms, etc., for access to the work. The methods
10 of testing shall comply in detail with the applicable ASTM Standards.
11

12 1.05 DELIVERY, STORAGE AND HANDLING
13

- 14 A. Deliver materials to the jobsite in original, unopened packages, clearly labeled
15 with the manufacturer's name, product identification, batch numbers and printed
16 instructions.
17
18 B. Store materials in full compliance with the manufacturer's recommendations.
19 Total storage time from date of manufacture to date of installation shall be
20 limited to 6 months or the manufacturer's recommended storage time,
21 whichever is less.
22
23 C. Material that becomes damp or otherwise unacceptable shall be immediately
24 removed from the site and replaced with acceptable material at no additional
25 cost to the Owner.
26
27 D. Non-shrink, cement-based grouts shall be delivered as pre-blended,
28 prepackaged mixes requiring only the addition of water.
29
30 E. Non-shrink epoxy grouts shall be delivered as pre-measured, prepackaged,
31 three component systems requiring only blending as directed by the
32 manufacturer.
33

34 1.06 DEFINITIONS
35

- 36 A. Non-shrink Grout: A commercially manufactured product that does not shrink
37 in either the plastic or hardened state, is dimensionally stable in the hardened
38 state and bonds to a clean base plate.
39

40 PART 2 – PRODUCTS
41

42 2.01 GENERAL
43

- 44 A. The use of a manufacturer's name and product or catalog number is for the
45 purpose of establishing the standard of quality desired.
46
47 B. Like materials shall be the products of one manufacturer or supplier in order to

1 provide standardization of appearance.
2
3

4 2.02 MATERIALS
5

6 A. Non-shrink Cementitious Grout
7

- 8 1. Non-shrink cementitious grouts shall meet or exceed the requirements of
9 ASTM C1107, Grades B or C and CRD C-621. Grouts shall be Portland
10 cement based, contain a pre-proportioned blend of selected aggregates
11 and shrinkage compensating agents and shall require only the addition
12 of water. Non-shrink cementitious grouts shall not contain expansive
13 cement or metallic particles. The grouts shall exhibit no shrinkage when
14 tested in conformity with ASTM C827.
15
16 2. General purpose non-shrink cementitious grout shall conform to the
17 standards stated above and shall be SikaGrout 212 by Sika Corp.; Set
18 Grout by Master Builders, Inc.; Gilco Construction Grout by Gifford Hill &
19 Co.; Euco NS by The Euclid Chemical Co.; NBEC Grout by U. S. Grout
20 Corp. or equal.
21
22 3. Flowable (Precision) non-shrink cementitious grout shall conform to the
23 standards stated above and shall be Masterflow 928 by Master Builders,
24 Inc.; Hi-Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika
25 Corp.; Supreme Grout by Gifford Hill & Co.; Five Star Grout by U. S.
26 Grout Corp. or equal.
27

28 B. Non-shrink Epoxy Grout
29

- 30 1. Non-shrink epoxy-based grout shall be a pre-proportioned, three
31 component, 100 percent solids system consisting of epoxy resin,
32 hardener, and blended aggregate. It shall have a compressive strength
33 of 14,000 psi in 7 days when tested in conformity with ASTM D695 and
34 have a maximum thermal expansion of 30×10^{-6} when tested in
35 conformity with ASTM C531. The grout shall be Ceilcote 648 CP by
36 Master Builders Inc.; Five Star Epoxy Grout by U.S. Grout Corp.; Sikadur
37 42 Grout-Pak by Sika Corp.; High Strength Epoxy Grout by the Euclid
38 Chemical Co. or equal.
39

40 C. Cement Grout
41

- 42 1. Cement grouts shall be a mixture of one-part portland cement conforming
43 to ASTM C150, Types I, II, or III and 1 to 2 parts sand conforming to
44 ASTM C33 with sufficient water to place the grout. The water content
45 shall be sufficient to impart workability to the grout but not to the degree
46 that it will allow the grout to flow.
47

1 D. Concrete Grout

2
3 1. Concrete grout shall be proportioned with cement, [pozzolan,] coarse and
4 fine aggregates, water, water reducer and air entraining agent to produce
5 a mix having an average strength of 2900 psi at 28 days, or 2500 psi
6 nominal strength. Coarse aggregate size shall be [3/8] [1/2]-in maximum.
7 Slump should not exceed 5-in and should be as low as practical yet still
8 retain sufficient workability.

9
10 2. Synthetic reinforcing fibers shall be added to the concrete grout mix at
11 the rate of 1.5 lbs of fibers per cubic yard of grout. Fibers shall be added
12 from the manufacturer's premeasured bags and according to the
13 manufacturer's recommendations in a manner that will ensure complete
14 dispersion of the fiber bundles as single monofilaments within the
15 concrete grout.

16
17 E. Water

18
19 1. Potable water, free from injurious amounts of oil, acid, alkali, organic
20 matter, or other deleterious substances.

21
22 PART 3 – EXECUTION

23
24 3.01 PREPARATION

25
26 A. Grout shall be placed over cured concrete which has attained its full design
27 strength unless otherwise directed by the Engineer.

28
29 B. Concrete surfaces to receive grout shall be clean and sound; free of ice, frost,
30 dirt, grease, oil, curing compounds, laitance, and paints and free of all loose
31 material or foreign matter that may affect the bond or performance of the grout.

32
33 C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical
34 means to ensure bond of the grout to the concrete. Remove loose or broken
35 concrete. Irregular voids or projecting coarse aggregate need not be removed
36 if they are sound, free of laitance and firmly embedded into the parent concrete.

37
38 1. Air compressors used to clean surfaces in contact with grout shall be the
39 oil-less type or equipped with an oil trap in the air line to prevent oil from
40 being blown onto the surface.

41
42 D. Remove all loose rust, oil or other deleterious substances from metal
43 embedments or bottom of base plates prior to the installation of the grout.

44
45 E. Concrete surfaces shall be washed clean and then kept moist for at least 24
46 hours prior to the placement of cementitious or cement grout. Saturation may
47 be achieved by covering the concrete with saturated burlap bags, use of a

1 soaker hose, flooding the surface, or other method acceptable to the Engineer.
2 Upon completion of the 24-hour period, visible water shall be removed from the
3 surface prior to grouting. The use of an adhesive bonding agent in lieu of
4 surface saturation shall only be used when directed by the Engineer for each
5 specific location of grout installation.
6

7 F. Epoxy-based grouts do not require the saturation of the concrete substrate.
8 Surfaces in contact with epoxy grout shall be completely dry before grouting.
9

10 G. Construct grout forms or other leak-proof containment as required. Forms shall
11 be lined or coated with release agents recommended by the grout manufacturer.
12 Forms shall be of adequate strength, securely anchored in place and shored to
13 resist the forces imposed by the grout and its placement.
14

15 1. Forms for epoxy grout shall be designed to allow the formation of a
16 hydraulic head and shall have chamfer strips built into forms.
17

18 H. Level and align the structural or equipment bearing plates in accordance with
19 the structural requirements and the recommendations of the equipment
20 manufacturer.
21

22 I. Equipment shall be supported during alignment and installation of grout by
23 shims, wedges, blocks, or other means. The shims, wedges and blocking
24 devices shall be prevented from bonding to the grout by appropriate bond
25 breaking coatings and removed after grouting unless otherwise directed by the
26 Engineer.
27

28 3.02 INSTALLATION - GENERAL 29

30 A. Mix, apply and cure products in strict compliance with the manufacturer's
31 recommendations and this Section.
32

33 B. Have sufficient manpower and equipment available for rapid and continuous
34 mixing and placing. Keep all necessary tools and materials ready and close at
35 hand.
36

37 C. Maintain temperatures of the foundation plate, supporting concrete, and grout
38 between 40 and 90 degrees F during grouting and for at least 24 hours
39 thereafter or as recommended by the grout manufacturer, whichever is longer.
40 Take precautions to minimize differential heating or cooling of base plates and
41 grout during the curing period.
42

43 D. Take special precautions for hot weather or cold weather grouting as
44 recommended by the manufacturer when ambient temperatures and/or the
45 temperature of the materials in contact with the grout are outside of the 60 and
46 90 degrees F range.
47

- 1 E. Install grout in a manner that will preserve the isolation between the elements
2 on either side of the joint where grout is placed in the vicinity of an expansion or
3 control joint.
4
- 5 F. Reflect all existing underlying expansion, control and construction joints through
6 the grout.
7

8 3.03 INSTALLATION - CEMENT GROUTS AND NONSHRINK CEMENTITIOUS
9 GROUTS

- 10
- 11 A. Mix in accordance with manufacturer's recommendations. Do not add cement,
12 sand, pea gravel or admixtures without prior review by the Engineer.
13
- 14 B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is
15 recommended. Pre-wet the mixer and empty excess water. Add premeasured
16 amount of water for mixing, followed by the grout. Begin with the minimum
17 amount of water recommended by the manufacturer and then add the minimum
18 additional water required to obtain workability. Do not exceed the
19 manufacturer's maximum recommended water content.
20
- 21 C. Placements greater than 3-in in depth shall include the addition of clean,
22 washed pea gravel to the grout mix when approved by the manufacturer.
23 Comply with the manufacturer's recommendations for the size and amount of
24 aggregate to be added.
25
- 26 D Place grout into the designated areas in a manner that will avoid segregation,
27 air entrapment or both. Do not vibrate grout to release air or to consolidate the
28 material. Placement should proceed in a manner that will ensure the filling of
29 all spaces and provide full contact between the grout and adjoining surfaces.
30 Provide grout holes as necessary.
31
- 32 E. Place grout rapidly and continuously to avoid cold joints. Do not place cement
33 grouts in layers. Do not add additional water to the mix (retemper) after initial
34 stiffening.
35
- 36 F. Just before the grout reaches its final set, cut back the grout to the substrate at
37 a 45-degree angle from the lower edge of bearing plate unless otherwise
38 directed by the Engineer. Finish this surface with a wood float (brush) finish.
39
- 40 G. Begin curing immediately after form removal, cutback, and finishing. Keep grout
41 moist and within its recommended placement temperature range for at least 24
42 hours after placement or longer if recommended by the manufacturer. Saturate
43 the grout surface by use of wet burlap, soaker hoses, ponding, or other
44 appropriate means. Provide sunshades as necessary. If drying winds inhibit
45 the ability of a given curing method to keep grout moist, erect wind breaks until
46 wind is no longer a problem or curing is finished.
47

1 3.04 INSTALLATION - NONSHRINK EPOXY GROUTS

- 2
- 3 A. Mix in accordance with the procedures recommended by the manufacturer. Do
- 4 not vary the ratio of components or add solvent to change the consistency of
- 5 the grout mix. Do not overmix. Mix full batches only to maintain proper
- 6 proportions of resin, hardener, and aggregate.
- 7
- 8 B. Monitor ambient weather conditions and contact the grout manufacturer for
- 9 special placement procedures to be used for temperatures below 60 or above
- 10 90 degrees F.
- 11
- 12 C. Place grout into the designated areas in a manner which will avoid trapping air.
- 13 Placement methods shall ensure the filling of all spaces and provide full contact
- 14 between the grout and adjoining surfaces. Provide grout holes as necessary.
- 15
- 16 D. Minimize "shoulder" length (extension of grout horizontally beyond base plate).
- 17 In no case shall the shoulder length of the grout be greater than the grout
- 18 thickness.
- 19
- 20 E. Finish grout by puddling to cover all aggregate and provide a smooth finish.
- 21 Break bubbles and smooth the top surface of the grout in conformity with the
- 22 manufacturer's recommendations.
- 23
- 24 F. Epoxy grouts that are self-curing shall not require the application of water.
- 25 Maintain the formed grout within its recommended placement temperature
- 26 range for at least 24 hours after placing, or longer if recommended by the
- 27 manufacturer.
- 28

29 3.05 INSTALLATION - CONCRETE GROUT

- 30
- 31 A. Screed underlying concrete to the grade shown on the Drawings. Provide the
- 32 surface with a broomed finish, aligned to drain. Protect and keep the surface
- 33 clean until placement of concrete grout.
- 34
- 35 B. Remove the debris and clean the surface by sweeping and vacuuming of all dirt
- 36 and other foreign materials. Wash the tank slab using a strong jet of water.
- 37 Flushing of debris into tank drain lines will not be permitted.
- 38
- 39 C. Saturate the concrete surface for at least 24 hours prior to placement of the
- 40 concrete grout. Saturation may be maintained by ponding, by the use of soaker
- 41 hoses, or by other methods acceptable to the Engineer. Remove excess water
- 42 just prior to placement of the concrete grout. Place a cement slurry immediately
- 43 ahead of the concrete grout so that the slurry is moist when the grout is placed.
- 44 Work the slurry over the surface with a broom until it is coated with
- 45 approximately 1/16 to 1/8-in thick cement paste. A bonding grout composed of
- 46 1 part portland cement, 1.5 parts fine sand, a bonding admixture and water,
- 47 mixed to achieve the consistency of thick paint, may be substituted for the

1 cement slurry.

- 2
- 3 D. Place concrete grout to final grade using the scraper mechanism as a guide for
- 4 surface elevation and to ensure high and low spots are eliminated. Unless
- 5 specifically approved by the equipment manufacturer, mechanical scraper
- 6 mechanisms shall not be used as a finishing machine or screed.
- 7
- 8 E. Provide grout control joints as indicated on the Drawings.
- 9
- 10 F. Finish and cure the concrete grout as specified for cast-in-place concrete.

11

12 3.06 SCHEDULE

13

- 14 A. The following list indicates where the particular types of grout are to be used:
- 15
- 16 1. General purpose non-shrink cementitious grout: Use at all locations
- 17 where non shrink grout is called for on the plans except for base plates
- 18 greater in area than 3-ft wide by 3-ft long and except for the setting of
- 19 anchor rods, anchor bolts or reinforcing steel in concrete.
- 20
- 21 2. Flowable non-shrink cementitious grout: Use under all base plates
- 22 greater in area than 3-ft by 3-ft. Use at all locations indicated to receive
- 23 flowable non-shrink grout by the Drawings. The Contractor, at his/her
- 24 option and convenience, may also substitute flowable non-shrink grout
- 25 for general purpose non-shrink cementitious grout.
- 26
- 27 3. Non-shrink epoxy grout: Use for the setting of anchor rods, anchor bolts
- 28 and reinforcing steel in concrete and for all locations specifically indicated
- 29 to receive epoxy grout.
- 30
- 31 4. Cement grout: Cement grout may be used for grouting of incidental base
- 32 plates for structural and miscellaneous steel such as post base plates for
- 33 platforms, base plates for beams, etc. It shall not be used when
- 34 nonshrink grout is specifically called for on the Drawings or for grouting
- 35 of primary structural steel members such as columns and girders.
- 36
- 37 5. Concrete grout: Use for overlaying the base concrete under scraper
- 38 mechanisms of clarifiers to allow more control in placing the surface
- 39 grade.
- 40

41 END OF SECTION

42

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1 SECTION 03740

2
3 MODIFICATIONS AND REPAIR TO CONCRETE

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. Furnish all labor, materials, equipment and incidentals required and cut,
10 remove, repair or otherwise modify parts of existing concrete structures or
11 appurtenances as shown on the Drawings and as specified herein. Work under
12 this Section shall also include bonding new concrete to existing concrete.

13
14 1.02 SUBMITTALS

- 15
16 A. Submit to the Engineer a Schedule of Demolition and the detailed methods of
17 demolition to be used at each location.
18
19 B. Submit manufacturer's technical literature on all product brands proposed for
20 use, to the Engineer for review. The submittal shall include the manufacturer's
21 installation and/or application instructions.
22
23 C. When substitutions for acceptable brands of materials specified herein are
24 proposed, submit brochures and technical data of the proposed substitutions to
25 the Engineer before delivery to the project.

26
27 1.03 REFERENCE STANDARDS

- 28
29 A. American Society for Testing and Materials (ASTM)
- 30
31 1. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding
32 Systems for Concrete.
 - 33
34 2. ASTM C882 - Standard Test Method for Bond Strength of Epoxy-Resin
35 Systems Used with Concrete by Slant Shear.
 - 36
37 3. ASTM C883 - Standard Test Method for Effective Shrinkage of
38 Epoxy-Resin Systems Used with Concrete.
 - 39
40 4. ASTM D570 - Standard Test Method for Water Absorption of Plastics.
 - 41
42 5. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
 - 43
44 6. ASTM D695 - Standard Test Method for Compressive Properties of Rigid
45 Plastics.
- 46

1 7. ASTM D732 - Standard Test Method for Shear Strength of Plastics by
2 Punch Tool.

3
4 8. ASTM D790 - Standard Test Methods for Flexural Properties of
5 Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
6

7 B. Where reference is made to one of the above standards, the revision in effect
8 at the time of bid opening shall apply.
9

10 1.04 QUALITY ASSURANCE

11
12 A. No existing structure or concrete shall be shifted, cut, removed, or otherwise
13 altered until authorization is given by the Engineer.
14

15 B. When removing materials or portions of existing structures and when making
16 openings in existing structures, all precautions shall be taken and all necessary
17 barriers, shoring and bracing and other protective devices shall be erected to
18 prevent damage to the structures beyond the limits necessary for the new work,
19 protect personnel, control dust and to prevent damage to the structures or
20 contents by falling or flying debris. Unless otherwise permitted, shown or
21 specified, line drilling will be required in cutting existing concrete.
22

23 C. Manufacturer Qualifications: The manufacturer of the specified products shall
24 have a minimum of 10 years of experience in the manufacture of such products
25 and shall have an ongoing program of training, certifying and technically
26 supporting the Contractor's personnel.
27

28 1.05 DELIVERY, STORAGE AND HANDLING

29
30 A. Deliver the specified products in original, unopened containers with the
31 manufacturer's name, labels, product identification and batch numbers.
32

33 B. Store and condition the specified product as recommended by the
34 manufacturer.
35

36 PART 2 – PRODUCTS

37 38 2.01 MATERIALS

39
40 A. General

41
42 1. Materials shall comply with this Section and any state or local
43 regulations.
44

45 B. Epoxy Bonding Agent
46

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1. General

- a. The epoxy bonding agent shall be a two-component, solvent-free, asbestos-free moisture insensitive epoxy resin material used to bond plastic concrete to hardened concrete complying with the requirements of ASTM C881, Type II and the additional requirements specified herein.

2. Material

- a. Properties of the cured material:

- 1) Compressive Strength (ASTM D695): 8500 psi minimum at 28 days.
- 2) Tensile Strength (ASTM D638): 4000 psi minimum at 14 days.
- 3) Flexural Strength (ASTM D790 - Modulus of Rupture): 6,300 psi minimum at 14 days.
- 4) Shear Strength (ASTM D732): 5000 psi minimum at 14 days.
- 5) Water Absorption (ASTM D570 - 2 hour boil): One percent maximum at 14 days.
- 6) Bond Strength (ASTM C882) Hardened to Plastic: 1500 psi minimum at 14 days moist cure.
- 7) Effective Shrinkage (ASTM C883): Passes Test.
- 8) Color: Gray.

- 3. Manufacturers include: Sika Corporation, Lyndhurst, NJ - Sikadur 32, Hi-Mod; Master Builder's, Cleveland, OH - Concesive Liquid (LPL) or equal.

C. Epoxy Paste

1. General

- a. Epoxy Paste shall be a two-component, solvent-free, asbestos free, moisture insensitive epoxy resin material used to bond dissimilar materials to concrete such as setting railing posts, dowels, anchor bolts and all-threads into hardened concrete and

1 shall comply with the requirements of ASTM C881, Type I, Grade
2 3 and the additional requirements specified herein. It may also be
3 used to patch existing surfaces where the glue line is 1/8-in or
4 less.

5
6 2. Material

7
8 a. Properties of the cured material:

- 9
10 1) Compressive Properties (ASTM D695): 10,000 psi
11 minimum at 28 days.
12
13 2) Tensile Strength (ASTM D638): 3,000 psi minimum at 14
14 days. Elongation at Break - 0.3 percent minimum.
15
16 3) Flexural Strength (ASTM D790 - Modulus of Rupture):
17 3,700 psi minimum at 14 days.
18
19 4) Shear Strength (ASTM D732): 2,800 psi minimum at 14
20 days.
21
22 5) Water Absorption (ASTM D570): 1.0 percent maximum at
23 7 days.
24
25 6) Bond Strength (ASTM C882): 2,000 psi at 14 days moist
26 cure.
27
28 7) Color: Concrete grey.

29
30 3. Manufacturers include:

- 31
32 a. Overhead applications: Sika Corporation, Lyndhurst, NJ - Sikadur
33 Hi-mod LV 31; Master Builders, Inc., Cleveland, OH - Concessive
34 1438 or equal.
35
36 b. Sika Corporation, Lyndhurst, N.J. - Sikadur Hi-mod LV 32; Master
37 Builders, Inc., Cleveland, OH - Concessive 1438 or equal.

38
39 D. Non-Shrink Precision Cement Grout, Non-Shrink Cement Grout, Non-Shrink
40 Epoxy Grout and Polymer Modified mortar are included in Section 03600
41 GROUT.

42
43 E. Adhesive Capsule type anchor system shall be equal to the HVA adhesive
44 Anchoring System by Hilti Fastening Systems, Tulsa, OK. The capsule shall
45 consist of a sealed glass capsule containing premeasured amounts of a
46 polyester or vinylester resin, quartz sand aggregate and a hardener contained

1 in a separate vial within the capsule.
2

3 F. Acrylic Latex Bonding Agent
4

5 G. Crack Repair Epoxy Adhesive
6

7 1. General
8

- 9 a. Crack Repair Epoxy Adhesive shall be a two-component,
10 solvent-free, moisture insensitive epoxy resin material suitable for
11 crack grouting by injection or gravity feed. It shall be formulated
12 for the specific size of opening or crack being injected.
13
14 b. All concrete surfaces containing potable water or water to be
15 treated for potable use that are repaired by the epoxy adhesive
16 injection system shall be coated with an acceptable epoxy coating
17 approved by the FDA for use in contact with potable water.
18

19 2. Material
20

21 a. Properties of the cured material
22

- 23 1) Compressive Properties (ASTM D695): 10,000 psi
24 minimum at 28 days.
25
26 2) Tensile Strength (ASTM D638): 5,300 psi minimum at 14
27 days. Elongation at Break - 2 to 5 percent.
28
29 3) Flexural Strength (ASTM D790 - Modulus of Rupture):
30 12,000 psi minimum at 14 days (gravity); 4,600 psi
31 minimum at 14 days (injection)
32
33 4) Shear Strength (ASTM D732): 3,700 psi minimum at 14
34 days.
35
36 5) Water Absorption (ASTM D570 - 2 hour boil): 1.5 percent
37 maximum at 7 days.
38
39 6) Bond Strength (ASTM C882): 2,400 psi at 2 days dry;
40 2,000 psi at 14 days dry plus 12 days moist.
41
42 7) Effective Shrinkage (ASTM 883): Passes Test.
43

44 3. Manufacturers include:
45

- 46 a. For standard applications: Sika Corporation, Lyndhurst,

1 NJ - Sikadur Hi-Mod; Master Builders Inc., Cleveland,
2 OH - Concessive 1380 or equal.

- 3
4 b. For very thin applications; Sika Corporation, Lyndhurst,
5 NJ - Sikadur Hi-Mod LV; Master Builders Inc., Cleveland,
6 OH - Concessive 1468 or equal.
7

8 PART 3 – EXECUTION

9 10 3.01 GENERAL

- 11
12 A. Cut, repair, reuse, demolish, excavate, or otherwise modify parts of the existing
13 structures or appurtenances, as indicated on the Drawings, specified herein, or
14 necessary to permit completion of the Work. Finishes, joints, reinforcements,
15 sealants, etc., are specified in respective Sections. All work shall comply with
16 other requirements of this of Section and as shown on the Drawings.
17
18 B. All commercial products specified in this Section shall be stored, mixed, and
19 applied in strict compliance with the manufacturer's recommendations.
20
21 C. In all cases where concrete is repaired in the vicinity of an expansion joint, or
22 control joint the repairs shall be made to preserve the isolation between
23 components on either side of the joint.
24
25 D. When drilling holes for dowels/bolts in new or existing concrete, drilling shall
26 stop if rebar is encountered, and the hole location shall be relocated to avoid
27 rebar. Rebar shall not be cut without prior review by the Engineer. Where
28 possible, rebar locations shall be identified prior to drilling using "rebar locators"
29 so that drilled hole locations may be adjusted to avoid rebar interference.
30

31 3.02 CONCRETE REMOVAL

- 32
33 A. Concrete designated to be removed to specific limits as shown on the Drawings
34 or directed by the Engineer, shall be done by saw cutting or line drilling at limits
35 followed by chipping or jack-hammering as appropriate in areas where concrete
36 is to be taken out. Remove concrete in such a manner that surrounding
37 concrete or existing reinforcing to be left in place and existing in place
38 equipment is not damaged.
39
40 B. Where existing reinforcing is exposed due to saw cutting/core drilling and no
41 new material is to be placed on the sawcut surface, a coating or surface
42 treatment of epoxy paste shall be applied to the entire cut surface to a thickness
43 of 1/4-in.
44
45 C. In all cases where the joint between new concrete or grout and existing concrete
46 will be exposed in the finished work, except as otherwise shown or specified,

1 the edge of concrete removal shall be a 1-in deep saw cut on each exposed
2 surface of the existing concrete.

- 3
4 D. Concrete specified to be left in place which is damaged shall be repaired.
5
6 E. The Engineer may from time to time direct the Contractor to make additional
7 repairs to existing concrete. These repairs shall be made as specified or by
8 such other methods as may be appropriate.
9

10 3.03 CONNECTION SURFACE PREPARATION

- 11
12 A. Connection surfaces shall be prepared as specified below for concrete areas
13 requiring patching, repairs or modifications as shown on the Drawings, specified
14 herein, or as directed by the Engineer.
15
16 B. Remove all deteriorated materials, dirt, oil, grease, and all other bond inhibiting
17 materials from the surface by dry mechanical means. Ensure the areas are at
18 minimum 1/2-in in depth. Irregular voids or surface stones need not be removed
19 if they are sound, free of laitance, and firmly embedded into parent concrete,
20 subject to the Engineer's final inspection.
21
22 C. If reinforcing steel is exposed, it must be mechanically cleaned to remove all
23 contaminants and rust. If half of the diameter of the reinforcing steel is exposed,
24 chip out behind the steel. The distance chipped behind the steel shall be a
25 minimum of 1/2-in. Reinforcing to be saved shall not be damaged during the
26 demolition operation.
27
28 D. Reinforcing from existing demolished concrete which is shown to be
29 incorporated in new concrete shall be cleaned by mechanical means to remove
30 all loose material and products of corrosion before proceeding with the repair.
31 It shall be cut, bent, or lapped to new reinforcing as shown on the Drawings and
32 provided with 1-in minimum cover all around.
33
34 E. The following are specific concrete surface preparation "methods" to be used
35 where called for on the Drawings, specified herein or as directed by the
36 Engineer.
37
38 1. Method A: After the existing concrete surface at connection has been
39 roughened and cleaned, thoroughly moisten the existing surface with
40 water. Brush on a 1/16-in layer of cement and water mixed to the
41 consistency of a heavy paste. Immediately after application of cement
42 paste, place new concrete or grout mixture as detailed on the Drawings.
43
44 2. Method B: After the existing concrete surface has been roughened and
45 cleaned, apply epoxy bonding agent at connection surface. The field
46 preparation and application of the epoxy bonding agent shall comply

1 strictly with the manufacturer's recommendations. Place new concrete
2 or grout mixture to limits shown on the Drawings within time constraints
3 recommended by the manufacturer to ensure bond.
4

5 3. Method C: Drill a hole 1/4-in larger than the diameter of the dowel. The
6 hole shall be blown clear of loose particles and dust just prior to installing
7 epoxy. The drilled hole shall first be filled with [epoxy paste], then
8 dowels/bolts shall be buttered with paste then inserted by tapping.
9 Unless otherwise shown on the Drawings, deformed bars shall be drilled
10 and set to a depth of ten bar diameters and smooth bars shall be drilled
11 and set to a depth of fifteen bar diameters. If not noted on the Drawings,
12 the Engineer will provide details regarding the size and spacing of
13 dowels.
14

15 4. Method D: Combination of Method B and C.
16

17 5. Method E: Capsule anchor system shall be set in existing concrete by
18 drilling holes to the required depth to develop the full tensile and shear
19 strengths of the anchor material being used. The anchor bolts system
20 shall be installed per the manufacturer's recommendation in holes sized
21 as required. The anchor stud bolt, rebar or other embedment item shall
22 be tipped with a double 45-degree chamfered point, securely fastened
23 into the chuck of all rotary percussion hammer drill and drilled into the
24 capsule filled hole. The anchor may be installed in horizontal, vertical
25 and overhead positions.
26

27 3.04 GROUTING

28 A. Grouting shall be as specified in Section 03600.
29

30 3.05 CRACK REPAIR

31 A. Cracks on horizontal surfaces shall be repaired by gravity feeding crack sealant
32 into cracks per manufacturer's recommendations. If cracks are less than 1/16-in
33 in thickness they shall be pressure injected.
34

35 B. Cracks on vertical surfaces shall be repaired by pressure injecting crack sealant
36 through valves sealed to surface with crack repair epoxy adhesive per
37 manufacturer's recommendations.
38
39
40

41
42 END OF SECTION

1 SECTION 05500

2 MISCELLANEOUS METAL

3
4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. Furnish all labor, materials, equipment, and incidentals required and install
10 miscellaneous metals as shown on the Construction Drawings and as
11 specified herein. The miscellaneous metal items include but are not limited
12 to the following:
13
14 1. All metal frames, ladders, stair rails, floor opening frames including
15 gratings and supports.
16
17 2. Prefabricated access hatches and frames.
18
19 3. Anchors and anchor bolts except those specified to be furnished with
20 all equipment.
21
22 4. Railings, posts and supports both interior, and exterior.
23
24 5. Cast iron frames, covers, grates, drain leaders, and drains.
25
26 6. Stair nosings, steel plates, overhead steel door frames, angle
27 frames, plates, and channels.
28
29 7. Guardrails

30
31 1.02 COORDINATION

- 32
33 A. The work in this section shall be completely coordinated with the work of
34 other Sections. Verify at the site both the dimensions and work of other
35 trades adjoining items of work in this Section before fabrication and
36 installation of items herein specified.
37
38 B. Furnish to the pertinent trades all items included under this Section that are
39 to be built into the work of all other Sections.
40

41 1.03 SHOP DRAWINGS AND SAMPLES

- 42
43 A. Detail Drawings, as provided for in the General Conditions, showing sizes
44 of members, method of assembly, anchorage, and connection to other
45 members shall be submitted to the Engineer for review before fabrication.

1
2
3 B. For each fabricated item include drawings, elevations, and details. Show
4 the following:

- 5
6 1. Details of Sections
7 2. Jointing and Connections
8 3. Indicate welded connections using standard AWS symbols; indicate
9 net weld length.
10 4. Reinforcing
11 5. Fasteners and Anchors
12 6. Accessories
13 7. Location of each finish
14

15 C. Manufacturer's specifications, details, and installation instructions. Submit
16 for:

- 17
18 1. All manufactured products used in fabrications.
19

20 D. Samples shall be submitted at the request of the Engineer for concurrent
21 review with shop drawings.
22

23 1.04 JOB CONDITIONS 24

25 A. Field measurements shall be taken at the site to verify or supplement
26 indicated dimensions and to insure proper fitting of all items.
27

28 B. Where fabricated items or their anchors are to be embedded into concrete
29 and masonry work, deliver such items to those performing the installation,
30 together with all coordination Drawings and installation instructions
31 required. Provide temporary bracing or anchors in formwork where required
32 for installation in new concrete or other adjacent work.
33

34 1.05 REFERENCE SPECIFICATIONS 35

36 A. Design, manufacturing, and assembly of elements of the materials herein
37 specified shall be in accordance with the standards of the below listed
38 organizations, except as otherwise shown or specified. Where reference is
39 made to a standard of one of these, or other organizations the version of
40 the standard in effect at the time of bid opening shall apply.
41

- 42 1. Welded and Seamless Steel Pipe ASTM A53
43 2. Gray Iron Castings ASTM A48 (Class 30)
44 3. Galvanizing, general ASTM A123
45 4. Galvanizing, hardware ASTM A153

- | | | | |
|----|-----|---|------------------------------|
| 1 | 5. | Galvanizing, assemblies | ASTM A386 |
| 2 | 6. | Stainless Steel Bolts, Fasteners | AISI, Type 316 |
| 3 | 7. | Stainless Steel Plate and Sheet Wire | AISI, Type 316 |
| 4 | 8. | Welding Rods for Steel | AWS Spec. for Arc
Welding |
| 5 | | | |
| 6 | 9. | ANSI/AWS D1.1-88 -- Structural Welding Code -- Steel; 1988. | |
| 7 | 10. | ANSI/AWS D1.3-81 -- Structural Welding Code -- Sheet Steel; 1981 | |
| 8 | 11. | ASTM A 36/A 36M-88d -- Standard Specification for Structural Steel; 1988. | |
| 9 | | | |
| 10 | 12. | ASTM A 307-88a -- Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength; 1988. | |
| 11 | | | |
| 12 | 13. | ASTM A 501-88 -- Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 1988. | |
| 13 | | | |
| 14 | 14. | ASTM A 563-88a -- Standard Specification for Carbon and Alloy Steel Nuts; 1988. | |
| 15 | | | |
| 16 | 15. | ASTM B 221-85a -- Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes; 1985. | |
| 17 | | | |
| 18 | 16. | FS FF-S-92B -- Screw, Machine: Slotted, Cross-Recessed or Hexagon Head; 1974 (Amended 1975). | |
| 19 | | | |
| 20 | 17. | FS FF-W-84A -- Washers, Lock (Spring); 1967 (Amended 1980). | |
| 21 | 18. | FS FF-W-92B -- Washer, Flat (Plain); 1974. | |
| 22 | 19. | SSPC-PA 1 -- Shop, Field, and Maintenance Painting; Steel Structures Painting Council; 1982. | |
| 23 | | | |
| 24 | 20. | SSPC-Paint 12 -- Cold-Applied Asphalt Mastic (Extra Thick Film); Steel Structures Painting Council; 1982. | |
| 25 | | | |
| 26 | 21. | SSPC-Paint 13 -- Red or Brown One-Coat Shop Paint; Steel Structures Painting Council; 1982. | |
| 27 | | | |
| 28 | 22. | SSPC-SP 1 -- Solvent Cleaning; Steel Structures Painting Council; 1982. | |
| 29 | | | |
| 30 | 23. | SSPC-SP 3 -- Power Tool Cleaning; Steel Structures Painting Council; 1982. | |
| 31 | | | |
| 32 | 24. | SSPC-SP 5 -- White Metal Blast Cleaning; Steel Structures Painting Council; 1985. | |
| 33 | | | |
| 34 | 25. | SSPC-SP 6 -- Commercial Blast Cleaning; Steel Structures Painting Council; 1985. | |
| 35 | | | |
| 36 | 26. | SSPC-SP 8 -- Pickling; Steel Structures Painting Council; 1982. | |
| 37 | 27. | SSPC-SP 10 -- Near-White Blast Cleaning; Steel Structures Painting Council; 1985. | |
| 38 | | | |
| 39 | | | |

40 PART 2 – PRODUCTS

41
42 2.01 ANCHORS, BOLTS, AND FASTENING DEVICES

- 43
44 A. Anchors, bolts, etc., shall be furnished as necessary for installation of the
45 work of this Section.

- 1
2 B. Compound masonry anchors shall be of the type shown or required and
3 shall be equal to Star Slug in compounded masonry anchors manufactured
4 by Star Expansion Industries, equal by Phillips Drill Co., Rahlplug, or equal.
5 Anchors shall be minimum "two unit" type.
6
7 C. The bolts used to attach the various members to the anchors shall be the
8 sizes shown or required. Stainless steel shall be attached to concrete or
9 masonry by means of stainless-steel machine bolts and iron or steel shall
10 be attached with steel machine bolts unless otherwise specifically noted.
11
12 D. For structural purposes, unless otherwise noted, expansion bolts shall be
13 Wej-it "Ankr-Tite", Phillips Drill Co. "Wedge Anchors", or Hilti "Kwik-Bolt".
14 When length of bolt is not called for on the Construction Drawings, the
15 length of bolt provided shall be sufficient to place the wedge portion of the
16 bolt a minimum of 1-inch behind the reinforcing steel within the concrete.
17 Material shall be as noted on the Construction Drawings. If not listed, all
18 materials shall be stainless steel.
19

20 2.02 ALUMINUM ITEMS
21

- 22 A. Aluminum gratings shall be of serrated I-Bar Aluminum Alloy 6063-T6, and
23 shall be Thompson Fabricating Company, Aluminum I-Bar Grating; or
24 equal. Bearing bars shall be 1-1/2 inch minimum. Grating to be of sufficient
25 strength to carry a uniformly distributed live load of not less than 200 pounds
26 per square foot with maximum deflection of 1/4" of the span length. Provide
27 bearing angles, anchors, and bolts constructed of aluminum or stainless
28 steel and as detailed. Grating shall be removable type with standard
29 removable fasteners. Aluminum surfaces in contact with concrete surfaces
30 shall be protected with a special protective lacquer, bituminous coating, or
31 other specified coating in order to keep stains to a minimum. Top surface
32 of all bars shall be flush; ends of gratings shall be provided with binding
33 strips of same depth and thickness as the main bars welded thereto. All
34 openings 2 inches and greater in diameter shall be banded with a bar of the
35 same depth and thickness as the main bearing bars of the grating or
36 furnished with continuous cross bridges. Each cut bar shall be welded to
37 the band if banding is utilized. The ends of all grating sections shall be
38 likewise banded. Clamps and bolts used for attaching grating to supporting
39 members shall be stainless steel. All grating shall be clamped unless noted
40 otherwise. Clamps shall be as recommended by the manufacturer.
41
42 B. Stair treads shall be as specified above for grating and shall have abrasive
43 nonslip nosing.
44

1 C. Aluminum nosing at concrete stairs shall be an extrusion of 4-inch minimum
2 width with abrasive filled and shall be Wooster Products, Inc., Alumogrit
3 Treads, Type 116; equal by Barry Pattern and Foundry Co.; Andco; or
4 equal. Embedded anchors shall be furnished with a minimum of three
5 anchors per tread.
6

7 D. Aluminum ladders shall be fabricated to the dimensions and details and
8 installed as shown on the Construction Drawings.
9

10 E. Aluminum Handrails, Mechanically Fastened Type:

11
12 All aluminum mechanically fastened type pipe handrails and guardrails shall
13 be clear anodized aluminum finish and installed as specified herein and
14 indicated on the Construction Drawings. Handrails shall be made of
15 nominal 1-1/2 inches inside diameter pipe (schedule 40 for rails, schedule
16 80 for posts) fabricated of seamless 6105-T5 or 6061-T6 alloy, ASTM B-
17 429 or ASTM B-221. The supplier of the handrail system shall supply all
18 necessary fittings, rackets, transition, corner, and connector pieces,
19 toeboards, protective gaskets, etc., for a complete job at the locations
20 indicated on the Construction Drawings. All mounting hardware including
21 bolts, studs, nuts, etc., shall be stainless steel Type 316. Bends shall be
22 smooth and accurate to the details shown. The handrail systems shall
23 comply with all OSHA codes and Section 1208.2 of the Standard Building
24 Code. Railing systems incorporating pop-rivets or glued fittings shall not be
25 allowed.
26

27 Handrailings and components shall be as manufactured by Thompson
28 Fabricating Company, Birmingham, Alabama, or equal.
29

30 Handrails and stair rails shall be designed to withstand a 200 lb
31 concentrated load applied in any direction at any point on the top rail.
32 Handrails and stair rails shall also be designed to withstand a load of 50
33 lb/ft. applied horizontally to the top rail. The 200 lb load will not be applied
34 simultaneously with the 50lb/ft. load. In addition, the handrails shall be
35 designed to withstand a load of 100lb/ft. applied vertically downward to the
36 top rail and simultaneously with the 50lb/ft. horizontal load. The 100lb/ft.
37 vertical load does not apply to stair rails.
38

39 Spacing of posts where posts are required shall be as noted on shop
40 drawings, but in all cases shall be uniform and shall not exceed the
41 requirements of OSHA and Section 1208.2 of the Standard Building Code.
42 Shorter spacing may be used where required to maintain the maximum
43 spacing. The fabricator of the aluminum handrail and guardrail system shall
44 be responsible for the design and preparation of shop drawings and design

1 calculations (signed and sealed by a Registered Professional Engineer) to
2 meet OSHA requirements and Section 1208.2 of Standard Building Code.

3
4 All railings shall be erected in line and plumb. Field splicing and expansion
5 compensation shall be accomplished using internal splice sleeves. Make
6 provisions for removable railing sections, as detailed and where shown on
7 the Construction Drawings.

8
9 Where handrail or guardrail posts are set in concrete, as per the
10 manufacturer's requirements, the posts shall be set into aluminum sleeves
11 cast in the concrete and firmly cemented with 1651 epoxy resin by E-Bond
12 Epoxies, Oakland Park, Florida, or Moulded Reinforced Plastics, Inc., Fort
13 Lauderdale, Florida or equal. Collars shall be placed on the posts and
14 fastened in place, as shown and as detailed on the shop drawings.

15
16 Where handrail is supported from structural members, it shall be done by
17 the use of sockets, flanges, brackets, or other means, which will provide
18 neat and substantial support for the pipe railing.

19
20 All railing shall be properly protected by paper, plastic, a coating or by all
21 three against scratching, splashes, mortar, paint, or other defacements
22 during transportation and erection and until adjacent work by other trades
23 has been completed.

24
25 F. Toeboards:

- 26
27 1. Contractor shall furnish and install aluminum toeboards conforming
28 to latest OSHA requirements on all railings and other locations.
29
30 2. Toeboards shall consist of an extruded 6063-T6 aluminum shape
31 bolted by means of a pipe clamp to the railing posts without requiring
32 any drilling or welding of the toeboard to the railing posts as
33 manufactured by Thompson Fabricating Company, or equal.
34 Toeboards shall have pitched top and tear drop bottom to prevent
35 accumulation of dirt, or other material.
36
37 3. Toeboards shall be aluminum alloy 6063-T6. All fastening hardware
38 shall be Type 316 stainless steel.

39
40 G. Kickplates, if required, shall be fabricated and installed as shown on the
41 Drawings.

42
43 H. Aluminum safety gate shall be fabricated of extruded aluminum.
44

- 1 I. Prefabricated checkerplate aluminum floor hatches shall be Type "JD", or
2 "KD" as manufactured by Bilco Co., equal by Babcock-Davis Associates,
3 Inc.; Type "AM" Inland-Ryerson Construction Products Co., Milcor Division;
4 or equal, sized as shown. Hatches with either dimension over 3 feet-6
5 inches shall be double leaf type. Hatches shall be designed for a live load
6 of 300 pounds per square foot. Hatches shall be watertight.
7
- 8 J. Ship ladders shall be of all aluminum construction as detailed. Treads shall
9 have abrasive nosing as manufactured by Thompson Fabricating
10 Company, Birmingham, Alabama.
11
- 12 K. Checkplate aluminum cover plates shall be fabricated to the details shown
13 and installed at the locations shown.
14
- 15 L. Structural aluminum angle and channel door frames shall be provided as
16 shown on the Construction Drawings and shall be anodized. Frames shall
17 be fabricated with not less than three anchors on each jamb.
18
- 19 M. Miscellaneous aluminum shapes and plates shall be fabricated as shown.
20 Angle frames for hatches, beams, grates, etc., shall be furnished complete
21 with welded strap anchors attached. Furnish all miscellaneous aluminum
22 shown but not otherwise detailed. Structural shapes and extruded items
23 shall conform to the detail dimensions or the Shop Drawings within the
24 tolerances published by the American Aluminum Association.
25

26 2.03 STEEL ITEMS 27

- 28 A. Sleeves shall be steel or cast iron pipe in walls and floors with end joints as
29 shown on the Drawings. All pipe sleeves shall have center anchor around
30 circumference as shown.
31
- 32 B. Miscellaneous steel pipe for sleeves and lifting attachments and other uses
33 as required shall be Schedule 40 pipe fabricated according to the details as
34 shown on the Drawings.
35
- 36 C. Miscellaneous steel shall be fabricated and installed in accordance with the
37 Construction Drawings and shall include: beams, angles, support brackets,
38 closure angles in roof at edge of T-beam; base plates to support ends of
39 T-beams; door frames; splice plates, anchor bolts (except for Equipment
40 furnished in Divisions 11, 13, 14 and 15); lintels and any other
41 miscellaneous steel called for on the Drawings and not otherwise specified.
42
- 43 D. Guardrails shall be of a standard FDOT W-Beam design with reflectors. All
44 mounting hardware including bolts, washers, nuts shall be galvanized.
45

1 2.04 CAST IRON ITEMS

- 2
- 3 A. Outside pipe clean-out frames and covers, when and where shown on the
- 4 Construction Drawings, shall be heavy duty, R-6013-R-6099 series as
- 5 manufactured by Neenah Foundry Co., or equal. All outside pipe clean-outs
- 6 shall be 6-inch diameter.
- 7
- 8 B. Frames, covers and grates for wet wells, catch basins and inlets shall be of
- 9 a good quality, strong, tough even grained cast iron and capable of
- 10 supporting an H-20 loading. Castings shall be as manufactured by the U.S.
- 11 Foundry, Neenah Foundry, Mechanics Iron Foundry or equal. Sizes shall
- 12 be as shown on the Drawings. Covers to have letters "WATER", "SEWER"
- 13 or "DRAIN", as applicable, embossed on top.
- 14
- 15 C. Electric and telephone wet well frames and covers, when and where shown
- 16 on the Construction Drawings, shall be ductile iron castings conforming to
- 17 all requirements of ASTM A536. The covers shall be watertight and shall
- 18 have the letters "HIGH VOLTAGE," "LOW VOLTAGE," "SIGNAL,"
- 19 "TELEPHONE," as applicable, embossed on top in letters 2 inches high.
- 20 The clear opening shall be 36-inches.
- 21

22 2.05 STAINLESS STEEL ITEMS

- 23
- 24 A. Stainless steel items, where shown on the Drawings, shall be manufactured
- 25 using 316 S.S., unless otherwise noted.
- 26

27 2.06 MATERIALS - MISCELLANEOUS

- 28
- 29 A. Use fasteners of suitable size and length for the materials being fastened
- 30 and for the type of connection required.
- 31
- 32 1. For concealed interior and exterior use or built into exterior walls use
- 33 nonferrous stainless steel and zinc coated.
- 34
- 35 2. For embedded anchor that will be protected from the elements, use
- 36 fasteners of the same material as the miscellaneous stem being
- 37 fastened.
- 38

39 PART 3 – EXECUTION

40

41 3.01 FABRICATION

42

- 43 A. All miscellaneous metal work shall be formed true to detail, with clean,
- 44 straight, sharply defined profiles and smooth surfaces of uniform color and
- 45 texture and free from defects impairing strength or durability.

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- B. Connections and accessories shall be of sufficient strength to safely withstand stresses and strains to which they will be subjected. Steel accessories and connections to steel or cast iron shall be steel, unless otherwise specified. Threaded connections shall be made so that the threads are concealed by fitting.
- C. Welded joints shall be rigid and continuously welded or spot welded as specified or shown. The face of welds shall be dressed flush and smooth. Exposed joints shall be close fitting and jointed where least conspicuous.
- D. Welding of parts shall be in accordance with the Standard Code for Arc and Gas Welding in Building Construction of the AWS and shall only be done where shown, specified, or permitted by the Engineer. All welding shall be done only by welders certified as to their ability to perform welding in accordance with the requirements of the AWS Code. Component parts of built-up members to be welded shall be adequately supported and clamped or held by other adequate means to hold the parts in proper relation for welding.
- E. Welding of aluminum work shall be on the unexposed side as much as possible in order to prevent pitting or discoloration.
- F. All aluminum finish exposed surfaces, except as specified below, shall have manufacturer's standard mill finish. Aluminum handrails shall be given an anodic oxide treatment in accordance with the Aluminum Association Specification AA-C22-A41. A coating of methacrylate lacquer shall be applied to all aluminum before shipment from the factory.
- G. Castings shall be of good quality, strong, tough, even-grained, smooth, free from scale, lumps, blisters, sand holes, and defects of any kind which render them unfit for the service for which they are intended. Castings shall be thoroughly cleaned and will be subjected to a hammer inspection in the field by the Engineer. All finished surfaces shown on the Drawings and/or specified shall be machined to a true plane surface and shall be true and seat at all points without rocking. Allowances shall be made in the patterns so that the thickness specified or shown shall not be reduced in obtaining finished surfaces. Castings will not be acceptable if the actual weight is less than 95 percent of the theoretical weight computed from the dimensions shown. The Contractor, if requested by the Owner or Engineer, shall provide facilities for weighing castings in the presence of the Owner or Engineer showing true weights, certified by the supplier.
- H. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust, and foreign matter before shipment and shall be given

1 one shop coat of primer compatible with finish coats specified in Painting
2 Section after fabrication but before shipping. Paint shall be applied to dry
3 surfaces and shall be thoroughly and evenly spread and well worked into
4 joints and other open spaces. Abrasions in the field shall be touched up
5 with primer immediately after erection. Final painting is specified in Painting
6 Section 09900.
7

8 I. Galvanizing, where required, shall be the hot-dip zinc process after
9 fabrication. Following all manufacturing operations, all items to be
10 galvanized shall be thoroughly cleaned, pickled, fluxed, and completely
11 immersed in a bath of molten zinc. The resulting coating shall be adherent
12 and shall be the normal coating to be obtained by immersing the items in a
13 bath of molten zinc and allowing them to remain in the bath until their
14 temperature becomes the same as the bath. Coating shall be not less than
15 2 oz. per sq. ft. of surface.
16

17 J. Provide for anchorage of type indicated; use anchors of same material and
18 finish as item except where specifically indicated otherwise.
19

20 K. Fabricate to prevent water intrusion or migration.
21

22 3.02 INSTALLATION

23

24 A. Install all items furnished except items to be imbedded in concrete or other
25 masonry which shall be installed under Division 03. Items to be attached to
26 concrete or masonry after such work is completed shall be installed in
27 accordance with the details shown. Fastening to wood plugs in masonry
28 will not be permitted. All dimensions shall be verified at the site before
29 fabrication is started.
30

31 B. All steel surfaces to come in contact with exposed concrete or masonry shall
32 receive a protective coating of heavy bitumastic troweling mastic applied in
33 accordance with the Manufacturer's instructions prior to installation.
34

35 C. Where aluminum is embedded in concrete, apply a heavy coat of bitumastic
36 troweling mastic in accordance with the Manufacturer's instructions prior to
37 installation.
38

39 D. Where aluminum contacts masonry or concrete, provide a 1/32-inch
40 neoprene gasket between the aluminum and the concrete or masonry.
41

42 E. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of
43 zinc-chromate primer and provide a 1/32-inch neoprene gasket between the
44 aluminum and the dissimilar metal.
45

- 1 F. Where aluminum contacts wood, apply two coats of aluminum metal and
2 masonry paint to the wood.
3
4 G. Anchor metal fabrications to substrata indicated; set all fasteners required.
5
6 H. Cut, drill and fit items as required for installation.
7
8 1. Fit exposed connection together accurately to form tight hairline
9 joints.
10
11 2. Weld joints as indicated.
12
13 a. Comply with AWS code for welding procedures, for
14 appearance and quality of welds, and for corrective methods.
15 b. Grind exposed joints smooth.
16
17 I. Set items accurately in location, alignment and elevation; level, true and
18 free of rack, measured from established lines and levels.
19
20 J. Provide temporary bracing as required.

21
22 3.03 CLEANING AND TOUCH-UP
23

- 24 A. Touch up shop paint immediately after erection.
25
26 1. Clean field welds, bolted connections and abraded surfaces.
27
28 2. Paint with same material used for shop painting, minimum 2 mils dry
29 film thickness.
30

31 END OF SECTION
32

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1 SECTION 09865

2 SURFACE PREPARATION AND SHOP PRIME PAINTING

3
4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. Furnish all labor, materials, equipment, and incidentals required for the
10 surface preparation and application of shop primers necessary to complete
11 this Contract in its entirety.

12
13 1.02 SUBMITTALS

- 14
15 A. Submit to the Engineer for review, shop drawings, manufacturer's
16 specifications and data on the proposed primers and detailed surface
17 preparation, application procedures and dry mil thickness.
18
19 B. Submit representative physical samples of the proposed primers, if required
20 by the Engineer.

21
22 PART 2 – PRODUCTS

23
24 2.01 MATERIALS

25
26 A. Submerged Surfaces:

- 27
28 1. Shop primer for ferrous metals that will be submerged or that are
29 subject to splash action or that are specified to be considered
30 submerged service shall be sprayed with one coat of Tnemec Series
31 66 at 3.0-5.0 mils (D.F.T.), PPG Pitt-Guard Epoxy Coating 97-145 at
32 4.0-6.0 mils (D.F.T.), or equal.
33
34 2. Voids and bugholes in concrete surfaces must be filled with Tnemec
35 Series 218 (up to 1/4" deep) or Tnemec Series 219 (1/4" to 1 1/2"
36 deep) or equal as recommended by the manufacturer of the paint
37 system.

38
39 B. Non-submerged Surfaces:

- 40
41 1. Shop primer for ferrous metals other than those covered by
42 Paragraph 2.01A shall be sprayed with one coat of Tnemec Series
43 66 Epoxy Fast Dry Primer 94-109 (3.0-5.0 mils D.F.T.) or equal.

44
45 C. Non-primed Surfaces:

1 1. Gears, bearings surfaces, and other similar surfaces
2 obviously not to be painted shall be given a heavy shop coat
3 of grease or other suitable rust-resistant coating. This coating
4 shall be maintained as necessary to prevent corrosion during
5 all periods of storage and erection and shall be satisfactory to
6 the Engineer up to the time of the final acceptance test.
7

8 D. Compatibility of Coating Systems:
9

10 1. Shop priming shall be done with primers that are guaranteed
11 by the manufacturer to be compatible with their corresponding
12 primers and finish coats specified in Section 09900 for use in
13 the field and which are recommended for use together.
14

15 PART 3 – EXECUTION

16 3.01 APPLICATION
17

18 A. Surface Preparation and Priming:
19

- 20
- 21 1. Nonsubmerged components scheduled for priming, as defined
22 above, shall be sandblasted clean in accordance with SSPC-SP-6,
23 Commercial Grade, immediately prior to priming. Submerged
24 components scheduled for priming, as defined above, shall be
25 sandblasted clean in accordance with SSPC-SP-10. Near White,
26 immediately prior to priming.
27
 - 28 2. Surfaces shall be dry and free of dust, oil, grease, dirt, rust, loose
29 mill scale, and other foreign material before priming. Concrete
30 surfaces shall be prepared in accordance with ICRI CSP 4-6.
31
 - 32 3. Shop prime in accordance with the paint manufacturer's
33 recommendations.
34
 - 35 4. Priming shall follow sandblasting before any evidence of corrosion
36 has occurred and within 24 hours.
37
 - 38 5. Allow all new concrete to cure for a minimum of 28 days. Test for
39 moisture by plastic film tape down test (ASTM D4263).
40

41
42 END OF SECTION
43
44

1 SECTION 09900

2 PAINTING

3
4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. The work of this section consists of furnishing all materials, labor, equipment
10 and incidentals required and performing all the painting necessary to complete
11 this Contract in its entirety.
12
13 B. It is the intent of these Specifications to paint all concrete where scheduled,
14 exposed miscellaneous metal, pipe, fittings, supports, valves, equipment and all
15 other work obviously required to be painted unless otherwise specified. Minor
16 items omitted in the schedule of work shall be included in the work of this
17 Section where they come within the general intent of the Specifications as stated
18 herein.
19
20 C. The following surfaces or items are not required to be painted:
21
22 1. Portions of metal, other than aluminum, embedded in concrete. This
23 does not apply to the back face of items mounted to concrete or masonry
24 surfaces, which shall be painted before erection. Aluminum to be
25 embedded in or in contact with concrete or masonry shall be coated to
26 prevent electrolysis.
27 2. Stainless steel.
28 3. Fencing
29 4. Concealed surfaces of pipe or crawl spaces.
30 5. Acoustical ceilings.
31 6. Tile.
32 7. Fiberglass, other than piping.
33 8. Packing glands and other adjustable parts and nameplates of
34 mechanical equipment.
35 9. Electrical switchgear, motor control centers, lighting and power panels,
36 and control panels.
37 10. Polyethylene chemical storage tanks.

38
39 1.02 REFERENCES

- 40
41 A. Steel Structures Painting Council (SSPC)
42 SSPC-SP-1 through SSPC-SP-10 Surface Preparation Specifications
43
44 B. International Concrete Repair Institute (ICRI)
45 ICRI CSP – 3 through ICRI CSP – 6 Concrete Surface Preparation Standards.
46
47

1
2 1.03 SUBMITTALS
3

- 4 A. Submit to the Engineer for review in accordance with the General Conditions,
5 shop drawings, working drawings and product data including manufacturer's
6 specifications and data on the proposed paint systems and detailed surface
7 preparation, application procedures and dry film thickness.
8
9 B. Submit to the Engineer for review in accordance with the General Conditions,
10 color cards, including standard and special colors, for initial color selections.
11
12 C. Schedule of Painting Operations: Submit to the Engineer for review a complete
13 Schedule of Painting Operations in a timely manner and properly notify and
14 coordinate the fabricators' surface preparation and painting operations with
15 these Specifications. This Schedule shall include for each surface to be painted,
16 the brand name, the percent volume of solids, the coverage and the number of
17 coats the Contractor proposes to use in order to achieve the specified dry film
18 thickness, and color charts. Apply all material in strict accordance with the
19 Schedule and the manufacturer's instructions. Wet and dry paint film gauges
20 shall be made available to the Engineer to verify the proper application while
21 work is in progress.
22

23 1.04 SPARE MATERIAL
24

- 25 A. Furnish one unopened gallon can of each type and each color of paint used.
26

27 1.05 CONTRACTOR QUALIFICATIONS
28

- 29 A. Contractor shall submit a list of similar projects successfully completed within
30 the past 3 years. Contractor shall also supply record of Certificates of Approval
31 from Manufacturers to show they have completed technical product and
32 application training. Contractors shall submit a list of surface preparation and
33 application equipment sufficient to mix and apply the products specified.
34

35 PART 2 – PRODUCTS
36

37 2.01 MATERIALS
38

- 39 A. All painting materials shall be fully equal to those manufactured by the Tnemec
40 Company Inc., Carboline, PPG/Porter Coatings, and Sherwin Williams. The
41 painting schedule has been prepared on the basis of these products and
42 recommendations for applications. No brand other than those named will be
43 considered, unless the brand and type of paint proposed for each item, together
44 with sufficient data, substantiated by certified tests conducted at no expense to
45 the Owner, demonstrating equality to the paint(s) named, is submitted in writing
46 to the Engineer for review within 30 days after the issuance of the Notice to
47 Proceed. The type and number of tests performed shall be subject to the

1 Engineer's review.
2

- 3 B. All painting materials shall be delivered to the mixing room in unbroken
4 containers, bearing the manufacturer's brand, date of manufacturer, batch
5 number, and name. They shall be used without adulteration and mixed, thinned,
6 and applied in strict accordance with manufacturer's directions for the applicable
7 materials and surface.
8
9 C. Shop priming shall be done with primers that are guaranteed by the
10 manufacturer to be compatible with the finish paints to be used.
11
12 D. No paint containing lead will be allowed. Oil shall be pure boiled linseed oil.
13
14 E. Work areas will be designated by the Engineer for storage and mixing of all
15 painting materials. Materials shall be in full compliance with the requirements
16 of pertinent codes and fire regulations. Proper containers outside of the
17 buildings shall be provided and used for painting wastes, and no plumbing
18 fixture shall be used for this purpose.
19
20 F. All recommendations of the paint manufacturer in regard to the health and safety
21 of workmen shall be followed.
22
23 G. Where new painting is specified for surfaces with existing finishes, the
24 Contractor shall sample the existing coating(s) for compatibility with the
25 proposed new paint and notify the Engineer of any incompatibilities found.
26

27 2.02 PAINTING SYSTEMS 28

- 29 A. Colors for pipe shall match that of existing connected piping. Colors for
30 structural steel shall match that of existing connected structural steel.
31
32 B. The following surfaces shall have the types of paint scheduled below applied at
33 the dry film thickness (D.F.T.) in mils per coat noted. Some of the painting
34 systems listed below may not be used in this project. Some colors will require
35 an additional coat beyond that listed below to obtain the proper color coverage.
36
37 1. Non-submerged concrete and precast concrete walls and ceilings:
38
39 a. Tnemec
40 1st Coat: Tnemec Series 66 (3.0 - 5.0 mils D.F.T.)
41 2nd Coat: Tnemec Series 66 (4.0 - 6.0 mils D.F.T.)
42
43 b. Carboline
44 1st Coat : Carboguard 890 (4.0-6.0 mils D.F.T.)
45 2nd Coat : Carboguard 890 (4.0-6.0 mils D.F.T.)
46
47 c. PPG/HPC

- 1 1st Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils
2 D.F.T.)
3 2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils
4 D.F.T.)
5
6 d. Sherwin Williams
7 1st Coat: Concrete and Masonry Primer
8 2nd Coat: Loxon Topcoat
9
- 10 2. Submerged Concrete
11
12 a. Tnemec
13 1st Coat: Tnemec Series N69 (3.0 – 5.0 mils D.F.T.)
14 2nd Coat: Tnemec Series N69 (4.0 – 6.0 mils D.F.T.)
15
16 b. Carboline
17 1 Coat: Carboguard 691 (10.0-14.0 mils D.F.T.)
18
19 c. PPG/HPC
20 2 Coats: Pitt-Guard All Weather D-T-R Epoxy Coating 97-946/949
21 Series. (5.0-7.0 mils D.F.T. per coat)
22
23 d. Sherwin Williams
24 1st Coat : Cor Cote FRE (80-100 mils D.F.T
25
- 26 3. Interior Exposed Masonry (above grade and interior partitions)
27
28 a. Tnemec
29 1st Coat: Tnemec Series 54-660- (80-100 sq. ft. per gal.)
30 2nd Coat: Tnemec Series 66 (4.0 – 6.0 mils D.F.T.)
31 3rd Coat: Tnemec Series 66 (4.0 – 6.0 mils D.F.T.)
32
33 b. Carboline
34 1 Coat: Sanitile 600/600TG (60-80 sq. ft. per gal.)
35 2 Coats: Sanitile 655 (4.0-6.0 mils D.F.T. per coat)
36
37 c. PPG/HPC
38 1 Coat: Aquapon Polyamide Epoxy Block Filler 97-685/686 (40 to
39 80 sq. ft. per gal @ 12.0-24.0 mils D.F.T.)
40
41 2 Coats: Aquapon High Build Semi-Gloss Polyamide Epoxy
42 Coating
43 97-130 Series. (4.0-6.0 mils D.F.T. per coat)
44
45 d. Sherwin Williams
46 1st Coat: Concrete and Masonry Primer
47 2nd Coat: Loxon Topcoat

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- 4. Interior and Exterior Exposed Masonry (Unpainted)
 - a. Tnemec
Regular CMU
2 Coats: Prime a Pell 200 @ 75-100 SF/gallon/coat
Split face CMU
2 Coats: Prime a Pell Plus @ 65-80 SF/gallon/coat
 - b. Carboline
CMU
1 Coat: Carbocrete Sealer WB @ 60-80 SF/gallon
Split Face CMU
2 Coats: Carbocrete Sealer WB, 1st coat @ 40-60 SF/gallon &
2nd coat @ 80-120 SF/gallon
 - c. PPG/HPC
2 Coats: PPG/HPC Canyon Tone Stain Clear at 100 to 150 SF
per gallon.

- 5. Exterior Exposed Stuccoed Walls
 - a. Tnemec
1st Coat: Tnemec Series 180 smooth (4.0 – 6.0 mils D.F.T.)
2nd Coat: Tnemec Series 180 smooth (4.0 –6.0 mils D.F.T.)
 - b. Carboline
1st Coat: Sanitile 100 (10.0-12.0 mils D.F.T.)
2nd Coat: Sanitile 155 (2.0-3.0 mils DFT)
3rd Coat: Sanitile 155 (2.0-3.0 mils D.F.T.) - OPTIONAL
 - c. PPG/HPC
1st Coat Pitt-Flex Elastomeric Coating 4-110 (5.5-7.3 mils D.F.T.)
2nd Coat Pitt-Flex Elastomeric Coating 4-110 (5.5-7.3 mils D.F.T.)

- 6. Ferrous metals submerged or subject to splashing
 - a. Tnemec
1st Coat: Tnemec Series 104-1211 High Solids Catalyzed Epoxy
Coating (3.0-5.0 mils D.F.T.)
2nd Coat: Tnemec Series 104-Color High Solids Catalyzed Epoxy
Coating (8.0 – 10.0 mils D.F.T.)
 - b. Carboline
1 Coat: Carboguard 691 (10.0-14.0 mils D.F.T.)
 - c. PPG/HPC

- 1 1 Coat: Pitt-Guard All Weather D-T-R Epoxy Coating 97-946/949
2 Series. (5.0-7.0 mils D.F.T per coat)
3 1 Coat: Pitt-Guard All Weather D-T-R Epoxy Coating 97-946/949
4 Series. (5.0-7.0 mils D.F.T per coat)
5
6 d. Sherwin Williams
7 1st Coat: Cor-Cote HB 6.0-9.0 mils (D.F.T.)
8 2nd Coat: Cor-Cote HB 6.0-9.0 mils (D.F.T.)
9
10 7. Exterior non-submerged ferrous metals:
11
12 a. Tnemec
13 1st Coat: Tnemec Series 66 (3.0 - 5.0 mils D.F.T.)
14 2nd Coat: Tnemec Series 66 (4.0 - 6.0 mils D.F.T.)
15 3rd Coat: Tnemec Series 1074 (2.5 - 4.5 mils D.F.T.)
16
17 b. Carboline
18 1st Coat : Carboguard 893SG (3.0-5.0 mils D.F.T.)
19 2nd Coat : Carboguard 893SG (3.0-5.0 mils D.F.T.)
20 3rd Coat : Carbothane 133HB (3.0-4.0 mils D.F.T.)
21
22 c. PPG/HPC
23 1st Coat: Epoxy Fast Dry Primer 94-109 (4.0-6.0 mils D.F.T.)
24 2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils
25 D.F.T.)
26 3rd Coat: Pitthane HB Semi-Gloss Urethane 95-8800 (2.0-6.0 mils
27 D.F.T.)
28
29 d. Sherwin Williams
30 1st Coat: Macropoxy 646 (3.0-6.0 mils D.F.T.)
31 2nd Coat: HiSolids Polyurethane (2.0-4.0 mils (D.F.T.)
32
33 8. Interior non-submerged ferrous metals:
34
35 a. Tnemec
36 1st Coat: Tnemec Series 66 Color (3.0 - 5.0 mils D.F.T.)
37 2nd Coat: Tnemec Series 66 Color (4.0 - 6.0 mils D.F.T.)
38
39 b. Carboline
40 1st Coat : Carboguard 893SG (3.0-5.0 mils D.F.T.)
41 2nd Coat : Carboguard 893SG (3.0-5.0 mils D.F.T.)
42
43 c. PPG/HPC
44 1st Coat: Epoxy Fast Dry Primer 94-109 (4.0-6.0 mils D.F.T.)
45 2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils
46 D.F.T.)
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- 9. Exterior galvanized and non-ferrous metal:
 - a. Tnemec
1st Coat: Tnemec Series 66 (2.5 – 3.5 mils D.F.T.)
2nd Coat: Tnemec Series 1074 (2.5 – 3.5 mils D.F.T.)
 - b. Carboline:
1st Coat : Carboguard 893SG (3.0-4.0 mils D.F.T.)
2nd Coat : Carbothane 133HB (3.0-4.0 mils D.F.T.)
 - c. PPG/HPC
1st Coat: Epoxy Fast Dry Primer 94-109 (4.0-6.0 mils D.F.T.)
2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils D.F.T.)
3rd Coat: Pitthane HB Semi-Gloss Urethane 95-8800 (2.0-6.0 mils D.F.T.)
 - d. Sherwin Williams
1st Coat: Macropoxy 646 (2.5-3.5 mils D.F.T.)
2nd Coat: H-Solids Polyurethane (2.5-3.5 mils D.F.T.)
 - 10. Interior galvanized and non-ferrous metals:
 - a. Tnemec
1st Coat: Tnemec Series 66 Color (2.5 - 3.5 mils D.F.T.)
2nd Coat: Tnemec Series 66 Color (3.0 - 5.0 mils D.F.T.)
 - b. Carboline:
1st Coat : Carboguard 893SG (3.0-4.0 mils D.F.T.)
2nd Coat : Carboguard 893SG (3.0-5.0 mils D.F.T.)
 - c. PPG/HPC
1st Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils D.F.T.)
2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils D.F.T.)
 - 11. Galvanized and non-ferrous metal submerged or subject to splashing:
 - a. Tnemec
1st Coat: Tnemec Series 66 (2.5 – 3.5 mils D.F.T.)
2nd Coat: Tnemec Series 66 (2.5 – 3.5 mils D.F.T.)
 - b. Carboline
1 Coat: Carboguard 691 (10.0-14.0 mils D.F.T.)
 - c. PPG/HPC

1 1st Coat: PPG Pitt-Guard All Weather D-T-R Epoxy Coating 97-
2 946/949 Series. (5.0-7.0 mils D.F.T per coat)
3 2nd Coat: PPG Pitt-Guard All Weather D-T-R Epoxy Coating 97-
4 946/949 Series. (5.0-7.0 mils D.F.T per coat)
5 3rd Coat: PPG Pitt-Guard All Weather D-T-R Epoxy Coating 97-
6 946/949 Series. (5.0-7.0 mils D.F.T per coat)
7

8 12. Metal surfaces exposed to temperatures above 250°F:
9

- 10 a. Tnemec
11 1st Coat: Tnemec Series 39-1261(0.7 – 1.5 mils D.F.T.)
12 2nd Coat: Tnemec Series 39-1261(0.7 – 1.5 mils D.F.T.)
13
14 b. Carboline
15 1 Coat: Thermaline 450, up to 450°F (8.0-10.0 mils D.F.T.)
16 or
17 1st Coat: Carbozinc 11 or 11 HS (2.0-3.0 mils D.F.T.)
18 2nd Coat: Thermaline 4700, 400-1000°F (2.0 mils D.F.T.)
19
20 c. PPG/HPC
21 2 Coats: Speedhide Int/Ext Aluminum Paint 6-230. (1.0 -1.3 mils
22 D.F.T. per coat)
23

24 13. Insulated Pipe:
25

- 26 a. Tnemec
27 1st Coat: Tnemec Series 6 (2.0 – 3.0 mils D.F.T.)
28 2nd Coat: Tnemec Series 6 (2.0 – 3.0 mils D.F.T.)
29
30 b. Carboline
31 2 Coats: Sanitile 155 (2.0-3.0 mils D.F.T. per coat)
32
33 c. PPG/HPC
34 2 Coats: PITT-TECH Interior/Exterior Satin DTM Industrial
35 Enamels 90-474 Series.(2.0-3.0 mils D.F.T. per coat)
36

37 14. Aluminum in contact with dissimilar metals:
38

- 39 a. Tnemec
40 1st Coat: Tnemec Series 66 (2.5 - 3.5 mils D.F.T.)
41 2nd Coat: Tnemec Series 66 (2.5 - 3.5 mils D.F.T.)
42
43 b. Carboline
44 1st Coat : Carboguard 893SG (3.0-4.0 mils D.F.T.)
45 2nd Coat : Carboguard 893SG (3.0-4.0 mils D.F.T.)
46
47 c. PPG/HPC

- 1 1st Coat: Epoxy Fast Dry Primer 94-109 (4.0-6.0 mils D.F.T.)
2 2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130 (4.0-6.0 mils
3 D.F.T.)
4
- 5 15. Plastic Piping - Interior:
6
7 a. Tnemec
8 1st Coat: Tnemec Series 66 (2.5 - 3.5 mils D.F.T.)
9 2nd Coat: Tnemec Series 66 (2.5 - 3.5 mils D.F.T.)
10
11 b. Carboline
12 1st Coat : Carbocrylic 120 (1.0-2.0 mils D.F.T.)
13 2 Coats : Carboguard 893SG (3.0-4.0 mils D.F.T. per coat)
14
15 c. PPG/HPC
16 1st Coat: Aquapon HB Semi-Gloss Epoxy 97-130
17 (4.0-6.0 mils D.F.T.)
18 2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130
19 (4.0-6.0 mils D.F.T.)
20
- 21 16. Plastic Piping - Exterior
22
23 a. Tnemec
24 1st Coat: Tnemec Series 73 (2.5 - 3.5 mils D.F.T.)
25 2nd Coat: Tnemec Series 73 (2.5 - 3.5 mils D.F.T.)
26
27 b. Carboline
28 1st Coat : Carbocrylic 120 (1.0-2.0 mils D.F.T.)
29 2 Coats : Carbothane 133HB (3.0-4.0 mils D.F.T. per coat)
30
31 c. PPG/HPC
32 1st Coat: Aquapon HB Semi-Gloss Epoxy 97-130
33 (4.0-6.0 mils D.F.T.)
34 2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130
35 (4.0-6.0 mils D.F.T.)
36 3rd Coat: Pitthane HB Semi-Gloss Urethane 95-8800
37 (2.0-6.0 mils D.F.T.)
38
39 d. Sherwin Williams
40 1st Coat: Hi-Solids Polyurethane (2.5-3.5 mils D.F.T.)
41 2nd Coat: Hi-Solids Polyurethane (2.5-3.5 mils D.F.T.)
42
- 43 17. Interior Drywall and Plaster-Industrial Areas
44
45 a. Tnemec
46 1st Coat: Tnemec Series 51-792 (1.0 - 1.5 mils D.F.T.)
47 2nd Coat: Tnemec Series 66 (2.5 - 3.5 mils D.F.T.)

- 1 3rd Coat: Tnemec Series 66 (2.5 - 3.5 mils D.F.T.)
2
3 b. Carboline
4 1st Coat : Carbocrylic 120 (1.0-2.0 mils D.F.T.)
5 2nd Coat : Sanitile 655 (4.0-5.0 mils DFT)
6 3rd Coat : Sanitile 655 (4.0-5.0 mils D.F.T.)
7
8 c. PPG/HPC
9 1st Coat: Aquapon HB Semi-Gloss Epoxy 97-130
10 (4.0-6.0 mils D.F.T.)
11 2nd Coat: Aquapon HB Semi-Gloss Epoxy 97-130
12 (4.0-6.0 mils D.F.T.)
13
14 18. Interior Drywall and Plaster-Office Areas
15
16 a. Tnemec
17 1st Coat: Tnemec Series 51-792 (1.0 – 1.5 mils D.F.T.)
18 2nd Coat: Tnemec Series 6 (2.0 – 3.0 mils D.F.T.)
19 3rd Coat: Tnemec Series 6 (2.0 – 3.0 mils D.F.T.)
20
21 b. Carboline
22 1st Coat : Carbocrylic 120 (1.0-2.0 mils D.F.T.)
23 2 Coats: Sanitile 155 (2.0-3.0 mils D.F.T. per coat)
24
25 c. PPG/HPC
26 1st Coat: Speedhide Interior Latex Primer/Sealer 6-2
27 (1 mil DFT)
28 2 Coats: Speedhide Int Latex Eggshell 6-411
29 (2 mils D.F.T. per coat)
30
31 19. Interior Concrete Floors
32
33 a. Tnemec
34 1st Coat: Tnemec Series 201 (5.0 – 7.0 mils D.F.T.)
35 2nd Coat: Tnemec Series 280 (8.0 – 10.0 mils D.F.T.)
36
37 Note: Apply 50 – 70 mesh silica sand at 5 lbs. per 150 sq. ft.
38 between 1st and 2nd coat to provide non-slip surface.
39
40 b. Carboline
41 1st Coat: Carboguard 1340 (1.0-2.0 mils D.F.T.)
42 2 Coats: Carboguard 890 (4.0-6.0 mils D.F.T. per coat)
43
44 Note: Utilize 40-60 mesh silica sand to provide non-slip surface.
45 Consult with Carboline for application details.
46
47

- 1 c. PPG/HPC
2 1st Coat: Megaseal High Solids Primer 99-6639
3 (5.0 – 7.0 mils D.F.T.)
4 2nd Coat: Megaseal Self-Leveling Epoxy 99-6680
5 (10.0-12.0 mils D.F.T.)
6
- 7 20. Concrete in highly Corrosive Environment Special Coating
8
- 9 a. Tnemec
10 1st Coat: Tnemec Series 434 Perma-Shield H₂S
11 (125 mils D.F.T.)
12 2nd Coat: Tnemec Series 435 Perma-Glaze
13 (12.0-15.0 mils D.F.T.)
14
- 15 b. Carboline
16 1st Coat: Plasite 5371 (125 mils)
17 2nd Coat: Plasite 4500S (12.0-15.0 mils D.F.T.)
18
- 19 c. PPG/HPC/Polyspec (Concrete Headworks)
20 1st Coat: 300EX Epoxy Primer
21 2nd Coat: TuffRez 240 Chemical Resistant Epoxy Liner
22 (100 mils)
23 3rd Coat: TuffRez 240 Chemical Resistant Epoxy Liner
24 (100 mils)
25
- 26 d. PPG/HPC/Polyspec (Wet wells/Lift Stations-Force & Gravity
27 Mains)
28 1st Coat: 300EX Epoxy Primer
29 2nd Coat: TuffRez 240 Chemical Resistant Epoxy Liner
30 (100 mils)
31 3rd Coat: TuffRez 240 Chemical Resistant Epoxy Liner
32 (100 mils)
33
- 34 e. PPG/HPC/Enviroline (Concrete Headworks)
35 1st Coat #54 High Solids Epoxy Primer (3-5 mils DFT)
36 2nd Coat #224 100% Solids Epoxy Novolac
37 (20-40 mils DFT)
38 3rd Coat #224 100% Solids Epoxy Novolac
39 (20-40 mils DFT)
40
- 41 f. PPG/HPC/Enviroline (Manholes/Lift Stations-Force & Gravity
42 Mains)
43 1st Coat #54 High Solids Epoxy Primer (3-5 mils DFT)
44 2nd Coat #224 100% Solids Epoxy Novolac (20-40 mils DFT)
45 3rd Coat #224 100% Solids Epoxy Novolac (20-40 mils DFT)
46
- 47 g. Sherwin Williams

- 1 1st Coat: CorCote FRE (80-100 mils D.F.T)
2
3 21. Metals submerged or subject to splashing in highly Corrosive
4 Environment Special Coating
5
6 a. Tnemec
7 1st Coat: Tnemec Series 435 Perma-Shield H₂S (30 mils D.F.T.)
8
9 b. Carboline
10 1 Coat: Plasite 4500S (35.0-40.0 mils D.F.T.)
11
12 c. PPG/HPC/Polyspec
13
14 d. Sherwin Williams
15 1st Coat: Cor Cote HB (6.0-9.0 mils D.F.T)
16 2nd Coat: Cor Cote HB (6.0-9.0 mils D.F.T)
17
18 22. Secondary Containment Concrete 12.5% Sodium Hypochlorite
19
20 a. Tnemec
21 1st Coat: Tnemec Series 61-5002 Tenemeliner
22 (8.0-10.0 mils D.F.T.)
23 2nd Coat: Tnemec Series 61-5001 Tenemeliner
24 (8.0-10.0 mils D.F.T.)
25
26 b. Carboline
27 1st Coat: Semstone 800 primer
28 Finish Coats: Semstone 870
29 (reference Semstone 870 application spec for installation details)
30
31 23. Buried Pipe Appurtenances (Coal Tar Epoxy / Bitumastic Coating)
32
33 a. Tnemec
34 1st Coat Tnemec Series 46H-413 Tneme-Tar
35 (14.0-20.0 mils D.F.T)
36 2nd Coat Tnemec Series 46H-413 Tneme-Tar
37 (14.0-20.0 mils D.F.T)
38
39 b. Carboline
40 1st Coat Carboline Bitumastic 300M (14.0-20.0 mils D.F.T)
41 2nd Coat Carboline Bitumastic 300M (14.0-20.0 mils D.F.T)
42
43 c. Sherwin Williams
44 1st Coat: Tar-Guard (16-20 mils D.F.T)
45 2nd Coat: Tar-Guard (16-20 mils D.F.T)
46

- 1 C. Any surfaces not specifically named in the Schedule and not specifically
2 excepted shall be prepared, primed, and painted in the manner and with
3 materials consistent with these Specifications. The Engineer shall select which
4 of the manufacturer's products, whether the type is indicated herein or not, shall
5 be used for such unnamed surfaces. No extra payment shall be made for this
6 painting.
7

8 2.03 COLOR CODING FOR PIPES AND EQUIPMENT 9

- 10 A. Color coding shall consist of color code painting and identification of all exposed
11 conduits, through items and pipelines for the transport of gases, liquid and semi-
12 liquids including all accessories such as valves, insulated pipe coverings,
13 fittings, junction boxes, bus bars, connectors and all operating accessories that
14 are integral to be whole functional mechanical pipe and electrical conduit
15 system. Colors shall be as noted in the Paint and Color-Coding Schedules
16 attached at the end of this Section.
17
- 18 B. All hangers and pipe support floor stands shall be painted the same color and
19 with the same paint as the pipe it supports. The system shall be painted up to,
20 but not including, the flanges attached to the mechanical equipment, nor the
21 flexible conduit connected to electrical motors. When more than one pipe
22 system is supported on the same bracket, the bracket shall be painted the same
23 color as the adjacent wall or ceiling. Colors shall be as noted in the Paint and
24 Color-Coding Schedule.
25
- 26 C. All systems which are an integral part of the equipment, that is originating from
27 the equipment and returning to the same piece of equipment, shall be painted
28 between and up to, but not including, the fixed flanges or connections on the
29 equipment.
30

31 2.04 LETTERING OF TITLES 32

- 33 A. Each pipe system shall be labeled with the name of the materials in each
34 pipeline and alongside this an arrow indicating the direction of flow of liquids.
35 Titles shall be as so described in attached schedule. Titles shall not be located
36 more than twenty (20) linear feet apart and shall also appear directly adjacent
37 to each side of any wall the pipeline breaches, adjacent to each side of the valve
38 regulator, flowcheck, strainer clean-out, and all pieces of equipment.
39
- 40 B. Titles shall identify the contents by complete name. Identification title locations
41 shall be determined by the Engineer but, in general, they shall be placed where
42 the view is unobstructed and on the two lower quarters of pipe or covering where
43 they are overhead. Title should be clearly visible from operating positions
44 especially those adjacent to control valves.
45
- 46 C. Titles on equipment shall be applied at eye level on machines, where possible,
47 or at the uppermost broad vertical surface of low equipment. Where more than

one piece of the equipment item to be titled exists, the items shall be numbered consecutively, as indicated on the mechanical drawings, or as directed by the Engineer; for example, Pump No. 1, Pump No. 2, etc. Titles shall be composed and justified on the left-hand side as follows: Pump No. 1.

D. Application of titles.

- 1. The color of the titles shall be black or white to best contrast with the color of the pipes and equipment and shall be stencil applied.
- 2. Stencil text is to be in ALL CAPS worded exactly as shown in the Schedule. Titles are to be printed in a single line.
- 3. Letter sizes.

<u>Outside Diameter of Pipe or Covering (inches)</u>	<u>Size of Legend Letters (inches)</u>
3/4 to 1-1/4	1/2
1-1/2 to 2	3/4
2-1/2 to 6	1-1/4
8 to 10	2-1/2
More than 10	3-1/2

Equipment titles are to be two inches high.

- 4. Arrow sizes. Where "a" is equal to 3/4 of outside diameter of pipe or covering, the arrow shaft shall be 2 "a" long by 3/8 "a" wide. The arrowhead shall be an equilateral triangle with sides equal to "a." Maximum "a" dimension shall be 6 inches.
- 5. When using direction arrows, point arrowhead away from pipe markers and in direction of flow. If flow can be in both directions, use a double-headed directional flow.

2.05 FABRICATED EQUIPMENT

- A. Unless otherwise indicated, all fabricated equipment shall be shop primed and shop or field finished.
- B. All items to be shop primed shall be thoroughly cleaned of all loose material prior to priming. If, in the opinion of the Engineer, any prime coating shall have been improperly applied or if material contrary to these Specifications shall have been used, that coating shall be removed by sandblasting to white metal and re-primed in accordance with these Specifications.

- 1 C. All shop prime coats shall be of the correct materials and applied in accordance
2 with these Specifications. Remove any prime coats not in accordance with
3 these Specifications by sandblasting and apply the specified prime coat at no
4 additional cost to the Owner.
5
6 D. Shop primed surfaces shall be cleaned thoroughly and damaged or bare spots
7 retouched with the specified primer before the application of successive paint
8 coats in the field.
9
10 E. Be responsible for and take whatever steps are necessary to properly protect
11 the shop prime and finish coats against damage from weather or any other
12 cause.
13
14 F. A shop finish coat shall be equal in appearance and protection quality to a field
15 applied finish coat. If, in the opinion of the Engineer, a shop finish coat does
16 not give the appearance and protection quality of other work of similar nature,
17 prepare the surfaces and apply the coat or coats of paint, as directed by the
18 Engineer, to accomplish the desired appearance and protection quality. Submit
19 to the Engineer sufficient evidence that the standard finish is compatible with
20 the specified finish coat.
21
22 G. Wherever fabricated equipment is required to be sandblasted, protect all
23 motors, drives, bearings, gears, etc., from the entry of grit. Any equipment found
24 to contain grit shall be promptly and thoroughly cleaned.
25

26 PART 3 – EXECUTION

27 28 3.01 PREPARATION OF SURFACES

- 29
30 A. All surfaces to be painted shall be prepared, as specified herein or in Section
31 09865, and shall be dry and clean before painting. Special care shall be given
32 to thoroughly clean interior concrete and concrete block surfaces of all marks
33 before application of finish.
34
35 B. All metal welds, blisters, etc., shall be ground and sanded smooth in accordance
36 with SSPC-SP-3 or in difficult and otherwise inaccessible areas by hand
37 cleaning in accordance with SSPC-SP-2. All pits and dents shall be filled, and
38 all imperfections shall be corrected so as to provide a smooth surface for
39 painting. All rust, loose scale, oil, grease, and dirt shall be removed by use of
40 solvents, wire brushing or sanding.
41
42 C. Concrete surfaces shall be finished as specified in Division 3. Report
43 unsatisfactory surface conditions to the Engineer. Concrete shall be free of
44 dust, oil, curing compounds, and other foreign matter. Concrete surfaces shall
45 have any laitance or weak layers removed prior to install of coatings or linings
46 using captive shot blasting systems. Concrete shall have a minimum surface
47 tensile strength of at least 300 PSI per ASTM D-4541 standard. Testing is

1 required to confirm this strength using ASTM D-4541 standard and methods.
2 Surface profile shall be CSP-3 to CSP-6 meeting ICRI (International Concrete
3 Repair Institute) standard guideline #03732 for Coating, Concrete, producing an
4 anchor profile equal to 60-grit sandpaper or coarser. Prepare concrete surfaces
5 by mechanical (captive shot blast) means to achieve this desired profile.
6 Moisture Vapor Transmission should be 3 pounds or less per 1,000 square feet
7 over 24-hour timeframe as confirmed through a calcium chloride test as per
8 ASTM E-1907. Quantitative relative humidity (RH) testing, ASTM F-2170,
9 should confirm concrete RH results < 75%. Application of coatings and linings
10 should be made when out gassing of concrete is declining during periods when
11 surface temperatures of the concrete is falling. Use of a surface thermometer
12 to determine when surface temperatures are falling is required. When in doubt,
13 double priming may be required. All surface irregularities, cracks, expansion
14 joints and control joints should be properly addressed prior to application of
15 coatings and linings. Remove all contaminants and contaminated surface
16 layers prior to application of coatings and linings.
17

- 18 D. Concrete block surface shall be smooth and cleaned of all dust, efflorescence,
19 chalk, loose mortar, dirt, grease, oil, tar and other foreign matter.
20
- 21 E. All plastic pipe surfaces shall be lightly sanded before painting.
22
- 23 F. Wood surfaces shall be dry. Sand to obtain a smooth surface. All encrustations
24 shall be removed.
25
- 26 G. Exposed Pipe: Bituminous coated pipe shall not be used in exposed locations.
27 Pipe that will be exposed after project completion shall be primed in accordance
28 with the requirements herein. Any bituminous coated pipe that is inadvertently
29 installed in exposed locations shall be sandblasted clean before priming and
30 painting. After installation all exterior, exposed flanged joints shall have the gap
31 between adjoining flanges sealed with a single component polysulfide sealant
32 to prevent rust stains.
33
- 34 H. Primed or Previously Painted Surfaces and Nonferrous Surfaces: All coated
35 surfaces shall be cleaned prior to application of successive coats. All
36 nonferrous metals not to be coated shall be cleaned. This cleaning shall be
37 done in accordance with SSPC-SP-1, Solvent Cleaning.
38
- 39 I. Shop-Finished Surfaces: All shop-coated surfaces shall be protected from
40 damage and corrosion before and after installation by treating damaged areas
41 immediately upon detection. Abraded or corroded spots on shop-coated
42 surfaces shall be "Hand Cleaned" and then touched up with the same materials
43 as the shop coat. All shop coated surfaces which are faded, discolored, or
44 which require more than minor touch-up, in the opinion of the Engineer, shall
45 receive new surface preparation before being repainted. Cut edges of
46 galvanized sheets and exposed threads, and cut ends of galvanized piping,

1 electrical conduit, and metal pipe sleeves, that are not to be finished painted,
2 shall be "Solvent Cleaned" and primed with zinc dust-zinc oxide metal primer.

3
4 J. Galvanized and Zinc-Copper Alloy Surfaces: These surfaces to be painted shall
5 be "Solvent Cleaned" and treated as hereinafter specified. Such surfaces not
6 to be painted shall be "Solvent Cleaned." Brush off blasting per SSPC-SP7
7 galvanized surfaces to insure optimum coating adhesion.

8
9 K. Aluminum embedded or in contact with concrete must be painted with one shop
10 coat of zinc chromate followed by one heavy coat of aluminum pigmented
11 asphalt paint. Brush off blasting per SSPC-SP7 of galvanized surfaces to insure
12 optimum coating adhesion.

13 14 3.02 WORKMANSHIP

15 16 A. General:

17
18 1. Primer (spot) and paint used for a particular surface shall, in general, be
19 as scheduled for that type of new surface. Confirm with the paint
20 manufacturer that the paint proposed for a particular repaint condition will
21 be compatible with the existing painted surface. Sample repainted areas
22 on the actual site will be required to insure this compatibility. Finished
23 repainted areas shall be covered by the same guarantee specified for
24 remainder of work.

25
26 2. At the request of the Engineer, samples of the finished work prepared in
27 strict accordance with these Specifications shall be furnished and all
28 painting shall be equal in quality to the samples. Finished areas shall be
29 adequate for the purpose of determining the quality of workmanship.
30 Experimentation with color tints shall be furnished to the satisfaction of
31 the Engineer where standard chart colors are not satisfactory.

32
33 3. Protection of furniture and other movable objects, equipment, fittings and
34 accessories shall be provided throughout the painting operations.
35 Canopies of lighting fixtures shall be loosened and removed from contact
36 with surface, covered and protected and reset upon completion. Remove
37 all electric plates, surface hardware, etc., before painting, protect and
38 replace when completed. Mask all machinery name plates and all
39 machined parts not receiving a paint finish. Dripped or spattered paint
40 shall be promptly removed. Lay drop cloths in all areas where painting
41 is being done to adequately protect flooring and other work from all
42 damage during the operation and until the finished job is accepted.

43
44 4. On metal surfaces apply each coat of paint at the rate specified by the
45 manufacturer to achieve the minimum dry mil thickness required. If
46 material has thickened or must be diluted for application by spray gun,
47 the coating shall be built up to the same film thickness achieved with

1 undiluted material. One gallon of paint as originally furnished by the
2 manufacturer shall not cover a greater area when applied by spray gun
3 than when applied unthinned by brush. Deficiencies in film thickness
4 shall be corrected by the application of an additional coat(s). On
5 masonry, application rates will vary according to surface texture,
6 however, in no case shall the manufacturer's stated coverage rate be
7 exceeded. On porous surfaces, it shall be the painter's responsibility to
8 achieve a protective and decorative finish either by decreasing the
9 coverage rate or by applying additional coats of paint.

- 10
- 11 5. Paints shall be mixed in proper containers of adequate capacity. All
12 paints shall be thoroughly stirred before use and shall be kept stirred
13 while using. No unauthorized thinners or other materials shall be added
14 to any paint.
- 15
- 16 6. Only skilled painters shall be used on the work and specialists shall be
17 employed where required.

18

19 B. Field Priming:

- 20
- 21 1. Steel members, metal castings, mechanical and electrical equipment and
22 other metals that are shop primed before delivery at the site will not
23 require a prime coat on the job. All piping and other bare metals to be
24 painted shall receive one coat of primer before exposure to the weather,
25 and this prime coat shall be the first coat as specified in the painting
26 schedule.
- 27
- 28 2. Equipment which is customarily shipped with a baked-on enamel finish
29 or with a standard factory finish shall normally be field painted unless the
30 prefinished equipment is specifically color selected and unless the finish
31 has not been damaged in transit or during installation. Surfaces that
32 have been shop painted and have been damaged, or where the shop
33 coats or coats of paint have deteriorated, shall be properly cleaned and
34 retouched before any successive painting is done on them in the field.
35 All such field painting shall match as nearly as possible the original finish.

36

37 C. Field Painting:

- 38
- 39 1. All painting at the site shall be designated as Field Painting.
- 40
- 41 2. All paint shall be at room temperature before applying, and no painting
42 shall be done when the temperature is below 50°F, in dust-laden air,
43 when rain or snow is falling, or until all traces of moisture have completely
44 disappeared from the surface to be painted.
- 45

- 1 3. Successive coats of paint shall be tinted so as to make each coat easily
2 distinguishable from each other with the final undercoat tinted to the
3 approximate shade of the finished coat.
4
- 5 4. Finish surfaces shall not show brush marks or other irregularities.
6 Undercoats shall be thoroughly and uniformly sanded with No. 00
7 sandpaper or equal to remove defects and provide a smooth even
8 surface. Top and bottom edges of doors shall be painted and all exterior
9 trim shall be back-primed before installation.
10
- 11 5. Painting shall be continuous and shall be accomplished in an orderly
12 manner so as to facilitate inspection. All exterior concrete and masonry
13 paint shall be performed at one continuous manner structure by
14 structure. Materials subject to weathering shall be prime coated as
15 quickly as possible. Surfaces of exposed members that will be
16 inaccessible after erection shall be cleaned and painted before erection.
17
- 18 6. All materials shall be brush painted unless spray painting is specifically
19 directed by the Engineer. The Contractor shall be responsible for all
20 damage caused by overspray or drifting.
21
- 22 7. All surfaces to be painted, as well as the atmosphere in which painting is
23 to be done, shall be kept warm and dry by heating and ventilation, if
24 necessary, until each coat of paint has hardened. Any defective paint
25 shall be scraped off and repainted in accordance with the Engineer's
26 directions.
27
- 28 8. Before final acceptance of the work, all damaged surfaces of paint shall
29 be cleaned and repainted as directed by the Engineer.
30
- 31 9. Any pipe scheduled to be painted and having received a coating of a tar
32 or asphalt-compound shall be painted with two coats of PPG/HPC PITT-
33 GUARD® Epoxy Penetrating Sealer 95-2328 or equal before successive
34 coats are applied per the schedule. Tnemec recommends using 66
35 Hi-Build Epoxoline over tar, but a test patch must be run initially to test
36 the paint's compatibility with the tar. Carboline does not recommend
37 application of their coatings over tar. Instead, Carboline recommends
38 removal of the tar followed by the application of suitable coatings based
39 on the substrate and intended service application.
40

41 3.03 CLEANUP

- 42
- 43 A. The premises shall at all times be kept free from accumulation of waste material
44 and rubbish caused by employees or work. At the completion of the painting
45 remove all tools, scaffolding, surplus materials, and all rubbish from and about
46 the buildings and leave work "broom clean" unless more exactly specified.
47

- 1 B. Upon completion, remove all paint where it has been spilled, splashed, or
2 splattered on all surfaces, including floors, fixtures, equipment, furniture, etc.,
3 leaving the work ready for inspection.
4
- 5 C. All cloths and waste that might constitute a fire hazard shall be placed in closed
6 metal containers or destroyed at the end of each day. Upon completion of the
7 work, the entire job left clean and acceptable to the Engineer.
8

9 3.04 INSPECTION, TESTING EQUIPMENT AND PROCEDURES
10

11 A. Inspection
12

- 13 1. All phases of the work are subject to inspection by the Engineer to assure
14 proper performance and compliance with the specifications.
15
- 16 2. The Engineer shall be advised of the proper time to inspect surface
17 preparation, prime coat and each succeeding coat. The Contractor shall
18 apply additional coats only after the previous coat has been observed by
19 the Engineer or Owner's representative.
20

21 B. Testing
22

- 23 1. The Contractor shall have on the project site the following testing
24 equipment. Equipment shall be in calibration and proper working order.
25 Equipment shall be used in accordance with the manufacturers'
26 instructions or as directed by the Engineer.
27

28 Sling Psychrometer: Relative humidity and dew point readings shall be
29 taken at intervals throughout the days work. Readings shall be taken at
30 the start of the mornings work, mid-day and afternoon. Should
31 environmental conditions change, additional reading shall be taken to
32 assure that coatings are being applied under the conditions as outlined
33 by the coatings manufacturer.
34

35 Surface Temperature Thermometer: Surface temperatures shall be
36 taken in areas where work is being performed. Surface temperature shall
37 be that as specified by the coatings manufacturer.
38

39 Replica Tape & Micrometer: Testex X-Course Replica Tape shall be
40 employed to determine the surface profile of blasted surfaces. Surface
41 profile shall be as specified.
42

43 Dry Film Thickness Measurements: Dry film thickness reading shall be
44 taken with a properly calibrated (per the manufacturer's instructions)
45 Type 1 (magnetic) or Type 2 (electromagnetic) instrument. Dry film
46 thickness reading will be taken and recorded in the in a frequency and
47 manner as dictated by the Engineer.

Holiday Detection: After completion of immersion coating systems on steel surfaces, all surfaces shall be holiday detected in accordance with ASTM G 62 low voltage holiday detection. Holiday detector shall be a Tinker & Rasor Model M-1 or equal. Areas found to have holidays shall be marked and repaired in accordance with the paint manufacturer's instructions. The Engineer shall be notified of time of testing so that he might be present to witness testing. The Contractor shall provide ladders, rigging, etc. as necessary to allow the Engineer to spot check paint thickness of each coat.

3.05 PAINT

A. General Notes & Guidelines:

1. All color numbers and names herein refer to the master color card. Colors of specified equal manufacturers shall be submitted for review to the Engineer.
2. Pipe lines, equipment, or other items which are not listed here shall be assigned a color by the Engineer and shall be treated as an integral part of the Contract.
3. When color coding is specified or directed by the Engineer, it shall consist of color code painting and identification of all exposed conduits, through lines and pipelines for the transport of gases, liquids, or semi-liquids, including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and any operating accessories which are integral to a whole functional mechanical pipe and electrical conduit systems.
4. The colors of the Finish Schedule shall be interpreted as follows:

COLORS	TNEMEC #	COLORS	TNEMEC #
White	11WH	Tank Blue	25BL
Ivory	01BR	Blue	11SF
Red	06SF	D. Blue	78BL
L. Green	52GN	L. Blue	26BL
Green	09SF	Aqua	10GN
D. Green	08SF		

COLORS	TNEMEC #	COLORS	TNEMEC #
L. Brown	06BR	Inter. Orange	05SF
Brown	84BR	Orange	04SF
Bronze	86BR	Tan	04BR
L. Gray	31GR	Yellow	03SF
M. Gray	33GR	Safety Yellow	02SF

- 1 D. Gray 34GR
- 2
- 3 5. All moving parts, drive assemblies, and covers for moving parts which
- 4 are potential hazards, shall be Safety Orange 04SF.
- 5
- 6 6. All safety equipment shall be painted in accordance with OSHA
- 7 standards.
- 8
- 9 7. All in-line equipment and appurtenances not assigned another color shall
- 10 be painted the same base color as the piping. The pipe system shall be
- 11 painted with the pipe color up to, but not including, the flanges attached
- 12 to pumps and mechanical equipment assigned another color. Tanks
- 13 shall be painted the color of the piping system that they serve, unless the
- 14 tank is fiberglass or polyethylene.
- 15
- 16 8. All conduits shall be painted to match its background surface.
- 17
- 18 9. Building surface colors shall be painted, as scheduled in the Finish
- 19 Schedule, or as selected by the Engineer.
- 20
- 21 10. Control panels shall be factory finished.
- 22

23 3.06 GUARANTEE AND ANNIVERSARY INSPECTION

- 24
- 25 A. All work shall be warranted for a period of one year from date of acceptance of
- 26 the project.
- 27
- 28 B. The Owner will notify the Contractor at least 30 days prior to the anniversary
- 29 date and shall establish a date for the inspection. Any defects in the coating
- 30 system shall be repaired by the Contractor at no additional cost to the Owner.
- 31 Should a failure occur to 25% of the painted surface, either interior or exterior,
- 32 the entire surface shall be cleaned and painted in accordance with these
- 33 specifications.
- 34

35 3.07 PAINT AND COLOR CODING SCHEDULE

36		
37	Piping and Legend	Color Bands
38	Backwash Waste	Light Brown
39	Blower Air	Green Orange
40	Coagulant	Aqua
41	Compressed Air	Dark Green Red
42	Drains	Black
43	Fuel	Red White
44	Potable Water	Dark Blue
45	Process Sample	Light Grey Red
46	Reclaimed Effluent	Pantone Purple 522C
47	Return Activated Sludge	Brown

1	Sodium Hypochlorite	Yellow	
2	Sprinkler	Red	
3	Thickened Sludge	Dark Brown	Orange
4	Wastewater	Dark Gray	
5	Waste Activated Sludge	White	
6			
7	Equipment and Building		Color
8	Exterior Equipment, Valves, Gates, Fans		Match System
9	Interior Equipment and Pumps (including factory finished)		Match System
10	Structural Steel (Interior)		White
11	Ceiling		White
12	Cranes and Hoists		Yellow
13	Ductwork		Match Surface Mounted
14	Interior Air Handling and Ventilation Equipment		Match Surface Mounted
15	Valve and Gate Operators		Match System
16	Electrical Conduit and Junction Boxes		Match Surface Mounted
17	Submerged Concrete		Black

- 18
- 19 3.08 PAINT SCHEDULE
- 20
- 21 A. All new equipment shall be painted to match the color of the existing equipment
- 22 being replaced.
- 23
- 24 B. All new piping, valves, and supports shall be painted to match the color of the
- 25 existing equipment piping valves, and supports being replaced.
- 26
- 27 C. Painting described by additive alternate items shall match the color of the
- 28 existing items.
- 29
- 30 D. Other items to be painted are as noted on the drawings and/or in the
- 31 Specifications.
- 32
- 33
- 34

35 END OF SECTION

36

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SECTION 13208

SUBMERSIBLE NON-CLOG PUMPS

PART 1 - GENERAL

1.01 SUMMARY

A. Contractor shall furnish and install four submersible sewage pumping units at the East WRF Influent Pump Station, together with base elbows, guide rail systems, liquid level controls, control panels, access covers and all appurtenances necessary for a complete installation.

1.02 REFERENCES

- A. Codes and standards referred to in this section are:
 1. ASTM A 48 -Specification for Grey Iron Castings
 2. Hydraulic Institute Standards
 3. IEEE 82 -Test Procedure for Impulse Voltage Tests on Insulated Conductors
 4. NEC -National Electric Code
 5. AFBMA 9 -Load Ratings and Fatigue Life for Ball Bearings
 6. AFBMA 10 -Specifications for Metal Balls

1.03 SYSTEM DESCRIPTION

- A. General: Provide pumps of the vertical, centrifugal, heavy duty, non-clog, close-coupled, submersible type, each driven by submersible electric motor mounted as an integral part of the pump. Design the pumping units to pump raw unscreened sewage. Arrange the pumping equipment guide rails and base elbow for installation in the spaces shown without appreciable revision of the piping or structure. All four pumps shall be operated with variable frequency drives.
- B. Operating Conditions: Provide pumps to operate at the capacities and heads and over the range of operating conditions specified without overloading, cavitation, and vibration. Furnish the pumps in accordance with the following requirements:

1

Items	Requirements			
	Pump #1	Pump #2	Pump #3	Pump #4
Pump Model	Flygt NP3306	Flygt NP3306	Flygt NP3171	Flygt NP3171
Capacity at rating point (gpm)	5020	5020	2000	2000
Total head at duty point (feet)	51.8	51.8	34	34
Efficiency at duty point	80%	80%	70%	70%
Shutoff head (feet)	93	93	103	103
Pump discharge diameter, minimum (inches)	14	14	6	6
Pump speed, maximum (rpm)	885	885	1755	1755
Motor horsepower (hp)	85	85	25	25
Rated Voltage (V)	480	480	460	460

2
3 C. Pump Curve: Design each pump to have a continuously rising characteristic
4 curve from the rating point to shutoff which passes through the rating point,
5 and which meets or exceeds the specified heads and capacities, all within
6 the Hydraulic Institute tolerances.

7
8 D. Provide submersible units capable of sustaining full reverse runaway speed
9 without damage.

10
11 1.04 SUBMITTALS

12
13 A. General: Provide all submittals, including the following, as specified in
14 Division 01.

15
16 B. Shop Drawings: Submit working drawings, including arrangement and erection
17 drawings of the equipment and equipment operating characteristics. Include
18 the following:

19
20 1. Pump performance curves. Draw the curves for the specified conditions
21 including those at reduced speed. Plot head, input kilowatts, and overall
22 efficiency, as a function of capacity from zero to maximum capacity.

23
24 2. Certification that the pump is physically capable of operating at the
25 specified reduced speed operating condition.

26
27 3. General arrangement drawing of pumping unit, base elbow, and guide rail
28 system. Include equipment weight and anchor methods and materials.

29
30 4. Cross section drawing of pumping unit.

31
32 5. Parts list with materials of construction identified.

- 1
2 6. Motor performance characteristics.
3
4 7. Spare parts list.
5
6 a) At minimum shall include:
7
8 i. 1 set of special tools required to service the pumps
9
10 ii. 2 mechanical seals, one for each type of pump
11
12 8. Painting procedure.
13
14 C. Quality Control Submittals: Submit one (1) electronic copy of the certified Shop
15 Test results.
16
17 D. Operation and Maintenance: Submit the Operation and Maintenance manuals
18 for the pumping equipment.
19
- 20 1.05 PUMP WARRANTY
21
22 A. The pump manufacturer shall warrant the pumps being supplied against
23 defects in workmanship and materials for a period of five (5) years from the
24 date of system acceptance by the Owner under normal use, operation, and
25 service.
26
- 27 1.06 QUALITY ASSURANCE
28
29 A. Qualifications: Provide pumping equipment produced by a manufacturer who
30 regularly engages in the design, manufacture, assembly, and production of
31 submersible sewage pumping equipment of the size and type as specified
32 for not less than five years.
33
34 B. Regulatory Requirements: Rate the motor unit, and wet well wiring for
35 service in hazardous Class 1, Division 1 locations.
36
- 37 1.07 DELIVERY, STORAGE AND HANDLING
38
39 A. Deliver, store, and handle all products and materials as specified in Division 01.
40
- 41 1.08 PARTS
42
43 A. Special Tools: Furnish a complete set of special wrenches, spanners,
44 eyebolts, and other special tools sufficient to completely dismantle and
45 reassemble each kind and size of pumping unit. Provide tools of forged steel,

1 case hardened, and full finished. Furnish the sets with a metal tool case with a
2 handle and provision for padlocking.

3
4 PART 2 - PRODUCTS

5
6 2.01 MANUFACTURERS

7
8 A. Acceptable manufacturers are Flgyt, or others approved equal.
9

10 2.02 GENERAL CONSTRUCTION

11
12 A. Materials: Provide stainless steel fasteners, bolts, nuts, and washers where
13 exposed to the pumped liquid.

14
15 B. Component Joints: Provide machined metal-to-metal joints on component parts
16 that are assembled together. Fit with an "O"ring seal where watertight joints
17 are required. Arrange the "O"ring seal for automatic compression and sealing
18 without adjustment or bolt torquing procedures. Do not use flat gaskets or
19 sealing compounds to obtain watertight joints.
20

21 2.03 CASING

22
23 A. General: Provide pump casing of the centrifugal single volute, centerline
24 discharge type. Do not use diffusion vanes.

25
26 B. Materials: Construct pump casing of ASTM A48, Class 30B or 35B cast iron.

27
28 C. Wear Ring: Construct renewable wear rings of stainless steel.
29

30 2.04 IMPELLER

31
32 A. General: Design impeller of the enclosed non-clog type. Provide pump-out
33 vanes or a back ring, arranged with minimum clearances so as to preclude
34 solids and stringy material from damaging the mechanical seal, on the back of
35 the impeller.

36
37 B. Materials: Construct the impeller of cast iron ASTM A48, Class 30B or 535B.

38
39 C. Balance: Dynamically balance the impellers.

40
41 D. Wear Ring: Construct renewable impeller wear ring of stainless steel.

42
43 E. Assembly: Secure the impeller to the shaft with a stainless steel key and lock
44 nut in such a way that it cannot unscrew or become loosened due to rotation in
45 either direction.

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46

2.05 OIL CHAMBER

- A. General: Provide an oil chamber to function as a buffer between the pumped liquid in the casing and the motor. Arrange the oil chamber to accommodate thermal expansion of the oil. Furnish an oil chamber drain plug that is accessible from outside the pump unit and permits changing oil without dismantling pump components.
- B. Materials: Construct the oil chamber of ASTM A48 cast iron, Class 30B or 35B.

2.06 MECHANICAL SEAL

- A. Design: Provide each pump with double tandem mechanical seals. Design the upper seal unit, between the oil chamber and motor housing, with one stationary silicon-carbide ring and one positively driven rotating silicon carbide ring. Design the lower seal unit, between the pump casing and oil chamber, with one stationary ring and one positively driven rotating ring. Furnish these rings made of silicon-carbide. Use type 316 stainless steel for metal parts. Protect the spring element of the lower seal from solids contained in the pumped liquid. Do not rely upon the pumped liquid for lubrication. No seal damage is to result from operating the pumping unit out of its liquid environment. Conventional double mechanical seals with a single or double constant differential pressure to effect sealing and subject to opening and penetration by pumping forces will not be acceptable.

2.07 MOTOR

- A. General: Provide submersible pump motor of 460-volt, 3-phase, 60-hertz. The pump shall be non-overloading throughout the entire range of operation without employing service factor.
- B. Ratings: Design the motor to have suitable output torque and speed characteristic to start and operate the pump over the range of specified conditions. For constant speed pumping units do not exceed the nameplate horsepower rating under maximum load conditions. Base the nameplate horsepower rating on an 80 degrees C temperature rise above an ambient temperature of 40 degrees C.
- C. Insulation: Provide the motor with a minimum of NEMA Class H (180 degrees C) moisture resistant insulation. Construct stator coils with NEMA Class H insulated winding wire. Apply impregnation resin to stator assembly in three dip and bake steps.
- D. Stator Housing: Provide the motor with an ASTM A48, Class 30B or 35B cast

1 iron stator housing. Sewage jackets will not be considered acceptable.

2
3 E. Cables: Provide the motor cable entry with a mechanical locking ring or
4 compression type cord grip to protect the cable jacket from being pulled out of
5 the motor. Do not use epoxy for this purpose. Arrange the cable entry so as
6 to provide a watertight seal with a terminal board and terminations next to the
7 motor. Isolate the cable entry leads from the internal motor leads to prevent
8 entry of water into the motor chamber by leakage or wicking. Provide cables
9 suitable for submersible pump application and conforming to NEC
10 specifications for cable sizing. Provide permanent label on cables.

11
12 F. Shaft

13
14 1. Design: Provide a one piece, fully machined pump, and motor shaft.
15 Design the shaft to limit shaft deflection under maximum pumping
16 load to .002 inches at the lower mechanical seal face and to obtain
17 a rotating assembly first critical speed of not less than 150 percent of
18 the rated speed.

19
20 2. Material: Provide shafts of stainless steel.

21
22 G. Bearings

23
24 1. Design: Provide two anti-friction bearing assemblies. Design one
25 assembly to carry only radial loads and to be free to float axially within
26 the frame. Design the other assembly to carry both radial and axial
27 loads and to be restrained from axial movement.

28
29 2. Bearing Life: Select bearings in accordance with AFBMA 9 and
30 AFBMA 10, Load Ratings and Fatigue Life for Ball and Roller Bearings,
31 to have a 100,000-hour minimum L10 bearing life at maximum pumping
32 load that occurs under the specified operating range conditions.

33
34 2.08 PROTECTION MONITORING SYSTEM

35
36 A. General: Provide each pumping unit with a monitoring system to protect critical
37 machine functions during operation.

38
39 B. Motor Winding Temperature: Provide thermal switches, one per phase, to
40 protect against overheating. Initiate an alarm and motor shutdown on high
41 temperature.

42
43 2.09 GUIDE RAIL SYSTEM AND BASE ELBOW

44
45 A. Design: Provide each pump with a base elbow and guide rail system.
46 Design the guide rail system to permit installation and removal of the pump
47 from its base elbow discharge connection without requiring personnel to enter

1 the wet well.

2
3 B. Guide Rail System: Provide a guide bracket which is an integral part of the
4 pump casing and permits sliding the pumping unit, along two unthreaded 316
5 stainless steel guide rails. Provide the guide rails of 316 stainless steel pipe
6 connected to the base elbow at the bottom. Support the guide rails at
7 intermediate locations and at the top with stainless steel brackets bolted to the
8 wall of the wet well or concrete slab. Fit each pump with a 316 stainless steel
9 cable of adequate length and strength to permit the raising and lowering of the
10 pump for inspection and removal.

11
12 C. Base Elbow: Provide a cast iron base elbow arranged for automatic pump
13 connection. Provide the pump casing with a machined discharge flange
14 which, when the pump is lowered into the pumping position, will automatically
15 align and mate with the plain-end of the base elbow. Design the discharge
16 connection such that no motion other than vertical is required to seat the
17 mating flange of the casing to the base elbow. Accomplish sealing of the pump
18 connection by metal to metal contact or by a positive resilient seal of Buna-N
19 attached to the pump casing discharge flange. Design the base elbow to
20 support the weight of the pumping unit and prevent it from bearing directly on
21 the wet well floor.

22
23 D. Mounting Accessories: Provide anchor bolts, nuts, washers, and accessories
24 and other adapter equipment necessary for mounting the pumping
25 equipment and appurtenances. Construct anchor bolts, nuts, washers,
26 accessories and adaptor equipment of 316 stainless steel. Provide 3/8-inch
27 minimum 316 stainless steel chain a minimum of 20 inches long attached to a
28 minimum 1/4-inch minimum 316 stainless steel wire rope which is to be hung
29 on a 316 stainless steel rack at the top of the wet well. The Contractor shall
30 coordinate with the pump manufacturer and the precast manufacturer to
31 include all hardware that is required to be pre-casted into the concrete wetwell
32 in order to properly anchor the pump.

33
34 PART 3 - EXECUTION

35
36 3.01 INSTALLATION

37
38 A. Install all equipment in accordance with the manufacturer's recommendations
39 and approved shop drawings and as specified in Division 1. Complete all
40 wiring and piping and make all necessary adjustments to equipment to provide
41 a complete operational pumping installation.

42
43 3.02 FIELD QUALITY CONTROL

44
45 A. Manufacturer's Field Services: Furnish the services of a qualified
46 representative of the manufacturer to provide instruction for proper installation
47 of the equipment, inspect the completed installation, make any necessary

1 adjustments, participate in the startup of the equipment, participate in the field
2 testing of the equipment, and place the equipment in trouble-free operation,
3 as specified in Division 1.
4

5 B. Tests: After installation of the pumping units, control equipment and all
6 appurtenances, subject each unit to a field running test as specified in
7 Division 01, under actual operating conditions. Perform the field tests in the
8 presence of and as directed by the ENGINEER. Demonstrate that under all
9 conditions of operation each unit:

- 10 1. Has not been damaged by transportation or installation.
- 11 2. Has been properly installed.
- 12 3. Has no mechanical defects.
- 13 4. Has been properly connected.
- 14 5. Is free of overheating of any parts.
- 15 6. Is free of overloading of any parts.

16
17
18 Test the pumps to demonstrate that the pumps and control system operate as
19 specified. Promptly correct any defects in the equipment or failure to meet the
20 requirements of the Specifications.
21

22 Conduct 72 hours of continuous operation test prior to acceptance.
23

24 C. Demonstrate that the pump can be properly removed from and lowered into the
25 wetwell.
26

27 3.03 CLEANING AND PAINTING

28
29 A. All metal surfaces coming into contact with the sewage, other than stainless
30 steel or brass, shall be protected by a factory applied spray coating of
31 acrylic dispersion zinc phosphate primer with a polyester resin paint finish on
32 the exterior of the pump.
33

34 END OF SECTION

SECTION 13280

TANK SPRAY CLEANING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. Contractor shall furnish and install a tank spray cleaning system at the East WRF Influent Pump Station, including: three spray nozzle heads, SCH 80 PVC piping, fittings, and all appurtenances necessary for a complete installation per the Contract Documents.

1.02 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 01.
- B. Shop Drawings: Submit working drawings, including arrangement and erection drawings of the equipment and equipment operating characteristics. Include the following:
 - 1. Descriptive literature, bulletins and/or catalogs of the equipment.
 - 2. Parts list with materials of construction identified.
 - 3. O&M Manual

1.03 QUALITY ASSURANCE

- A. Qualifications: Provide equipment produced by a manufacturer who regularly engages in the design, manufacture, assembly, and production of such spray nozzle as specified for not less than five years.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle all products and materials as specified in Division 01.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Spray Nozzle manufacturer shall be Spraying Systems Co., or approved equal.

2.02 GENERAL CONSTRUCTION

1 A. Spray Nozzle: The spray nozzles shall be manufactured by Spraying Systems Co.,
2 model TankJet 180 Tank Cleaner, or Engineer approved equal, with the following
3 specifications:

- 4
- 5 1. Maximum tank diameter of 80 ft. (24.4 m)
- 6 2. Flow rate range of 30 to 300 gpm (114 to 1136 lpm)
- 7 3. Operating pressure range of 40 to 350 psi (2.8 to 24 bar)
- 8 4. No. of Nozzles: 3
- 9 5. Nozzle Size: 9/32 in.
- 10 6. Wash cycle time range of 10 to 30 min
- 11 7. Maximum temperature of 250°F (121°C)
- 12 8. Materials:
 - 13 (a) Gears – 17-4PH stainless steel
 - 14 (b) O-rings – self-lubricating EPDM or Viton
 - 15 (c) Seals – high-performance spring-energized PTFE
 - 16 (d) Gear shaft bearing system – PTFE or oilite bearing
 - 17 (e) All other metallurgy – 316 stainless steel or Viton
- 18 9. Inlet connection: 2" NPT (F) with 2-1/2" quick-disconnect (M)
- 19 10. Spray Coverage: 180 degrees
- 20

21 2.03 Spare Parts

22
23 A. Manufacturer shall supply the following spare parts:

- 24
- 25 1. (1) Bearing-Cup Repair Kit
- 26 2. (1) Gear Ratio Gearset
- 27 3. (1) Gearbox Bearing Replacement Kit
- 28 4. (1) O-Ring Kit
- 29 5. (1) Tool Kit
- 30
- 31

32 PART 3 - EXECUTION

33 34 3.01 INSTALLATION

35
36 A. Install all equipment in accordance with the manufacturer's recommendations and
37 approved shop drawings and as specified in Division 1. Complete all piping and
38 make all necessary adjustments to equipment to provide a complete operational
39 pumping installation.

40 41 3.02 FIELD QUALITY CONTROL

42
43 A. Manufacturer's Field Services: Furnish the services of a qualified representative of
44 the manufacturer to provide instruction for proper installation of the equipment,
45 inspect the completed installation, make any necessary adjustments, participate in
46 the startup of the equipment, participate in the field testing of the equipment, and
47 place the equipment in trouble-free operation, as specified in Division 1. The

1 contractor shall provide detailed drawings and specifications of the nozzle spray
2 system, including the piping and nozzles, prior to installation.
3

4 B. Tests: After installation of the pumping units, control equipment and all
5 appurtenances, subject each unit to a field running test as specified in Division 01,
6 under actual operating conditions. Perform the field tests in the presence of the
7 Owner's Representative. Demonstrate that under all conditions of operation each
8 unit:
9

- 10 1. Has not been damaged by transportation or installation.
- 11 2. Has been properly installed.
- 12 3. Has no mechanical defects.
- 13 4. Has been properly connected.
- 14 5. Is free of overheating of any parts.
- 15 6. Is free of overloading of any parts.
- 16

17 END OF SECTION
18

SECTION 13290

LARGE BUBBLE MIXING SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Large Bubble Mixing System includes a rotary screw air compressor with dryer unit which will be installed in the blower room, inside the sludge handling building. The air produced by the air compressor unit will be transported through a 316 stainless steel airline to the Secondary Valve Enclosure (SVE) electrical control panel (PLC). On the discharge side of the PLC unit, seven (7) 316 stainless steel airlines will penetrate through the pump station wall and connect to the eleven (11) accumulator plates installed on the bottom of the wet well. When the system is in operation, oval shaped bubbles will produce from the accumulator plates and rise to the top of the tank, moving the entire contents in a powerful mixing motion without any moving parts inside the wet well.

1.02 SUMMARY OF WORK

- A. Contractor shall furnish all labor, equipment, appliances, materials and performing all operations in connection with providing and installing a complete Large Bubble Mixing System as shown on the Contract Drawings and as specified herein.

1.03 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Society of Mechanical Engineers (ASME): PTC 10, Compressors and Exhausters.
 2. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - b. MG 1, Motors and Generators.

1.04 DEFINITIONS

- A. Standard Cubic Foot Per Minute (scfm): Volume flow rate of air at standard conditions of 60 degrees F, 14.7 psia, and 36 percent relative humidity.

1.05 SUBMITTALS

1. Complete shop drawings, startup Manual, O&M manual shall be submitted to the Engineer for review.

1.06 QUALITY ASSURANCE

- 1 A. Provide large mixing bubble system and air compressor unit produced by
2 a manufacturer who regularly engages in design, manufacturer, assembly,
3 and production of such equipment of size and type as specified for not less
4 than fifteen years.
5

6 1.07 DELIVERY, STORAGE AND HANDLING
7

- 8 A. Deliver, store, and handle all products and materials as specified in
9 Division01.
10

11 PART 2 - PRODUCTS
12

13 2.01 MANUFACTURERS
14

- 15 A. Large Bubble Mixing Unit shall be manufactured by Pulsair, or approved
16 equal.
17
18 B. Rotary Screw Air Compressor with Dryer shall be manufactured by Atlas
19 Copco, or approved equal.
20

21 2.02 NAMEPLATES
22

- 23 A. Provide each major item of equipment with the manufacturer's name,
24 address, type or style, model or serial number, and catalog number on a
25 plate secured to the item of equipment.
26
27 B. Nameplates shall be provided for, but not limited to, air compressor and
28 pneumatic mixing system control panel.
29
30

31 2.03 LARGE BUBBLE MIXING UNIT
32

33 A. General
34

- 35 1. The Large bubble mixing unit shall be designed to use with
36 compressed air to form bubbles in wastewater wet wells to induce
37 mixing, maintain a consistent suspension of material within the liquid
38 mixture, prevent the settling of material out of the liquid mixture, and
39 prevent the formation of grease caps on the liquid surface. The
40 manufacturer shall provide a complete integrated system consisting of
41 an air compression system, PLC controller, pneumatic mixing system
42 control panel, and bubble accumulator plates of the size and quantity
43 necessary for mixing.
44 2. The mixing unit shall not include any components located in the wet
45 well that pivot, rotate, oscillate, or otherwise move to create the mixing
46 action.
47 3. The large bubble mixing unit shall be designed for continuous duty
48 operation. System components installed within the wet wells shall be
49 rated for continuous submerged wastewater application.
50 4. The large bubble mixing unit will be installed in the wet wells will

1 achieve uniform mixing throughout the entire volume of these wet wells
2 as described below.
3

Name	Wet Well
Number of Compartments	1
Tank Shape/Configuration	Rectangular
Tank Dimensions	
Length	25'
Width	16.5'
Height	20'
Average Liquid Depth	5'

- 4
5 5. The large bubble mixing unit shall be capable of maintaining a
6 consistent solids concentration throughout the wet wells.
7 a. The liquid mixture is municipal wastewater.
8

9 **B. Equipment Parts**

- 10
11 1. Large Bubble Mixing Unit Controller shall be manufactured by Pulsair,
12 model PPC-1A07-H03, or approved equal. With the following items:
13 a. Eleven (11) 12" 304 stainless steel double accumulator plates
14 with mounting eyelets.
15 b. One (1) NEMA-4X Stainless Steel Powder Coated White
16 enclosure
17 c. Color touchscreen HMI interface with standard adjustable mixing
18 modes
19 i. Continuous mixing
20 ii. Intermittent continuous mixing
21 iii. Process (batch) mixing
22 iv. Process (batch) intermittent mixing
23 d. Remote override & interrupt
24 e. Password Protection
25 f. Power Outage Restart Option
26 g. Programable Fault Monitoring
27 2. Pre-plumbed all weather NEMA-4X 304 Stainless Steel Powder Coated
28 White valve enclosure shall include:
29 a. One (1) Large Bubble Mixing Unit Controller housed inside a
30 NEMA-4X FRP enclosure
31 b. One (1) EPI-7/1 (Electro-pneumatic interface) integrated
32 c. Seven (7) 1-1/2" air injection valves mounted on air manifold
33 d. One (1) high-flow air filter with auto drain
34 e. One (1) manual air pressure regulator
35 f. One (1) Pressure transducer
36

37 **2.04 AIR COMPRESSOR**

38
39 **A. General**

- 40
41 1. Air Compressor unit shall be manufactured by Atlas Copco, model G

1 Series 7L-125 psi, or approved equal.
2 2. Furnish air compressors as a complete system that includes
3 compressor, motor, controls, refrigerant air dryer, filters, receiver, and
4 accessories.
5

6 B. Equipment Parts
7

8 1. Single stage, oil injected, rotary screw air compressor, includes the
9 following items and features:

- 10 a. Tank mounted on a 120 gallon ASME approved tank
11 b. Air Compressor Data Summary:

12 i. Inlet Condition

13 Barometric pressure 14.5 PSI
14 Ambient Temperature 68 F
15 Relative Humidity: 0%

16 ii. Performance

17 Discharge Pressure 125 PSI
18 Capacity Delivery 39.2 CFM
19 Package power input, loaded pack 10.8 kW
20 Package power input, unloaded pack 4.7 kW
21 Package power input, loaded FF 11.3 kW
22 Package power input, unloaded FF 4.9 kW
23 Sound Level 65 dB(A)

24 Minimum ambient temperature 32 F
25 Maximum ambient temperature 115 F

26 iii. Cooling Data

27 Cooling air flow pack 742 CFM
28 Discharge air temp Pack 16 F
29 Cooling air flow integrated dryer 230CFM
30 Discharge air temp FF 9 F

31 iv. Electrical Data: 460V, 60Hz, Type J or RK 25 A

32 Motor 10 HP
33 Motor Type IE3 Prem. Eff
34 Enclosure TEFC
35 Efficiency 90.3%
36 Starter type DOL

37 v. Physical Data

38 Air discharge size 0.5" NPT
39 Condensate drain size 0.375" NPT
40 Oil sump capacity 0.8 gal
41

42 2. Filter

- 43 a. Filter shall be manufactured by Atlas Copco, model UD+, type 25,
44 or approved equal.
45 b. high efficient coalescing filter type, removes contaminants such as
46 liquid water, oil aerosol up to 0.01ppm and particle size down to
47 0.01 micron. 40% pressure drop reduction, 0.0009 maximum oil
48 carry over
49 i. Smart indicator differential pressure gauge
50 ii. Non-stick float drain

1 iii. Aluminum die casted head and bowl
2

3 3. Oil Water Separator

4 a. Oil Water Separator shall be manufactured by Atlas Copco, model
5 OSC 12-2500 or approved equal.

6 b. Oil Water Separator shall include the following items and features:

7 i. Air Compressor Oil Type: synthetic oils and oil mixtures

8 ii. Filter Media: Orange Clay

9 iii. Condensate inlet: ¼"

10 iv. Water outlet: 3/8"

11 v. Test Outlet (ball valve) 3/8"

12 vi. Filing Volume: 0.5 gal
13

14 C. Spare Parts

15
16 1. Provide one (1) complete set of manufacturers recommended spare
17 parts.

18 2. Provide one (1) of each type of air filter per mixing system.
19

20 PART 3 - EXECUTION

21
22 3.01 GENERAL

23
24 A. Install all equipment in accordance with the manufacturer's
25 recommendations and approved shop drawings and as specified in
26 Division 01. Complete all wiring and piping and make all necessary
27 adjustments to equipment to provide a complete operational pumping
28 installation.
29

30 B. All equipment shall be field tested in accordance with this Section of the
31 Specifications.
32

33 3.02 WARRANTY

34
35 A. The complete system shall be warranted to be free from defects in
36 material and workmanship under normal and proper use and service, for a
37 period of one (1) year after startup and acceptance by the Owner, or 15-
38 months from the date of shipment; whichever should occur first. The
39 Contractor shall provide all labor and materials to repair or replace any
40 defective warranted items specified in this section.
41

42 B. Warranties: Submit a written warranty, executed by the Manufacturer of
43 the equipment and the Contractor, agreeing to repair or replace
44 components of the equipment that fail in materials or workmanship within
45 the specified warranty period.
46

47
48 3.03 STARTUP & FUNCTIONAL TESTING AND INSPECTION

49 A. Services of Manufacturer's Representative as specified herein.
50

1
2 B. Provide services of factory-trained Service Engineer, specifically trained
3 on type of equipment specified with at least 5-years' experience:
4

- 5 1. Submit qualifications of Service Engineer for approval.
- 6 2. Man-day requirements listed exclusive of travel time, and do not relieve
7 Contractor of obligation to provide sufficient service to place equipment
8 in satisfactory operation.
- 9 3. Start-up & Functional Testing and Inspection: Sufficient time for
10 calibration, testing and start-up.
11 a. 1 day(s)
- 12 4. Instruction: Sufficient time for classroom and/or field operation and
13 maintenance instruction.
14 a. 1 day(s)
15 b. Instruction can coincide with startup if scheduling allows.
- 16 5. Performance Testing (Full System Performance Test and Full System
17 Demonstration Test): Sufficient time for field performance testing.
18 a. 1 day(s)
19

20 3.04 PERFORMANCE TESTING
21

22 A. Manufacturer's Services:
23

- 24 1. Manufacturer's Service: Contractor shall obtain the services of a
25 qualified, factory-trained representative of the equipment manufacturer
26 to provide on-site assistance, direction and supervision during
27 equipment installation, start-up, testing, calibration, and adjustment as
28 required to deliver the Work, complete and operational, to the Owner
29 as specified herein, to the satisfaction of the Engineer.
- 30 2. Equipment Start-Up: Furnish all labor, parts, tools and lubricants for
31 start- up, testing and placing the equipment in full operational condition
32 in accordance with the requirements specified herein.
- 33 3. For equipment start-up inspection, calibration, adjustment, testing and
34 operator training, provide a minimum site visit of one 8-hour day per
35 pneumatic mixing system.
36

37 B. Upon complete installation of the air supply piping to each wet well, the
38 Contractor shall isolate the entire run of pipe from the pneumatic mixing
39 system control panel to the bubble forming accumulator plate. The
40 Contractor shall apply the manufacturer-recommended operating pressure
41 to the pipe and shall hold for 10 minutes. If the pipe loses pressure, the
42 Contractor shall be responsible for identifying the location of the leak and
43 making any necessary repairs, at no cost to the Owner. Following the
44 repair to a leak, the pipe shall be tested again until meeting the
45 requirements aforementioned. The wet well shall be brought online only
46 after the supply piping passes the approved pressure test and is accepted
47 by Engineer/Owner.
48

49 C. In the event that a unit fails to pass a test, make all modifications required
50 to place the unit in proper working order.

1
2
3
4
5
6
7
8
9
10
11

- D. In the event that a unit fails a test a second time, remove the unit and replace with a satisfactory one, at no cost to the Owner.
- E. The Contractor shall provide all necessary instrumentation, equipment, devices, and appurtenances, as well as temporary wiring or piping, required to perform performance tests.

END OF SECTION

1
2
3
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1 SECTION 13305

2
3 CONTROL DESCRIPTIONS

4
5 PART 1 GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. This section is provided to clarify the control strategies to be used to program the
10 changes defined as part of this project.
11
12 B. All SCADA PLC controller programming and SCADA Operator Interface Terminal
13 (OIT) or Operator Workstation Station (OWS) graphics and programming shall be
14 performed as defined in Section 13300.

15
16 1.02 MEASUREMENT AND PAYMENT

- 17
18 A. No separate payment will be made for work performed under this Section. Include
19 the cost for this work in the lump sum Base Bid Item.
20

21 1.03 RELATED WORK

- 22
23 A. Refer to Section 13300 "I & C - General Provisions."
24

25 PART 2 PRODUCTS – NOT USED

26
27 PART 3 EXECUTION

28
29 3.01 GENERAL

- 30
31 A. The control descriptions are broken into the following.
32
33 1. Flow Meters
34
35 2. Level Transmitters
36
37 B. The control descriptions are broken into a hierarchical layer concept. There may be
38 one layer or multiple layers per loop, depending upon that loop. An example of
39 multiple layered loop is as follows. The lowest layer of control, local control, is at that
40 piece of equipment or that piece of equipment's panel or drive. The second layer of
41 control is at an intermediate control panel between the equipment and the SCADA
42 I/O or vendor's PLC I/O. The third layer would be at the vendor's PLC or
43 microprocessor touchscreen station. The highest layer of control is by the SCADA
44 PLC System with its associated operator workstations (OWS) in the main control
45 room. The SCADA PLC/ OWS refers to both the SCADA PLC, which does the actual
46 monitoring and control logic for the process equipment and the SCADA operator

1 workstation (OWS), which are computers that have graphical software that interface
2 to the PLC software for monitoring and implementing all operator-required tasks to
3 control that process equipment. Any functions done in the operator workstations also
4 take place at all the SCADA OITs.

5 6 3.02 CONTROL FUNCTION DEFINITIONS AND GENERAL CRITERIA 7

- 8 A. The hardware and/or software functions noted by this paragraph reference are to be
9 implemented by the SCADA PLC/OWS control system specified herein.
- 10
11 B. The following list of ISA abbreviations is typical of those utilized. The description,
12 following the abbreviation, summarizes the basic function to be implemented in the
13 SCADA PLC/OWS software.
- 14
15 1. HS: Represent selector switches or pushbuttons, which shall be implemented by
16 keyboard entry. Function shall be similar to their hardware counterparts.
17 Examples are as follows:
 - 18 a. HSH-Open Command
 - 19 b. HSL-Close Command
 - 20 c. HSS-Start/Stop Command
 - 21
22 2. YI: Represents equipment status (i.e., availability, running, in remote, etc.)
23 implemented by a change of color on the OWS symbol for this equipment. For
24 motor driven equipment such as pumps, blowers, compressors, etc., availability
25 contact represents remote operation and no alarm conditions. Examples are as
26 follows:
 - 27 a. YCI-Selector switch in computer, auto or remote position
 - 28 b. YRI-Motor running status
 - 29 c. YFI-Motor failure or overload status
 - 30 d. YMI-Selector switch in maintenance position
 - 31
32 3. PAL, AAH, UA, etc.: Represent high or low alarms implemented on the OWS.
 - 33
34 4. FIC, PIC, AIC, etc.: Represent PID process controllers implemented in a
35 computer logic algorithm incorporating proportional, integral, and/or derivative
36 modes. Local/remote and manual/auto capabilities shall be provided.
 - 37
38 5. FIK, PIK, AIK, etc.: Represent control stations implemented in logic (via keyboard
39 entry and CRT display) to allow downloading of a set point to a FIC, PIC, AIC,
40 etc., and display of the process variable or controller output.
 - 41
42 6. FI, PI, AI, etc.: Represent digital output display on the CRT of a process variable
43 in engineering units and/or a dynamic representation of the variable by symbol or
44 graphical means.
- 45

- 1 7. FIR, PIR, AIR, Represent values stored on the hard disk to provide the data for
2 historical trend graphics of process variables against time (or other selected
3 variables).
- 4
- 5 8. ZSH, ZSL etc.: Represent high or low, open or close limit positions implemented
6 on the OWS
- 7
- 8 C. Following are general criteria followed for SCADA system design. Not all of them will
9 be applicable for the project. Detailed control descriptions for each process area are
10 provided in the following sections.
- 11
- 12 D. All interlocks that are represented, before the local operational descriptions, or are
13 stated as hardwired interlocks, shall interlock all the controls locally and at the SCADA
14 PLC/OWS or at the vendor PLCs. The SCADA PLC shall be programmed to
15 shutdown that equipment if that hardwired interlock is also wired to the SCADA PLC.
- 16
- 17 E. All interlocks that are represented in a particular layer of the operational descriptions,
18 shall interlock all the controls in that layer and the layer after it. However, the interlock
19 shall not interlock the commands in the layer before it.
- 20
- 21 F. All motors that are requested to start by an operator or an automatic program shall
22 alarm if the run confirm status for that motor does not activate within two seconds. If
23 a motor stops by an interlock or stops without any operator or SCADA intervention,
24 then that motor shall go into alarm. All motors that are stopped by a program or the
25 operator shall not go into an alarm.
- 26
- 27 G. All valves that are requested to open by an operator or an automatic program shall
28 alarm if the open feedback status for that valve does not activate within ten seconds.
29 All valves that are requested to close by an operator or an automatic program shall
30 alarm if the close feedback status for that valve does not activate within ten seconds.
- 31
- 32 H. Motors that have an H/O/A shall indicate to the operator that the pump is being run
33 in the "Hand" position. A motor is being run in "Hand" when the "Auto" position is not
34 true and the run confirm status is true. If not in "Auto" the SCADA PLC shall open up
35 its output contact to stop (shutdown) the pump from SCADA.
- 36
- 37 I. All motors shall be programmed so if a motor stops for any reason, it shall not be re-
38 started automatically once the problem with the motor has been resolved. The start
39 command on the OWS shall not be a maintained contact but a momentary command
40 to the PLC. The run confirms of all motors shall seal in the control output to the motor
41 once the momentary start command drops out. The run confirms shall be on a five
42 second timer delay in that if the run confirm is not present after five seconds, the
43 contact output to the motor from the PLC shall drop out. Thus, the only way a motor
44 can be restarted after five seconds by the SCADA system is if the operator reinitiates
45 the start command for that motor on the OWS or when that motor control at the OWS

1 is placed in complete automatic mode and the SCADA computer through
2 logic/interlocks requests the motor to run.

3
4 J. Terminology associated with interlocks is as follows:

- 5
6 1. When a contact or status is true, the SCADA computer will receive power to its
7 input channel. The SCADA computer registers this as a binary bit of one.
8
9 2. When a contact or status is false, the SCADA computer will receive no power
10 (open circuit) to its input channel. The SCADA computer registers this as a binary
11 bit of zero.

12
13 K. When an analog signal goes outside the 4-20 mA range due to a failure at the
14 instrument or PLC card, the following SCADA programming shall take place:

- 15
16 1. Alarm the signal at any local OITs and in the HMI system.
17
18 2. If the analog signal is associated with a control loop or ratio control loop that loop
19 shall go into manual.
20
21 3. If the analog signal is used in a calculation, that calculation shall use the last good
22 analog signal. The computer shall place the control loop in manual if using the
23 calculation.

24
25 L. Disable all alarms on analog inputs unless specifically called for in the drawings or
26 specifications.

27
28 M. All interlocks that shutdown (Stop a piece of equipment and prevent it from being
29 restarted or moved) shall be shown on the faceplate pop-up graphic for that piece of
30 equipment.

31
32 N. The run confirms or on status of all motors and lamps shall be accumulated to
33 calculate a run time status of the equipment on the HMI graphic. Each run time
34 accumulation shall come with a reset button on the HMI screen.

35
36 O. All flow indications shall be totalized. Do not totalize if the analog signal is outside the
37 4-20 mA range. Each flow totalization shall come with a reset button on the HMI
38 screen. Do not totalize if the value of the flow input is less than 2% of the full range
39 of the input.

40
41 END OF SECTION
42

1 **Equipment: Flow Meters**

2 **Tags:**

3 **PLC:**

4

5 **General:**

6

7 1. One new flow meter shall be installed at the influent assembly as shown on the
8 Drawings.

9

10 2. The flow meters shall measure, record, totalize, and indicate flow at the HMI.

11

12 3. Instantaneous flow, daily maximum flow, daily minimum flow, and a daily flow
13 total shall be displayed at the HMI.

14

15 4. Historical trending shall be provided for instantaneous flow at the HMI.

16

17 **Equipment: Level Transmitters**

18 **Tags: LIT-105**

19 **PLC:**

20

21 1. One new level transmitter shall be installed at the influent pump station as
22 shown on the Drawings.

23

24 2. The level transmitters shall measure, record, and indicate level at the HMI.

25

26 3. The level transmitters shall be provided with operator adjustable low and high
27 level alarm setpoints that shall be displayed on the HMI.

28

29 4. The level transmitter shall be used for automatic controls as specified herein.

30

31 5. Historical trending shall be provided for instantaneous level on the HMI.

32

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1 SECTION 13340

2
3 PROCESS INSTRUMENTATION AND EQUIPMENT

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. The Contractor shall furnish and install all instrumentation and controls hereinafter
10 specified to perform the intended function and achieve a fully integrated and
11 operational system. The equipment and services defined herein shall be
12 furnished by a single instrumentation system integrator who shall coordinate the
13 instrument and control system for proper operation with related equipment and
14 materials provided by other suppliers of the Owner.
15
16 B. Work shall include all labor, materials, plant facilities and equipment, performance
17 of all work necessary to complete the manufacture, to make factory tests, to
18 prepare and load for shipment, to deliver to the site, to provide programming,
19 calibration, installation supervision, training system, start-up services, and
20 incidentals required to completely furnish and install an integrated instrumentation
21 and control system, including all work necessary during the Warranty Period, as
22 specified herein, in other specification sections as listed herein, and as shown on
23 the Drawings.
24
25 C. Auxiliary and accessory devices necessary for system operation or performance,
26 such as transducers or relays to interface with existing equipment or equipment
27 provided by other suppliers under other Sections of these Specifications, shall be
28 furnished, coordinated, and interfaced by the instrumentation system integrator
29 whether or not they are shown on the Drawings or specified herein.
30
31 D. Equipment shall be fabricated, assembled, installed, and placed in proper
32 operating condition in full conformity with detail Drawings and Specifications,
33 engineering data, instructions, and recommendations of the equipment
34 manufacturer as approved by the Engineer.
35
36 E. All control panel and panel assemblies shall be assembled by a UL 508 approved
37 panel shop. Each panel and panel assembly shall bear the mark of such.
38

39 1.02 SUBMITTALS

- 40
41 A. Submit complete documentation of all field instruments using ISA-TR20.00.01-
42 2007 data sheet formats. Submit a complete Bill of Materials (BOM) or Index that
43 lists all instrumentation equipment. The list shall be sorted by Loop Number.
44
45 B. Submit separate data sheets for each instrument including:
46

- 1 1. Plant Equipment Number and ISA tag number per the Drawings.
- 2
- 3 2. Product (item) name used herein and on the Drawings.
- 4
- 5 3. Manufacturer's complete model number.
- 6
- 7 4. Location of the device.
- 8
- 9 5. Input - output characteristics.
- 10
- 11 6. Range, size, and graduations in engineering units.
- 12
- 13 7. Physical size with dimensions, enclosure NEMA classification and mounting
- 14 details in sufficient detail to determine compliance with requirements.
- 15
- 16 8. Materials of construction for enclosure and wetted parts.
- 17
- 18 9. Instrument or control device sizing calculations where applicable.
- 19
- 20 10. Certified calibration data for all flow metering devices.
- 21
- 22 11. Two-wire or four-wire device type as applicable.
- 23

- 24 C. Submit catalog cuts for all instruments. Submit descriptive literature for each
- 25 hardware component, which fully describes the units being provided.
- 26
- 27 D. Submit index and data sheets in electronic format as well as hard copies on 8-
- 28 1/2" x 11" formats. Electronic format shall be in Microsoft Excel or Word.
- 29

30 1.03 APPROVALS/CERTIFICATIONS

- 31
- 32 A. Instruments for hazardous locations shall have Factory Mutual (FM), Canadian
- 33 Standards Association (CSA), and CENELEC approvals and certifications as
- 34 specified herein and as indicated on the Drawings or in the Instrument Device
- 35 Schedule. The instrument specifications in Part 2 state the Class, Division, and
- 36 gas groups for FM/CSA approval, followed in parenthesis by the CENELEC
- 37 certification; however, instruments provided are only required to have the
- 38 approval/certification stated above. The instrument shall have a stainless-steel tag
- 39 identifying the relevant approval or certification.
- 40

41 1.04 QUALITY ASSURANCE

- 42
- 43 A. Instrumentation and control equipment furnished shall be manufactured by a firm
- 44 regularly and currently engaged in the design and manufacture of similar
- 45 equipment. Equipment furnished shall be new and of current design.
- 46

- 1 B. Equipment shall be designed for ease of maintenance and repair, and access to
2 critical parts shall not require a major disassembly. Internal field adjustments
3 where permitted or required herein shall be easily accessible upon removal of a
4 panel or cover.
5
- 6 C. Materials and installation shall comply with the requirements of the referenced
7 electrical codes and standards, and the codes and standards referred to shall be
8 used for establishing the minimum quality of the materials and equipment supplied
9 and installed. Equipment of the same type shall be a product of the same
10 manufacturer. Capacities of equipment shall not be less than that indicated on
11 the Drawings or specified herein.
12
- 13 D. All exposed pneumatic tubing shall be routed through a device designed to protect
14 the tubing from crushing through incidental contact. The pneumatic tubing shall
15 be attached to the protective track as required by manufacturer's
16 recommendations and shall be protected from crimping by those attachment
17 methods. The protective track devices shall be stainless steel and shall be "Tube-
18 Track" or approved equal.
19
- 20 E. All exterior mounted instruments shall be furnished with appropriately sized
21 stainless steel rain and sun shields.
22
- 23 F. Model numbers and names for equipment listed herein are for the purpose of
24 establishing a standard of quality or matching existing instrumentation. Like
25 equipment of a different manufacturer must be pre-approved by the Engineer.
26

27 1.05 MANUFACTURERS' START-UP AND TRAINING SERVICES
28

- 29 A. If indicated in the individual instrumentation paragraphs, the instrument
30 manufacturer or manufacturer's certified service representative shall provide start-
31 up and training services. This work shall not be done by the PCSS contractor.
32
- 33 B. The start-up services shall be to calibrate, oversee the installations of the sensor,
34 and start-up the sensor/transmitter in order to provide reliable measurement at
35 the instrument and to a remote system. The vendor shall work with the PCSS and
36 AESS to verify the transmitter sends correct information to the remote system (i.e.,
37 that the scaling and units are the same at the instrument and on the remote
38 operator interface).
39
- 40 C. While the instrument manufacturer or manufacturer's certified service
41 representative is starting up the instrumentation, training shall be provided to the
42 Owner's instrumentation technicians. The training shall be in how to calibrate,
43 install, troubleshoot, read the diagnostics, and maintain the sensor and
44 transmitter.
45

1 PART 2 – PRODUCTS

2
3 2.01 LEVEL TRANSMITTER

4
5 A. Type:

- 6
7 1. Microprocessor based compatible with the transducer(s) provided.

8
9 B. Functional/Performance:

- 10
11 2. Resolution (including transducer): Plus or minus 0.1 percent of range or
12 0.08 inches (2 mm), whichever is greater.
13
14 3. Accuracy (including transducer): Plus or minus 0.25 percent of range or
15 0.24 inches (6 mm).

16
17 C. Range:

- 18
19 1. As required by the installation indicated on the Drawings.

20
21 D. Temperature Range:

- 22
23 1. -20 to 50 degrees C.

24
25 E. Output:

- 26
27 1. Minimum one isolated 4-20 mA output and minimum four alarm contacts
28 (number of contacts above 4 required of each device to be determined by
29 signals required as shown on the drawings adjustable to trip at any point
30 in the instrument range.
31
32 2. Output contacts shall be rated 5 A at 230 VAC.

33
34 F. Temperature Compensation:

- 35
36 1. Compensation over the temperature range of the sensor.

37
38 G. Display:

- 39
40 1. Digital indicator displaying level/differential level or volume in engineering
41 units or percent as indicated on the Drawings or in the Instrument Device
42 Schedule.

43
44 H. Diagnostics:

- 45
46 1. On-screen instructions and display of self-diagnostics.

1
2 I. Loss of Signal:

- 3
4 1. Transmitter shall ignore momentary loss-of-echo signals and shall indicate
5 loss of echo on the transmitter unit.
6

7 J. Configuration Protection:

- 8
9 1. Programmable parameters shall be protected using E2PROM. Battery
10 backup protection is not acceptable.
11

12 K. Physical:

- 13
14 1. Transmitter shall be suitable for surface or pipe stand mounting. Enclosure
15 shall be NEMA 4X (IP65). A/C power.
16

17 L. Accessories Required:

- 18
19 1. Hand-held programmer where required for configuration and calibration of
20 the instrument.
21

22 M. Manufacturers:

- 23
24 1. Siemens Model HydroRanger 200
25

26 2.02 MAGNETIC FLOWMETER

27
28 A. Flow Element Type:

- 29
30 1. Proline Promag W 400 or approved equal
31

32 B. Function/Performance:

- 33
34 1. Operating Temperature: Process liquid temperatures of 0 to 140 degrees
35 F or greater dependent upon liner and an ambient of minus 30 to 150
36 degrees F.
37
38 2. Radio Frequency Interference (RFI) protection: RFI protection shall be
39 provided as recommended by the manufacturer.
40
41 3. Pressure rating: Equal to piping system where meter is installed.
42
43 4. Additional: Meter shall be capable of running empty indefinitely without
44 damage to any component. Meter shall be capable of maintaining
45 accuracy without straight runs of pipe upstream and downstream of the
46 meter.

1
2 C. Physical:
3

- 4 1. Metering Tube: Type 304 stainless steel or equivalent.
5
6 2. Flanges: ANSI 150 lb. or DIN PN 16 carbon steel, as required by the
7 piping system, unless otherwise indicated. ANSI 150 lb. or DIN PN 16
8 stainless steel flanges shall be used on all SS process pipes.
9
10 3. Liner: Polyurethane or composite elastomer unless otherwise indicated
11 on the Drawings or in the Instrument Device Schedule.
12
13 4. Electrodes: Type 316 stainless steel standard minimum requirements. All
14 electrodes to be compatible with process fluid as indicated on the
15 Drawings or electrodes to be supplied as listed in the Instrument Device
16 Schedule.
17
18 5. For sludge, polymer, or any slurry application where the electrodes will be
19 coated, a self-cleaning or a removable electrode option must be provided
20 with that meter.
21
22 6. Housing: For meters with remote mounted transmitters, meters below
23 grade shall be suitable for submergence for up to 48 hours to a depth of
24 30 ft (9m). Meters above grade shall be NEMA 4X (IP65). Where
25 hazardous areas are indicated on the Drawings, the equipment shall be
26 rated for that area.
27 7. Finish: All external surfaces shall have a chemical and corrosion resistant
28 finish.
29

30 D. Power Requirements:
31

- 32 1. Meter shall be 24 VDC powered instrument, receiving its power from
33 transmitter.
34

35 E. Accessories/Documentation Required:
36

- 37 a. Factory calibration: All meters shall be factory calibrated. A copy of the
38 calibration report shall be included in the O&M manual.
39

- 40 F. Grounding: Meter shall be grounded in accordance with the manufacturer's
41 recommendation. Provide ground ring, ground wires, gaskets, etc., as required.
42 All materials shall be suitable for the liquid being measured and must be
43 compatible with process fluid and with the process pipe. For meters with remote
44 mounted transmitters, signal cable for installation between the flow tube and the
45 transmitter. Length shall be as required by installation as indicated on the
46 Drawings.

1
2 2.03 FLOW CONVERTER/TRANSMITTER:
3

4 A. Type: Micro-processor based intelligent transmitter compatible with flow tube
5 provided. Integral mount or mounted remote from the flow tube as shown on the
6 drawings or as required by the physical location.
7

8 B. Functional/Performance:
9

- 10 1. Accuracy (including flow tube): Plus/minus 0.5 percent of flow rate or
11 better.
12
13 2. Operating Temperature: -20 to 140 degrees F.
14
15 3. Output: Isolated 4-20 mA with HART protocol. Current output adjustable
16 over the full range of the instrument. Provide a dry contact to indicate
17 reverse flow.
18
19 4. Diagnostics: Self diagnostics with on screen display of faults.
20
21 5. Display: Digital indicator displaying flow in engineering units indicated in
22 the Instrument Device Schedule.
23
24 6. Totalizer: A fully configurable totalizer integral to the transmitter. Totalized
25 flow shall be displayed.
26
27 7. Empty Tube Zero: The transmitter shall include a feature that will lock the
28 output at zero when no flow is detected. The empty tube zero feature shall
29 be enabled automatically when the transmitter detects no flow or manually
30 through a contact input. Provide electrode cleaning unit to match flow
31 element requirements.
32

33 C. Physical:
34

- 35 a. Transmitter shall be suitable for surface or pipe stand mounting. Enclosure
36 shall be NEMA 4X (IP65).
37
38 b. Power Requirements: The transmitter shall be 120 VAC powered
39 instrument.
40
41 c. Accessories/ Required: Keypad where required for transmitter
42 configuration.
43
44 d. Manufacturer: Endress + Hauser Proline Promag W400 ODN (for post filter
45 flow) Or equal.
46

1 2.04 PRESSURE GAUGE

2
3 A. Type:

- 4
5 i. Bourdon tube actuated dial face pressure gauge.
6

7 B. Function/Performance:

8
9 1. Accuracy:

- 10
11 a. Plus or minus 1.0 percent of span or better.
12

13 C. Physical:

14
15 1. Case:

- 16
17 a. Phenolic shock resistant or Type 316 stainless steel for surface/stem
18 mounting with a pressure relieving back. The case shall be vented for
19 temperature/atmospheric compensation. Gauge shall be callable of
20 being liquid filled in the field or at the factory.
21

22 2. Window:

- 23
24 a. Clear acrylic or shatter proof glass.
25

26 3. Bourdon tube:

- 27
28 a. Stainless steel.
29

30 b. Connection:

- 31
32 1. 1/2 in. NPT.
33

34 c. Gauge size:

- 35
36 1. Minimum 4-in. viewable.
37

38 D. Pointer travel:

- 39
40 1. Not less than 200 degrees not more than 270-degree arc.
41

42 E. Range:

- 43
44 1. As indicated in the instrument device schedule. Range may include inches
45 of water vacuum.
46

1 F. Accessories/Options Required:
2

- 3 1. Shutoff valve: Each gauge shall have a process shutoff valve that can also
4 be used as an adjustable pressure snubber.
5
6 2. Special scales: Engineer reserves the right to require special scales and/or
7 calibration if the manufacturer's standard is not suitable for the application.
8
9 3. Gauges listed as liquid filled in the instrument device schedule shall be liquid
10 filled at the factory.
11

12 G. Manufacturers: Ashcroft, Ametek US Gauge, Weksler, Or equal.
13

14 2.05 NON-CONTACT RADAR LEVEL TRANSMITTER
15

16 A. Type:
17

- 18 1. Non-contact, microwave type level meter.
19
20 2. Low 6.3 GHz radar frequency for continuous level measurement of liquid,
21 slurry and sludge processes in storage vessels that may be turbulent, have
22 heavy vapors and foaming conditions in nominal pressure and temperature.
23
24 3. Antenna: Rod, Horn, Parabolic, or Encapsulated. The type chosen shall be
25 based upon the type of process being measured and in what storage vessel
26 is being used.
27

28 B. Function/Performance:
29

- 30 1. Measuring Range: Range shall be suitable for the installation indicated.
31
32 2. Accuracy: Plus or minus 0.32 inches (8 mm).
33
34 3. Operating Temperature: -40 to 65 degrees C.
35
36 4. Output: Isolated 4-20 mA output.
37
38 5. Display: Digital indicator displaying level or volume in engineering units or
39 percent, as indicated on the Drawings or in the Instrument Device Schedule.
40
41 6. Diagnostics: On-screen instructions and display of self-diagnostics.
42

43 C. Physical:

- 1
- 2 1. Antenna shall be PVDF, Type 316 stainless steel, Hastelloy C or other
- 3 material depending upon its compatibility to the process in which it is
- 4 measuring. Transmitter and antenna shall be integral.
- 5
- 6 2. Instrument shall be provided with a minimum Class 150 pound (DN 80, PN16)
- 7 mounting flange to match vessel flange size, material and class.
- 8
- 9 3. Housing shall be NEMA 4X (IP66). Where the instrument is installed in a
- 10 hazardous area, the housing shall be explosion-proof, approved for Class I,
- 11 Division 1, Groups C and D (EEx d IIB T4) installation. The instrument shall
- 12 be certified for installation of the antenna in a Class I, Division 1, Groups C
- 13 and D (Zone 0) environment.
- 14
- 15 4. Power Requirements: 120VAC power.
- 16
- 17 5. Remote Display: Digital indicator displaying level or volume in engineering
- 18 units or percent, as indicated on the Drawings or in the Instrument List.
- 19 Display unit shall also be used to remotely program the transmitter.
- 20

21 D. Accessories Required:

- 22
- 23 1. Where required for calibration/programming, a hand-held programmer shall
- 24 be provided.
- 25

26 E. Manufacturer Start-up and Training services:

- 27
- 28 1. Provide manufacturer's start-up and training services as specified in the
- 29 start-up and training services paragraph.
- 30

31 F. Manufacturers:

- 32
- 33 1. Endress & Hauser FMR20
- 34
- 35 2. Siemens
- 36
- 37 3. Rosemount
- 38
- 39 4. VEGA Americas, Inc. (formerly Ohmart Vega)
- 40
- 41 5. Or equal
- 42

43 2.06 SPARE PARTS AND ACCESSORIES

- 44
- 45 A. General requirements for spare parts are specified in Section 13300.
- 46

1 B. Furnish following field Instrument related Spare Parts:

- 2
3 One flow indicating transmitter for each type of flow element provided.
4 One level indicating transmitter for each type of level element provided.
5 One spare level switch for each type provided.
6 One spare pressure gauge for each type of gauge provided.
7 One spare pressure switch for each type of switch provided.
8

9 C. Furnish following Accessories:

- 10
11 1. All mounting hardware required for pipe stand, surface, or other mounting.
12 Each instrument shall be provided with a manufacturer installed stainless
13 steel tag identifying the instrument tag number.
14

15
16 PART 3 – EXECUTION

17
18 3.01 INSTALLATION

- 19
20 A. Field mounted elements shall be installed, calibrated, and started-up in strict
21 compliance with the manufacturer's requirements and recommendations.
22 Conflicts between the manufacturer's requirements and recommendations and
23 these Specifications or the Drawings shall be presented to the Engineer for
24 resolution before any affected work is started. Installed equipment shall be
25 certified as appropriate for the application and process by the Contractor.
26
27 B. Connections of instruments to process piping shall include, as close as practical
28 to the point of connection, a tight closing block valve suitable for the maximum
29 process pressure and temperature and for the material involved. If connections
30 are of threaded or welded pipe, there shall be a union or flanged connection
31 located to facilitate disassembly of the connection and removal of the instrument
32 without interrupting process operation.
33
34 C. All field-mounted instruments shall be protected and isolated from vibration,
35 temperature extremes, radiant heat, rain, sleet or falling water, and similar
36 adverse conditions.
37

38 3.02 EQUIPMENT TESTING AND CALIBRATION

- 39
40 A. Factory Tests and Calibration. All field-mounted elements shall be
41 factory-tested by the manufacturer to assure satisfactory performance prior to
42 shipment to the job site. Whenever possible, this shall include calibration to
43 the actual range and conditions of use. Calibration shall be traceable to the
44 National Bureau of Standards with an uncertainty not more than 1/2 of the
45 specified or claimed accuracy of the instruments.

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2
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25

3.03 MODIFICATIONS TO EXISTING PLC AND SCADA HMI SYSTEM

- A. The bypass pumping system shall be equipped with a flow meter with 4-20mA output that shall be installed on the temporary bypass piping and connected to the existing CompactLogix PLC located in the administration building. The facility currently has an Influent Sampler that is flow-paced from the existing clamp-on flow meter at the headworks structure. As part of the work, the installation of the new magnetic flow meter will require the removal of the existing clamp-on flow meter. As such, through the Systems Integrator, the Contractor shall modify the Owner's existing CompactLogix PLC program and Citect SCADA HMI System to flow pace the existing Influent Sampler from the flow meter installed on the temporary bypass piping, while the clamp-on flow meter is out-of-service. Once the new magnetic flow meter is placed in-service, the Systems Integrator shall modify the PLC program to flow pace the Influent Sampler from the new magnetic flow meter.

- B. The Systems Integrator shall be responsible to modify, reprogram, and reconfigure the existing PLC and SCADA HMI graphic screens to which all new process instrumentation are installed as part of this project. This shall include but not be limited to re-scaling, re-mapping, etc. of all new I/O installed as part of this project.

END OF SECTION

1 SECTION 13567

2
3 TEMPORARY BYPASS PUMPING PROVISIONS

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. The Contractor shall design, furnish, install, startup, operate, maintain, and
10 coordinate continuous bypass pumping systems as required to perform the
11 work at the East WRF Influent Pump Station
12
13 B. The temporary bypass pumping system shall be disassembled and
14 removed after all work is completed, tested, and accepted ready for service.
15 All areas, structures, and landscaping disturbed or removed by the bypass
16 pumping operations shall be restored.
17
18 C. The Contractor shall employ the services of a subcontractor specializing in
19 the design, furnishing and operation of temporary bypass pumping systems.
20 The bypass subcontractor shall provide 5 references for projects of similar
21 size and complexity as the proposed system for approval by the Engineer.
22 The proposed bypass pumping system shall meet the requirements of all
23 codes and regulatory agencies having jurisdiction.
24
25 D. Information provided by the City shows the influent pump station has four
26 Flygt submersible pumps currently installed as listed below:
27
28 Two pumps at 6,000 gpm and 85 HP.
29 Two pumps at 2,000 gpm and 25 HP.
30 All four pumps are variable speed.
31 The static head on the pumps based on the drawings is 32.75 feet.
32
33 E. The bypass pumping system shall be designed for a firm average pumping
34 rate of 1500 gpm, a firm peak pumping rate of 5400 gpm, and a firm low
35 pumping rate of 700 gpm. Velocity in the temporary force main(s) shall not
36 exceed 5 feet per second. The bypass pumping system shall be operate
37 using variable frequency drives (VFD).
38
39 E. The bypass pumping system shall be equipped with a flow meter with 4-
40 20mA output that shall be installed on the temporary bypass piping and
41 connected to the existing CompactLogix PLC located in the administration
42 building. The facility currently has an Influent Sampler that is flow-paced
43 from the existing clamp-on flow meter at the headworks structure. As part
44 of the work, the installation of the new magnetic flow meter will require the
45 removal of the existing clamp-on flow meter. As such, through the Systems
46 Integrator, the Contractor shall modify the Owner's existing CompactLogix

1 PLC program and Citect SCADA HMI System to flow pace the existing
2 Influent Sampler from the flow meter installed on the temporary bypass
3 piping, while the clamp-on flow meter is out-of-service. Once the new
4 magnetic flow meter is placed in-service, the Systems Integrator shall
5 modify the PLC program to flow pace the Influent Sampler from the new
6 magnetic flow meter.
7

8 F. The bypass pumping system shall include both primary and standby pumps.
9 The standby pumping capacity shall be equal to the primary pumping
10 capacity. All standby pumps shall be completely piped, wired, fueled, and
11 ready to run should a primary bypass pump fail. All pumps shall be
12 equipped with VFD's. A constant speed bypass pump system is NOT
13 acceptable.
14

15 G. The Contractor shall furnish and install temporary plugs in the existing
16 sewer pipes entering the wet wells as needed and as shown on the
17 drawings.
18

19 1.02 BYPASS PUMPING PLAN SUBMITTAL 20

21 A. The Contractor shall submit a written Bypass Pumping Plan/Working
22 Drawings (Plan) and attend a meeting with the Engineer and the Owner to
23 review the Plan. The Bypass Pumping Plan shall be submitted in
24 accordance with Section 01310 to the Engineer prior to beginning any work
25 at the site.
26

27 B. The Plan shall consist of detailed descriptions and diagrams of the
28 proposed pumping system that describes equipment schedules, time
29 schedules, locations, power, controls, instrumentation, piping, and valves.
30 Cut sheets for all equipment and materials shall be submitted. All pumps
31 and valves shall be enumerated and shown on the diagrams.
32

33 C. The Plan shall be detailed and specific for each location and for this project.
34

35 D. The Plan shall show at minimum the following information:
36

- 37 1. Staging areas for all pumps
- 38 2. Number, size, material, and location of suction and discharge
39 piping and valves
- 40 3. Pump curves, sizes, capacities, size, power requirements,
41 and rpm operating range of each pump
- 42 4. Fuel type, estimated consumption rate, on-site fuel storage
43 and detailed refueling plan
- 44 5. Temporary pipe supports, pipe restraints, pipe anchors, and
45 thrust blocks.
- 46 6. Control system details

- 7. Schematics showing the control circuits for each pump.
- 8. List of Personnel to be called by the autodialer.

PART 2 – PRODUCTS

2.01 BYPASS PUMPING SYSTEMS - GENERAL REQUIRMENTS AND RESTRICTIONS

- A. The bypass pumping system shall have dedicated suction and discharge piping. The suction shall be taken from those manholes and structures shown on the Drawings. The discharge shall be upstream of the screens at the influent pump station.
- B. The bypass pumping system shall utilize fully automatic, self-priming pumps that do not require foot valves.
- C. The bypass pumping system shall comply with local noise ordinances.
- D. Fuel storage on site shall only be permitted in dedicated fuel tanks attached to portable pumps and portable generators. No other fuel sources or auxiliary fuel storage shall be permitted.
- E. None of the existing emergency generators at the East WRF may be used for the bypass pumping system.

2.02 CAPACITY

- A. The capacity of the bypass pumping systems is specified in Section 1.01.
- B. The Contractor shall be responsible for designing the bypass pumping systems to have adequate flow and pressure capacity to maintain flow to and from each lift station without accumulation in the collection system.

2.03 REDUNDANCY AND RELIABILITY

- A. The temporary bypass pumping system shall be designed to maintain continuous uninterrupted service at all times.
- B. The temporary bypass pumping system shall consist of a primary and a backup pumping system. The primary and backup system shall be complete, independent, and redundant and be capable of starting and operating automatically based on a water level signal. The primary and backup system shall each have dedicated power and control components.

2.04 POWER AND CONTROLS

- 1 A. The bypass pumping system shall be controlled by a water level signal from
2 the supply suction manhole. The bypass pumping system shall utilize a 4-
3 20mA level transducer and transmitter that will serve as the primary controls
4 for the bypass pumps and will provide actual water level in the supply
5 suction manhole. The bypass pump system shall also be equipped with
6 float switches to active the bypass pump(s) should the level
7 transducer/transmitter fail.
8
- 9 B. The level transducer/transmitter shall be used increase or decrease the
10 speed of the bypass pump(s) to maintain a user adjustable level setpoint.
11
- 12 C. The Contractor shall design, furnish, and install temporary power and
13 controls for the bypass pumping system and shall pay all power or energy
14 costs for the bypass pumping effort.
15
- 16 D. If electric power is proposed for the temporary bypass pumping system, two
17 sources of power shall be provided. One of the sources may be from the
18 Utility Company. The second power source shall be a temporary portable
19 generator of sufficient size to power all the pumps running at the same time.
20 The temporary generator shall also be capable of supporting two pumps
21 starting at locked rotor conditions at the same time.
22

23 2.05 ALARMS

- 24
- 25 A. The temporary bypass pumping system shall have a high level/alarm based
26 on the water level signal in the suction manhole. Activation of this alarm
27 shall cause a visual and audible alarm to occur at the pump controls. The
28 high level/alarm shall also activate an auto dialer and temporary telephone
29 service to notify the Contractor and the Owner of the high-level alarm. The
30 Contractor shall be responsible for responding to the alarms and shall
31 provide the Owner with the phone numbers and emergency contacts of
32 response personnel capable of being reached 24 hours per day, 7 days per
33 week.
34

35 PART 3 – EXECUTION

36 3.01 STARTUP AND OPERATION

- 37
- 38
- 39 A. The Contractor shall demonstrate, mechanical, electrical, control, and alarm
40 function integrity of the bypass pumping system to the Engineer and the
41 City prior to beginning any rehabilitation work. The bypass pumping system
42 must function without failure for a period of 24 consecutive hours prior to
43 beginning any other site work.
44
- 45 B. The Contractor shall be responsible for operation and maintenance of the
46 temporary bypass pumping system 24 hours per day and shall not depend

1 on the Owner to perform any operations or maintenance tasks.

2
3 C. If diesel or gasoline powered pumps are used, the Contractor shall be
4 responsible for operating the pumps 24 hours per day and for keeping the
5 pumps fueled and maintained. The Contractor shall pay all fuel costs for
6 bypass pumping if diesel or gasoline powered pumps are used.

7
8 D. The Contractor shall be responsible for any wastewater spills that occur as
9 a result of the bypass pumping operation and shall pay any and all fines,
10 fees, property damage, environmental damage, and cleanup costs that are
11 associated with the wastewater spills.

12
13 END OF SECTION
14

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1 SECTION 15010

2
3 BASIC MECHANICAL REQUIREMENTS

4
5 PART 1 – GENERAL

6
7 1.01 RELATED DOCUMENTS

8
9 Drawings and general provisions of the Contract, including all specification
10 sections apply to the work.

11
12 1.02 SUMMARY

13
14 This Section specifies the basic requirements for mechanical installations and
15 includes requirements common to more than one section of these specifications.

16
17 1.03 ACCESSIBILITY

18
19 Equipment and materials shall be installed allowing for adequate access for
20 service and. Coordinate the final location of concealed equipment with the final
21 location of access panels and doors. Allow ample space to remove all parts that
22 may be replaced or require service. Extend all grease fittings to an accessible
23 location.

24
25 1.04 MECHANICAL INSTALLATIONS

26
27 A. Coordinate mechanical equipment and materials installation with other
28 building components. Verify all dimensions by field measurements. Verify
29 final locations for rough-ins with field measurements and with the
30 requirements of the actual equipment to be connected. Arrange for chases,
31 slots, and openings in other building components to allow for mechanical
32 installations.

33
34 B. Coordinate the installation of supporting devices and sleeves to be set in
35 poured in place concrete and other structural components, as they are
36 constructed. Sequence, coordinate, and integrate installations of
37 mechanical materials and equipment for efficient flow of the work. Give
38 particular attention to large equipment requiring positioning.

39
40 C. Where mounting heights are not detailed or dimensioned, install mechanical
41 services and overhead equipment to provide the maximum headroom
42 possible. Coordinate the installation of mechanical materials and
43 equipment above ceilings with suspension system, light fixtures, and other
44 installations.

45
46 D. Coordinate connection of mechanical systems with exterior underground

1 and overhead utilities and services. Comply with requirements of governing
2 regulations, franchised service companies, and controlling agencies.
3 Provide required connection for each service.
4

5 1.05 NAMEPLATE DATA
6

7 Provide permanent operational data nameplate on each item of power operated
8 mechanical equipment, indicating manufacturer, product name, model number,
9 serial number, capacity, operating and power characteristics, labels of tested
10 compliances, and similar essential data. Locate nameplates in an accessible
11 location.
12

13 1.06 THIRD PARTY CERTIFICATION
14

15 All packaged equipment shall be Independently Third Party labeled as a system
16 for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in
17 accordance with OSHA Federal Regulation 29CFR1910.399 and NFPA 70,
18 "National Electrical Code" (NEC), Article 90-7.
19

20 PART 2 – PRODUCTS (NOT USED)
21

22 PART 3 – EXECUTION (NOT USED)
23

24 END OF SECTION
25
26
27
28

1 SECTION 15062

2
3 DUCTILE IRON PIPE AND FITTINGS

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. The Contractor shall furnish all the materials, tools, labor, supervision and
10 appliances for and properly install, connect, adjust, test and place in
11 continuous satisfactory service all ductile iron pipe and fittings at the
12 locations and to the elevations indicated, specified or required for the proper
13 completion of all work.
14
15 B. Wherever Construction activities disturb existing conditions or work already
16 completed, Contractor shall restore the same to its original condition in
17 every detail. All such replacement and repair shall be a no additional
18 expense to the Owner.
19
20 C. Ductile iron pipe and fittings are not necessarily completely indicated or
21 detailed on the Construction Drawings. The Drawings are schematic only,
22 and indicate pipe and fittings in a general way. It is the Contractor's
23 responsibility to furnish all materials, pipe and fittings required.
24
25 D. It is the intent of these Contract Documents to require an installation,
26 complete in every detail, whether or not indicated on the Construction
27 Drawings, or specified herein. Consequently, the Contractor shall be
28 responsible for all details, devices, accessories, and special construction
29 necessary to properly furnish, install, adjust, test, place into continuous
30 satisfactory service, and complete the Work in an acceptable manner.
31
32 E. Full responsibility for designing, fabricating, and installing the ductile iron
33 pipe and fittings, for selecting materials of construction, and for
34 demonstrating compliance with specified performance requirements shall
35 rest with the Contractor, and through the Contractor, the Manufacturer and
36 the Material Supplier. The Engineer's review of 1) the manufacture and
37 installation of the ductile iron pipe and fittings 2) the use of materials
38 included in this Specification, and 3) alternative materials offered by the
39 Contractor, shall not relieve the Contractor and Supplier of full responsibility
40 for meeting all performance requirements and guarantees.
41
42 F. The requirements of this specification 15062 supersede relevant articles in
43 Section IV.

44
45 1.02 DESCRIPTION OF SYSTEM

1 A. Piping shall be installed in the locations as shown on the Drawings and as
2 specified herein.

3
4 B. All pipe, fittings, specials and appurtenances used for potable water piping
5 shall be NSF-61 certified for continuous contact with potable water.
6

7 1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS
8

9 All Work specified herein shall be in accordance with the standards of the below
10 listed organizations, except as otherwise shown or specified. Where reference is
11 made to a standard of one of these, or other organizations the version of the
12 standard in effect at the time of bid opening shall apply.
13

14 American National Standards Institute (ANSI)

15 B1.1 - Standard Specification for Unified Inch Screw Threads.

16 B16.5 - Standard Specification for Pipe Flanges and Flanged Fittings and
17 other special Alloys.

18 American Society for Testing Materials (ASTM)

19 A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi
20 Tensile Strength.

21 C33 - Standard Specification for Concrete Aggregates.

22 C128 - Standard Specification for Specific Gravity and Absorption of Fine
23 Aggregate.

24 C144 - Standard Specification for Masonry Mortar.

25 C150 - Portland Cement.

26 D75- Standard Practice for Sampling Aggregates.

27 E8 - Methods of Tension Testing of Metallic Materials.

28 E23 - Methods for Notched Bar Impact Testing of Metallic Materials.

29 G95 - Cathodic Disbondment Test.
30

31 American Water Works Association (AWWA)

32 C104 - Standard for Cement - Mortar Lining for Ductile Iron Pipe and Fittings
33 for Water.

34 C105 - Standard for Polyethylene Encasement for Ductile-Iron Piping for
35 Water and Other Liquids.

36 C111 - Standard for Rubber - Gasket Joints for Ductile Iron Pressure Pipe
37 and Fittings.

38 C115 - American National Standard for Flanged Ductile-Iron Pipe with
39 Threaded Flanges.

40 C150 - Standard for the Thickness Design of Ductile Iron Pipe.

41 C151 - Standard for Ductile - Iron Pipe. Centrifugally Cast for Water or
42 Other Liquids.

43 C153 - Standard for Ductile Iron Compact Fittings. 3-inch through 16-inch
44 for Water and Other Liquids.

45 C600 - Standard for Installation of Ductile Iron Water Mains and Their
46 Appurtenances.

1 C651 - Standard for Disinfecting Water Mains.

2
3 NSF International, The Public Health and Safety Company

4
5 No. 60 - Drinking Water Treatment Chemicals - Health Effects.

6 No. 61 - Drinking Water System Components - Health Effects.

7
8 1.04 SUBMITTALS

9
10 A. The Contractor shall submit Shop Drawings to the Engineer of pipe, fittings,
11 and all appurtenances in accordance with these Contract Documents and
12 Sections 01300 and 01340. The requirements of AWWA C110, C150, C151
13 and the following supplemental requirements are applicable:

- 14
15 1. Certified dimensional drawings of all pipe, specials and fittings.
16
17 2. Joint and pipe/fitting wall construction details, which indicate the type
18 and thickness of the wall; manufacturing tolerances; performance
19 history; and all other pertinent information required for the
20 manufacture of the product.
21
22 3. Details of fittings and specials such as elbows, wyes, tees, outlets,
23 connections, test bulkheads, bosses and nozzles or other specials
24 where shown on the Construction Drawings, which indicate amount
25 and position of reinforcement. All fittings and specials shall be
26 properly reinforced to withstand the internal pressure both
27 circumferential and longitudinal, and the external loading conditions
28 as indicated in the Contract Documents. Shop Drawings shall clearly
29 detail special castings indicating all pertinent dimensions.
30

31 B. The Contractor shall furnish a certified affidavit of compliance for all pipe
32 and other products or materials furnished under this Section of the
33 Specifications, as specified in ANSI/AWWA C105, C110, C150, and C151;
34 respectively, and certified copies of the following supplemental data for all
35 pipe, fittings, and specials:

- 36
37 1. The Supplier shall provide, through the Contractor, a sworn
38 statement that the inspection and all specified tests have been made
39 and all results thereof comply with the requirements of these
40 Specifications.
41

42 C. All expenses incurred in making samples for certification of tests and in the
43 preparation of any design reports shall be borne by the Contractor.

44
45 D. Review of the Shop Drawings shall not relieve the Contractor of the
46 responsibility to ensure that the pipe is designed and installed in strict

1 accordance with the Contract Documents.

2
3 1.05 QUALITY ASSURANCE
4

- 5 A. The Contractor shall furnish materials under this Section that are new,
6 unused and as specified, or if not particularized herein, which are the best
7 of their respective kind, free of defects and imperfections, and suitable for
8 the service intended, subject to review by the Engineer.
9
- 10 B. The Contractor shall provide workmanship that is first class in every respect,
11 and have the installation performed by workmen thoroughly experienced in
12 such work. A neat and workmanlike appearance in the finished Work shall
13 be required.
14
- 15 C. The Contractor shall perform Work in accordance with all applicable laws
16 and regulations and in accordance with all applicable permits and
17 easements.
18
- 19 D. The ductile iron pipe furnished under this Specification shall comply with
20 AWWA C151 except as it may be modified herein.
21
- 22 E. Welders and welding methods shall be certified to a nationally recognized
23 welding specification for the type of ductile iron used to manufacture the
24 pipe and fittings.
25
- 26 F. All test equipment used in activities affecting quality control shall be
27 calibrated and certified at not longer than annual intervals, unless otherwise
28 specified or required.
29
- 30 G. All pipe shall be clean, sound, and without defects. No manner of repair will
31 be accepted, unless otherwise specified by the Engineer.
32
- 33 H. The Contractor, at no additional cost to the Owner, shall perform all the
34 testing and recording that is required in these Specifications unless
35 otherwise specified.
36
- 37 I. The Engineer shall have the right to determine the amount of pipe to be
38 rejected as defined in AWWA C151 Section 5.7.1 "Determining Rejection."
39

40 1.06 SUPPLIER'S QUALIFICATIONS
41

42 All pipe shall be manufactured, fabricated, coated, cement mortar-lined or epoxy-
43 lined by a single qualified Manufacturer. Fittings may be fabricated and the lining
44 for force main pipe and fittings may be applied at a site other than where the pipe
45 is manufactured. The Manufacturer shall have at least 5 years of experience in
46 work similar in specification to that which is to be furnished on this project. The

1 Manufacturer shall be required to show experience in supplying pipe in
2 environments similar to those expected to exist on this project and that the pipe
3 supplied in those environments has functioned satisfactorily.
4

5 1.07 SHOP TESTS 6

7 All pipes shall be tested by the Manufacturer in accordance with AWWA C104,
8 C110, C150, and C151, the Manufacturer's standard procedures, and this
9 Specification. Shop Tests shall be subject to witness by the Engineer and/or
10 Owner, and/or the Owner's Representative and certified test reports shall be
11 submitted to the Engineer by the Contractor. No lot of pipe shall be shipped to the
12 site of the Work until acceptable shop tests are completed and have been reviewed
13 by the Engineer.
14

15 1.08 INSPECTION 16

17 A. All Work under this Specification, including but not limited to proof of design
18 testing, shop testing and the production of the pipe, fittings and specials,
19 shall be subject to inspection by the Owner's representatives and/or the
20 Engineer in the Supplier's plant. All travel, lodging and meal costs
21 associated with this plant inspection shall be incurred by the Owner and/or
22 the Engineer.
23

24 B. The Engineer shall have the right to order any pipe that, in the Engineer's
25 opinion, does not meet the Specifications to be rejected and not shipped to
26 the Project site.
27

28 PART 2 – PRODUCTS 29

30 2.01 GENERAL 31

32 A. All ductile iron pipes, including flanged, mechanical joint, push-on joint,
33 restrained joint, and plain end pipe, shall be manufactured in accordance
34 with ANSI/AWWA Specification C 151/A 21.51.
35

36 B. Where ductile iron pipe is supplied for the Project or shown on the Drawings,
37 above ground pipe shall be flanged and buried (underground) pipe shall be
38 mechanical joint, restrained joint or push-on joint, as required.
39

40 C. All ductile iron fittings shall be marked in accordance with ANSI/AWWA C
41 110/A 21.10 Section 10-9, "Markings on Fittings." All ductile iron pipe shall
42 be marked in accordance with Section 51-10, "Marking Pipe" of
43 ANSI/AWWA Specification C 151/A 21.51.
44

45 D. Maximum pipe laying lengths shall be 20 feet with shorter lengths provided
46 as required by the Construction Drawings or to complete the Work and as

1 allowed by AWWA C151.

2
3 E. Shop cement-mortar lined pipe shall have smooth dense interior surfaces
4 and shall be free from fracture, excessive interior surface crazing and
5 roughness.

6
7 F. Pipe joints shall not be bonded for electrical conductivity in accordance with
8 these Specifications and the details as shown on the Construction Drawings
9 and the following schedule:

10
11 1. All blow-offs, air valve assemblies, and lateral connections to or from
12 the pipe shall not be fitted with dielectric gaskets and/or couplings.

13
14 G. All materials that may be in contact with the water being conveyed (linings,
15 gaskets, lubricants, grout, disinfecting agents, etc.) shall be in accordance
16 with and approved by the appropriate NSF Standard 60 or 61.

17
18 2.02 DESIGN CRITERIA

19
20 A. The pipe furnished under this section shall be ductile iron pipe, cement
21 mortar or epoxy lined and asphalt coated, with EPDM gasket joints. The
22 pipe shall consist of a cast ductile iron wall, shop lined with Portland cement
23 mortar (potable water and reclaimed water) or epoxy (sanitary force main)
24 and an exterior coating of asphalt.

25
26 B. The pipe shall be designed, manufactured, tested, inspected, and marked
27 according to applicable requirements stated herein and except as modified,
28 shall conform to ANSI/AWWA C104, C150, C151.

29
30 C. Pipe supplied for this project shall be suitable for use with neutral pH
31 (approximately 7.0) meeting FDEP Part IV water quality standards
32 (reclaimed water), domestic raw sewage (force mains) or chloraminated
33 drinking water (potable water).

34
35 2.03 PIPE DESIGN

36
37 A. All ductile iron pipe shall have a minimum wall thickness corresponding to
38 Class 150, as calculated according to AWWA C150.

39
40 B. Where threaded flanges are used on ductile iron pipe, the minimum
41 thickness of the pipe wall at the last critical thread after threading shall not
42 be less than the minimum calculated thickness of the pipe including net
43 thickness, casting tolerance and service allowance.

44
45 C. The Contractor shall provide design data on the pipe including calculations
46 showing the separate and combined stresses in the wall of the pipe due to

1 the design loads.

2
3 2.04 MATERIALS
4

- 5 A. All ductile-iron pipes shall meet the requirements of ANSI/AWWA C
6 151/A21.51. The interior of the pipe shall be finished so that the
7 Hazen-Williams friction factor will not be less than 130. Each length of pipe
8 shall be hydrostatically tested to at least 500 psi by the manufacturer in
9 accordance with ANSI/AWWA C 151/A21.51. Additionally, 30-inch and
10 larger pipe shall be hydrostatically tested to 75% of the yield strength of the
11 metal, based on the nominal thickness of the pipe.
12
- 13 B. Castings and connecting pieces, such as bell and bell, bell and spigot, bell
14 and flange, flange and flange, flange and spigot, and flange and flare, shall
15 meet the requirements of ANSI/AWWA C110/A21.10. Connecting pieces
16 may be fabricated.
17
- 18 C. The exterior of exposed ductile iron pipe, fittings, glands and bolts shall be
19 field coated with one prime coat of Tnemec 66, 3.0 to 5.0 mils minimum dry
20 film thickness, a second coat of compatible Tnemec Enamel, 4.0 to 6.0 mils
21 per coat minimum dry film thickness and a final coat of Tnemec 73, 2.5 to
22 4.5 mils per coat minimum dry film thickness. Field coatings shall be applied
23 in strict conformance with the coating manufacturer's recommendations and
24 Section 09900.
25
- 26 D. Pipe that is to be buried shall have the standard asphaltic outside coating
27 specified in ANSI/AWWA C151/A21.51.
28
- 29 E. The weight and class designation shall be painted conspicuously in a
30 contrasting color on the outside of each pipe, fitting, and special casting
31 after the shop coat has cured.
32
- 33 F. Epoxy lining for force mains shall be an amine cured epoxy containing at
34 least 20% ceramic quartz pigment by volume. The standard of quality is
35 Proteco 401 Ceramic Epoxy.
36

37 2.05 JOINTS
38

- 39 A. Flanges and flanged joints for ductile iron piping shall conform to the
40 dimensions and requirements of ANSI Specification B 16.1. Where
41 threaded flanges are used, they shall be ductile iron and conform to the
42 requirements of ANSI/AWWA Specification C 115/A 21.15. All flanged
43 ductile iron pipe and fittings shall be rated for 250 pound working pressure
44 and shall be faced and drilled to match ANSI B16.1 Class 125 flanges
45 unless special drilling is called for or required. Where tap or stud bolts are
46 required, flanges shall be drilled and tapped accordingly.

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- B. All pipe flanges shall be coated with a rust preventive coating, as specified in ANSI/AWWA Specification C 115/A 21.15, immediately after they have been faced and drilled.
- C. Flanged bolt holes on each end of flanged pipe and fittings shall accurately straddle the same horizontal and vertical centerlines unless special drilling is called for, or required.
- D. The Contractor shall be responsible for assuring that the flanges of the pipe are compatible with the flanges of the various components and/or appurtenances.
- E. Flanged pipe, approximately twelve (12) inches or less in length, shall have flanges cast solidly to pipe barrel. Flanges on pipe longer than twelve (12) inches in length may be of the threaded type. Pipe threads shall be of such length that, with flanges screwed home, the end of the pipe shall project beyond the face line of the flange. Flange and pipe shall then be faced to give a flush finish to the flange and the flange surface shall be normal to the axis of the pipe. Flanges shall be of such design that the flanged neck completely covers the threaded portion of the pipe to protect it against damage and corrosion.
- F. Push-on joints for ductile iron piping shall conform to the dimensions and requirements of ANSI/AWWA Specification C111/A 21.11 as they apply to push-on joints.
- G. Mechanical joints for ductile iron piping shall conform to the dimensions and requirements of ANSI/AWWA Specification C 111/A 21.11. Where stud bolts are required, bells shall be drilled and tapped accordingly. The Contractor shall tighten joint bolts with appropriate wrenches, to a tension recommended by the pipe Supplier.
- H. Where joints are in contact with liquids, or buried underground, the Contractor shall paint all bolts and nuts with two (2) heavy coats of coal tar pitch and where joints are buried, the joints, including glands and bolts, shall be wrapped with two laps of 8 mil polyethylene film and sealed to the pipe with polyethylene adhesive tape.
- I. Restrained Joints:
 - 1. All buried pipe shall be restrained as shown on the Drawings and as specified herein. Pipes subject to pressure or being fed by a pumping system shall be restrained based on the pressures shown on the drawings or specified elsewhere herein. Pipes subject to gravity flow shall be restrained based on 30 psi of working pressure.

1 Restrained joint length indicated in the Tables included on the
2 Drawings represents the length on all sides of fittings and valves
3 within which all joints must be restrained. As a minimum, the joints
4 at all fittings and valves shall be restrained.
5

6 2. Restrained joints shall be capable of holding against withdrawal for
7 line pressures 50 percent above the normal working pressure, but
8 not less than 200 psi. The pipe and fittings shall be restrained push-
9 on joints or restrained mechanical joints.
10

11 3. The pipe Supplier's standard restrained joints shall be of the type
12 utilizing cast lugs, shop welded retainer lugs or retainer rings bearing
13 against pipe shoulders. Field installed joint restraint systems, such
14 as Megalugs, as manufactured by EBAA Iron, or equal, are required
15 for restraining mechanical joint fittings. Field welding or grooving of
16 the restrained joint or components shall not be acceptable.
17 Restrained joints shall be capable of withstanding full bulkhead thrust
18 that can be developed within the pipeline due to the sum of the
19 working and surge pressures.
20

21 4. Thrust blocks shall not be permitted unless specifically identified on
22 the Drawings.
23

24 5. Joints in tunnels and casings shall be restrained joints as defined
25 previously.
26

27 2.06 FITTINGS

28
29 A. All restrained joint, flanged, mechanical joint, and push-on joint shall be
30 ductile iron and shall be manufactured in accordance with, and shall meet
31 the requirements of ANSI/AWWA Specification C 110/A 21.10 or C153.
32

33 B. Dimensions of flanged fittings not included under ANSI/AWWA
34 Specification C110/A 21.10 shall conform to the requirements of ANSI
35 Specification B 16.1, Class 125. Fittings shall be short radius (compact)
36 type were possible.
37

38 C. All fittings shall meet the requirements, as to dimensions and weights, as
39 shown in the current Edition of the "Handbook of Ductile Iron Pipe" of the
40 Ductile Iron Pipe Research Association.
41

42 D. All fittings furnished under ANSI/AWWA Specification C110/A 21.10 or
43 C153 shall be ductile iron and shall have the same minimum pressure rating
44 as the pipe to which it is connected.
45

46 E. Special fittings, where required, shall have the same diameters and

1 thickness as standard fittings, unless otherwise required, but their laying
2 lengths and other functional dimensions shall be determined by their
3 positions in the pipelines and by the particular piping materials to which they
4 connect.

5
6 2.07 INTERIOR LINING
7

8 A. Potable Water and Reclaimed Water Piping:
9

- 10 1. All ductile iron pipe and fittings shall be lined with standard single
11 thickness cement mortar lining and bituminous seal coated inside, at
12 the point of manufacture, in accordance with ANSI/AWWA
13 Specification C 104/A 21.4. Portland cement for cement mortar lining
14 shall be in accordance with the requirements of ASTM C150, Type II
15 cement. Shop cement-mortar lined pipe shall have smooth dense
16 interior surfaces and shall be free from fractures, excessive interior
17 surface crazing, disbondment, and roughness.
18
19 2. The Contractor shall take precautions to prevent damage to the
20 interior lining and shall repair all damaged linings to the satisfaction
21 of the Engineer.
22
23 3. Test records shall be submitted to the Engineer for review.
24
25 4. The use and type of any admixtures must be reviewed by the
26 Engineer prior to their use. All material batching shall be by weight.
27
28 5. The method of placing and curing of the mortar lining shall be one
29 with which the manufacturer has experience and can demonstrate a
30 successful history. The lining shall be cured in a manner acceptable
31 to the Engineer so that it will provide a hard and durable lining with a
32 minimum of cracks, surface crazing and disbonded areas.
33

34 B. Epoxy Lining for Wastewater Service
35

- 36 1. All pipe and fittings for sewer force mains shall be Coated with
37 Protecto 401 as specified.
38
39 2. Prior to abrasive blasting, the entire area to receive the protective
40 compound shall be inspected for oil, grease, etc. Any areas with oil,
41 grease, or any substance that can be removed by solvent, shall be
42 solvent cleaned to remove those substances. After the surface has
43 been made free of grease, oil or other substances, all areas to
44 receive the protective compounds shall be abrasive blasted using
45 sand or grit abrasive media. The entire surface to be lined shall be
46 struck with the blast media so that all rust, loose oxides, etc., are

1 removed from the surface. Only slight stains and tightly adhering
2 oxide may be left on the surface. Any area where rust reappears
3 before lining must be re-blasted.
4

5 3. After the surface preparation and within 8 hours of surface
6 preparation, the interior of the pipe shall receive 40 mils nominal dry
7 film thickness of Protecto 401. No lining shall take place when the
8 substrate or ambient temperature is below 40 degrees Fahrenheit.
9 The surface also must be dry and dust free. If flange pipe or fittings
10 are included in the project, the lining shall not be used on the face of
11 the flange.
12

13 4. Due to the tolerances involved, the gasket area and spigot end up to
14 6 inches back from the end of the spigot end must be coated with 6
15 mils nominal, 10 mils maximum using Protecto Joint Compound. The
16 Joint Compound shall be applied by brush to ensure coverage. Care
17 should be taken that the Joint Compound is smooth without excess
18 buildup in the gasket seat or on the spigot ends. Coating of the
19 gasket seat and spigot ends shall be done after the application of the
20 lining.
21

22 5. The number of coats of lining applied shall be as recommended by
23 the lining manufacturer. However, in no case shall this material be
24 applied above the dry thickness per coat recommended by the lining
25 manufacturer in printed literature. The maximum or minimum time
26 between coats shall be that time recommended by the lining material
27 manufacturer. To prevent delamination between coats, no material
28 shall be used for lining which is not indefinitely recoatable with itself
29 without roughening of the surface.
30

31 6. Protecto Joint Compound shall be used for touch-up or repair in
32 accordance with manufacturer's recommendations.
33

34 2.08 EXTERIOR COATINGS

35

36 A. The exterior of all pipe and fittings to be submerged in water and for
37 underground installation shall be given a bituminous coating at the point of
38 manufacture, in accordance with ANSI/AWWA Specification C 151/A 21.51.
39

40 2.09 PIPE APPURTENANCES

41

42 A. Threaded flanges shall be ductile iron and shall meet the requirements of
43 ANSI/AWWA C115/A21.15. Flanges with long hubs for flanged pipe shall
44 be screwed on the threaded end of the pipe in the shop. The face of the
45 flange and the end of the pipe shall be refaced together. There shall be no
46 leakage through the pipe threads, and the flanges shall be designed to

1 prevent corrosion of the threads from outside. Flanges shall meet the
2 requirements of ANSI B16.1, and shall be faced and drilled to that standard,
3 unless special drilling is called for or required. The Contractor shall be
4 responsible for assuring that the flanges of the pipe are compatible with the
5 flanges of the various components and/or appurtenances. They shall be
6 faced accurately at right angles to the pipe axis, drilled smooth and true,
7 and the machined faces covered with zinc dust and tallow or equivalent
8 material. The back of the flanges and bolt holes shall be coated with
9 asphaltic coating meeting the requirements of ANSI/AWWA C151/A21.51,
10 Section 51-8.1. Coating material shall be applied immediately after facing
11 and drilling. Where tap or stud bolts are required, flanges shall be tapped.
12 All flanged joints shall be thoroughly bolted through, stud or tap bolts of
13 required size. All flanged joints buried underground shall also be protected
14 as specified under Section 2.08. Only flanges made in USA shall be
15 supplied to the Project.
16

17 B. All bolts, studs, and threaded rods used in the finished work for flanges shall
18 be of carbon steel and shall conform to the ASTM A 307 Grade B. The
19 ends of all bolts shall be finished to the standard radius in an acceptable
20 manner. All screw threads shall be "American Standard, Coarse Thread
21 (N.C.). Stud bolts shall be hexagonal, cold pressed semi-finished and made
22 of medium open-hearth steel. All dimensions shall be in accordance with
23 "American Standard, Heavy." Nuts used shall be "Grade A Heavy Hex" in
24 conformance with ASTM A563 and be compatible with the bolts. Bolts and
25 nuts shall be cadmium or zinc plated at the point of manufacture with a
26 plating thickness of 0.0003 to 0.0005 inches. All bolts and nuts furnished
27 shall be delivered to the field free from grease, rust, and dirt.
28

29 C. All nuts and bolts that come into contact with water or that are to be buried
30 shall be painted with two (2) heavy coats of an coat tar pitch, in accordance
31 with Section 09900.
32

33 D. Gaskets for flanged joints shall be full-faced type EPDM gaskets one-eighth
34 (1/8) inch thick. All gaskets for flanged joints shall be EPDM having a
35 Durometer of 75 to 85 or neoprene having a Durometer of 55 to 65. As an
36 alternate, the Contractor may supply the pipe Supplier's (manufacturer's)
37 gasket such as American Cast Iron Pipe Company's "Toruseal" gasket or
38 U.S. Pipe's "Flange Tyte" gasket. Gaskets for bell and spigot joints shall be
39 fabricated and tested in accordance with AWWA C111.
40

41 E. Subject to the Engineer's review, welded outlets shall be allowed; however,
42 the welded-on outlet diameter shall not be greater than one quarter the
43 diameter of the main line.
44

45 2.10 COMPRESSION SLEEVE COUPLINGS

46

- 1 A. The Contractor shall furnish and install where required or where shown on
2 the Drawings, manufactured compression couplings equal to Style 38 or
3 Style 39 where isolating dielectric couplings are required, as manufactured
4 by the Dresser Manufacturing Division of Dresser Industries or equal. The
5 compression couplings shall consist of two (2) steel follower flanges, one
6 (1) steel middle ring with pipe stops removed, and sufficient rolled thread,
7 track-head bolts to properly compress the gaskets. After fabrication, the
8 middle and follower rings shall be cold expanded to size and dimension.
9 Thickness of the middle ring shall be suitable for the pressures specified,
10 and the application, and in no case be less than one-half (1/2) inch thick.
11 All parts of the compression coupling shall be galvanized or heavily
12 cadmium plated at the point of manufacture and shall be epoxy coated in
13 accordance with AWWA C210 or AWWA C203.
14
15 B. The entire compression sleeve coupling unit shall be rated for working
16 pressure plus surge pressure as a minimum.
17
18 C. The Contractor shall provide field coating for buried couplings in accordance
19 with AWWA C203 and these Contract Documents.
20
21 D. Small deflections in the pipe alignment shall be allowed at compression type
22 coupling joints, but such deflections shall not exceed three (3) degrees
23 between any two (2) adjacent pipe sections. Where changes in line and/or
24 grade in excess of three (3) degrees are required the deflections shall be
25 made by deflecting multiple joints.
26

27 2.11 Restrained Flange Adapter

- 28
29 A. The Contractor shall furnish and install where required or where shown on
30 the Drawings. The restrained flange adapters shall be used in lieu of
31 threaded, or welded, flanged spool pieces. Flange adapters shall be made
32 of ductile iron conforming to ASTM A536 and have flange bolt circles that
33 are compatible with ANSI/AWWA C110/A21.10.
34
35 B. Restraint for the flange adapter shall consist of a plurality of individual
36 actuated gripping wedges to maximize restraint capability. Torque limiting
37 actuating screws shall be used to insure proper initial set of gripping
38 wedges.
39
40 C. The flange adapter shall be capable of deflection during assembly, or permit
41 lengths of pipe to be field cut, to allow a minimum of 0.6" gap between the
42 end of the pipe and the mating flange without affecting the integrity of the
43 seal.
44
45 D. For PVC pipe, the flange adapter will have a pressure rating equal to the
46 pipe.

- 1
2 E. For ductile iron pipe, the flange adapter shall have a safety factor of 2:1
3 minimum.
4
5 F. The flange adapter shall be SERIES 2100 MEGAFLANGE adapter, as
6 produced by EBAA Iron, Inc., or approved equal.
7

8 PART 3 – EXECUTION
9

10 3.01 HANDLING PIPE AND FITTINGS
11

- 12 A. The Contractor shall transport, deliver and distribute along the line of the
13 work, the pipe, specials and appurtenances. All Work shall be in strict
14 accordance with the provisions of applicable permits and easements.
15
16 B. Pipe shall be loaded for shipment upon suitable cars or trucks that shall be
17 provided with padded bunks with nylon belt tie-down straps or padded
18 banding. In loading and unloading the pipe, more than ordinary care shall
19 be taken to prevent any injury to the pipe, ends, coatings and connections.
20 Such work shall be done slowly with the pipe at all times under control, and
21 under no condition shall the pipe be dropped. Field repair of damaged pipe
22 shall not be allowed, except for linings and coatings. The pipe shall be
23 protected during shipping by covering or some other means acceptable to
24 the Engineer to prevent contamination of the pipe and to protect the lining
25 from drying during transport.
26
27 C. All pipe, fittings, etc., shall be carefully handled and protected against
28 damage to the lining and coating/interior and exterior surfaces, impact
29 shocks, and free fall. All pipe handling equipment shall be acceptable to
30 the Engineer. Pipe handling equipment shall consist of wide belt slings,
31 padded cradles, or other devices designed and constructed to prevent
32 damage to the pipe or coatings. The use of forks, chains, hooks, or other
33 equipment that may damage the pipe or its lining or coating shall not be
34 allowed.
35
36 D. In distributing the pipe in the field, each pipe shall be placed as nearly as
37 possible to the point where it is to be laid, and facing in the proper direction.
38 Pipe shall not be placed directly on rough ground but shall be supported in
39 a manner that will protect the pipe against injury whenever stored at the
40 trench site or elsewhere. Coated pipe shall be stored on padded skids,
41 sand or dirt berm, sandbags, or other suitable means so that coating will not
42 be damaged. Coated pipe shall be handled with wide belt slings. Pipe
43 fittings and specials which are placed in storage, streets or drives must be
44 so arranged as not to cause undue inconvenience to traffic and must be
45 protected sufficiently to prevent any damage including but not limited to the
46 interior lining and exterior coatings. Chains, cables or other equipment

1 likely to cause damage to the pipe, fitting or special coating or lining shall
2 not be used. Pipe which has been improperly distributed and which must
3 be moved longitudinally along the trench shall be reloaded on a suitable car
4 or truck or lifted and swung by a derrick or moved by such means as may
5 be satisfactory to the Engineer.
6

7 E. If in the process of manufacture, transportation, or handling, any ductile iron
8 pipe, fitting or special receives any deformation to the pipe wall, ends or
9 connections, such pipe, fitting or special shall be rejected and replaced at
10 the Contractor's expense.

11
12 F. In the presence of the Engineer, the Contractor shall inspect upon delivery
13 all pipe, fittings, and specials and mark as "rejected" all pipe lengths and
14 fittings or specials exhibiting signs of damage to the exterior coating, interior
15 cement mortar linings, joint ends, or pipe wall and the Contractor shall at
16 the Contractor's expense immediately remove the same from the job site,
17 or repair to the Engineer's satisfaction. Any pipe, fittings or specials
18 deemed not suitable for installation shall be replaced in kind by the
19 Contractor at the Contractor's own expense.
20

21 G. The Contractor shall inspect each pipe and fitting to ensure that there are
22 no damaged portions of the pipe. If any defective pipe is discovered after
23 having been laid, it shall be removed and replaced with a sound pipe or
24 fitting in a satisfactory manner, by the Contractor at the Contractor's own
25 expense.
26

27 H. The Contractor shall thoroughly clean each pipe or fitting of any foreign
28 substance that may have collected on or in it prior to the pipe or fitting being
29 placed in the trench. The openings of all pipes and fittings in the trench
30 shall be closed during any interruption of the Work. As pipe laying
31 progresses, the Contractor shall keep the pipe interior free of all debris. The
32 Contractor shall completely clean the interior of the pipe of all sand, dirt,
33 mortar splatter, and any other debris following completion of pipe laying,
34 pointing of joints and any necessary interior repairs prior to testing and
35 disinfecting the completed pipeline.
36

37 3.02 INSTALLATION OF PIPE

38
39 A. Ductile iron piping shall be installed in strict accordance with the manu-
40 facturer's instructions. Pipe shall be laid only after the trench has been
41 excavated as described Division 2 of the Specifications. Pipe laid in trench
42 shall be laid to a firm and even bearing for its full length. Precautions shall
43 be taken against flotation. The pipe shall be backfilled with selected fine
44 excavated material as shown on the Drawings and thoroughly compacted
45 to one foot above the top of the pipe and thereafter backfilled as specified
46 in Section 02221.

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- B. Precautions shall be taken against flotation. Pipe shall be laid directly on the bedding material. Pipe shall be laid in the trench where the bedding forms a continuous and uniform support for the full length of the pipe except that the grade may be disturbed for the removal of lifting tackle. Bell holes shall be formed at the ends of the pipe to prevent point loading at the bells or couplings. Excavation shall be made as needed outside the normal trench section at field joints to permit adequate access to the joints for field connection operations.

- C. Each section of pipe shall be laid in the order and position shown on the laying schedule. In laying pipe, it shall be laid to the set line and grade, within plus or minus one inch.

- D. The maximum obtainable separation between raw water, potable water, reclaimed water and sewage lines shall be practiced. A minimum horizontal separation of 3 feet, outside to outside, shall be maintained between raw water lines, potable water mains and reclaimed water mains or a minimum of 6 feet separation between sewage lines and either water or potable water lines. In instances where water lines cross a potable water main or a sewage collection line, a minimum vertical separation of 12 inches shall be maintained between the invert of the upper pipe and the crown of the lower pipe. In instances where a vertical separation of 12 inches between a raw water line and a potable water main or a sewage collection line cannot be achieved, then the raw water line shall be placed in a cast iron sleeve or encased in concrete centered at the point of crossing.

- E. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the Engineer may change the alignment and/or the grades. Such change shall be made by the deflection of joints, or by the use of additional fittings.

- F. Except for short runs that may be permitted by the Engineer, pipe shall not be laid uphill on grades exceeding 10 percent. Pipe that is laid on a downhill grade shall be blocked and held in place until sufficient support is furnished by the following pipe to prevent movement.

- G. Contractor shall coordinate yard piping installation such that a minimum of 36 inches of cover is maintained over piping at all times, unless otherwise indicated on the plans. At crossings, a minimum of 6 inches of vertical separation between pipes shall be maintained while also maintaining 36-inch minimum cover, unless otherwise indicated on the Drawings.

- H. Bedding and backfilling shall be in accordance with Section 02221 of these Specifications and the details shown on the Construction Drawings.

- 1 I. Bedding shall be carefully worked into the area between the trench bottom
2 and the pipe wall to keep it round. Bedding shall not be deposited on top of
3 the pipe, but alongside it, and in such a way that it rises evenly on both
4 sides.
5
- 6 J. All joints shall be assembled in accordance with the Manufacturer's
7 recommended procedures. In general, the procedure shall be as described
8 herein. Immediately before jointing pipe, the bell of the pipe shall be
9 thoroughly cleaned, and a clean gasket shall be placed in the bell groove.
10 The spigot shall be carefully cleaned and the bell containing the gasket and
11 the spigot lubricated with a vegetable-based lubricant. The spigot of the
12 pipe section shall then be aligned with the bell end and inserted into the bell
13 of the previously laid joint and telescoped into its proper position. Tilting of
14 the pipe to insert the spigot into the bell will not be permitted.
15
- 16 K. Restrained joints shall be assembled in a similar manner as described
17 above except that the restraining device shall be installed in accordance
18 with the Manufacturer's recommended procedures.
19
- 20 L. Bolt holes of flanges shall straddle the field horizontal and field vertical
21 centerlines of the pipe. The Contractor shall clean flanges by wire brushing
22 before installing flanged fittings. The Contractor shall clean flange bolts and
23 nuts by wire brushing.
24
- 25 M. The Contractor shall insert the nuts and bolts (or studs), finger tighten, and
26 progressively tighten diametrically opposite bolts uniformly around the
27 flange to the proper tension. The Contractor shall execute care when
28 tightening joints to prevent any strain upon valves, pumps and other
29 equipment. After tightening all bolts any stulls shall be removed from the
30 interior of the pipe if it is not to be buried.
31
- 32 N. If flanges leak under pressure testing, loosen or remove the nuts and bolts,
33 reset or replace the gasket, reinstall or retighten the bolts and nuts, and
34 retest the joints. Flanged joints shall be watertight.
35
- 36 O. Pipe stulls, if recommended by the Supplier, shall be left in place until
37 bedding and backfilling operations have been completed. After the backfill
38 has been placed, the stulls shall be removed and shall remain the property
39 of the Contractor.
40
- 41 P. After stulls are removed, the Contractor shall check the inside diameter of
42 the pipe to verify that deflection has not exceeded the allowable 3 percent.
43 The frequency of checking shall be as directed by the Engineer but in no
44 case shall be less than the frequency of soil density testing.
45
- 46 Q. All pipes shall be laid with a 2-inch metallic tape, appropriately color coded

1 and imprinted with the type of service, 12 inches below final grade and
2 directly above the utility, for identification and ease of location. The
3 appropriate tape color codes are as follows:
4

5 Sanitary Force Main: Green

6 Potable Water: Blue

7 Reclaimed Water: Purple
8

9 R. Care shall be taken in bolting flanged joints so that there is no restraint on
10 the opposite end of one piece which would induce stresses in the pipe or
11 fitting or prevent pressure from being evenly and uniformly applied upon the
12 gasket. The pipe or fitting shall be free to move in any direction while bolting.
13 Bolts shall be gradually tightened, each in turn, at a uniform rate of gasket
14 compression around the entire flange.
15

16 S. No pipe shall be installed upon a foundation into which frost has penetrated
17 or at any time that there is a danger of the formation of ice or penetration of
18 frost at the bottom of the excavation. No pipe shall be laid unless it can be
19 established that the trench will be backfilled before the formation of ice and
20 frost occurs.
21

22 T. Pipes underneath structures and slabs shall be ductile iron and shall have
23 a 6-inch minimum concrete encasement for pipes 24 inches and smaller
24 (except pipes 3 inches and smaller, which shall be SCH 80 PVC). 8-inch
25 minimum concrete encasement for pipes larger than 24 inches up to and
26 including 36 inches and 9 inches minimum concrete encasement for pipes
27 larger than 36 inches. Concrete encasement shall extend a minimum of 12
28 inches past edge of structure or slab.
29

30 U. All pipe and fitting joints occurring within restrained joint limits as required
31 on the Construction Drawings, or as ordered, shall be properly secured to
32 prevent thrust forces from pulling the pipeline joints apart. All tied joints
33 shall be harnessed by using the pipe Manufacturer's standard restrained
34 joint arrangements conforming to these Specifications. Certain joints may
35 be restrained by the use of rods and clamps as directed by the Engineer.
36 The rods and clamp harnessing arrangements shall be installed utilizing
37 lugged fittings and pipe with saddle clamps placed to bear against the pipe
38 bells. Saddle clamps around the barrel of the pipe that depend on friction
39 or set screws to prevent sliding of the clamp are not acceptable. The pipe
40 clamps, tie rods and their assembly shall meet the requirements of the
41 National Fire Protection Association Bulletin No. 24. After each tied joint is
42 connected up, all pipe clamps, bolts, heads, tie rods and nuts shall be
43 coated as recommended by the Supplier.
44

45 V. Careful inspection shall be made of every joint to insure a smooth
46 continuous interior surface. The Contractor shall thoroughly clean the

1 interior of the pipe and remove any obstructions that may reduce the pipe's
2 carrying capacity. Following completion of pipeline progressively or in
3 sections, including completion of inside inspections, insofar as might be
4 possible or practicable, the line shall be kept partially filled with water.
5

6 W. The Contractor shall patch the cement mortar lining of any pipe that has a
7 crack exceeding the allowable crack as determined by the Engineer. Lining
8 failures that exceed 100 square inches and that have dimension greater
9 than 12-inches shall be cause for the pipe to be rejected. There shall not
10 be more than one patch on the lining of any one joint of pipe, fitting or
11 special.
12

13 X. Wherever necessary and directed by the Engineer, patches shall be made
14 by the Contractor with a mortar of one part Portland cement and two parts
15 clean, sharp sand; all measurements to be by weight. No pipe requiring the
16 lining to be patched shall be installed until the patch is placed. Pipe thus
17 patched shall not be installed until the patch has been properly and
18 adequately cured and observed by the Engineer.
19

20 Y. All buried process piping (excluding drainage and stormwater piping) shall
21 be restrained in accordance with the restrained joint table provided in the
22 Drawings. Pipes subject to pressure or being fed by a pumping system
23 shall be restrained based on a 150 psi working pressure. Pipes subject to
24 gravity flow shall be restrained based on a 30 psi working pressure.
25 Restrained joint length indicated in the Tables represents the length on all
26 sides of fittings and valves within which all joints must be restrained. As a
27 minimum, the joints at all fittings and valves shall be restrained. Restrained
28 joints shall be capable of holding against withdrawal for line pressures 50
29 percent above the normal working pressure but not less than 150 psi on
30 pipe subject to pressure and 30 psi on pipe subject to gravity flow. The pipe
31 and fittings shall be restrained mechanical joints.
32

33 3.03 CUTTING PIPE 34

35 Whenever pipes require cutting to fit into the lines, the work shall be done in a
36 satisfactory manner so as to leave a smooth end, at right angles to the axis of the
37 pipe. Pipe cutting shall only be done by saws specifically designed for that
38 purpose. After cutting, the end of the pipe shall be beveled to the dimensions of
39 the Manufacturer's specifications.
40

41 3.04 COMPRESSION SLEEVE COUPLINGS 42

43 A. The Contractor shall thoroughly clean with a wire brush all surfaces that will
44 be in contact with the gaskets.
45

46 B. The follower rings shall be placed over the pipe ends, then the Contractor

1 shall slip the lubricated gaskets (vegetable based lubricant) over the pipe
2 ends. The Contractor shall place the middle ring over the previously laid
3 pipe then insert the end of the joining pipe into the middle ring, and position
4 both gaskets evenly in the middle ring gasket grooves. The Contractor shall
5 insert bolts in bolt holes of follower rings and tighten nuts in the sequence
6 and with the torque requirements of the coupling manufacturer. After
7 tightening all bolts the stulls shall be removed from the interior of the pipe if
8 it is not to be buried.
9

10 3.05 DRILLING AND TAPPING

- 11
- 12 A. Where shown on the Construction Drawings or where required, ductile iron
13 pipe, fittings or specials shall be drilled and tapped to receive drainage
14 outlets, air relief outlets, or other pipe or plugs for pressure testing and/or
15 chlorination. Holes shall be drilled accurately and at right angles to the axis
16 of the pipe or fitting.
17
- 18 B. Where size of the outlet pipe to be connected is such as to require bosses
19 or reinforcement saddles for making the connection, the Contractor shall
20 furnish such outlet connections with bosses or reinforcement saddles drilled
21 and tapped as indicated on the Construction Drawings or as directed by the
22 Engineer.
23

24 3.06 SURFACE PREPARATION AND PAINTING

- 25
- 26 A. The Contractor shall remove all debris, dirt, grease, mortar and other foreign
27 material by the use of soap and water or other solvent as may be required.
28
- 29 B. After each joint has been made the Contractor shall give all steel bolts and
30 nuts a chemical wash of the phosphate type followed by one (1) coat of
31 primer especially prepared for the finish of the bolt and nut installed. After
32 this pretreatment, the Contractor shall coat all bolts and nuts as follows:
33
- 34 C. Give all bolts and nuts that will be exposed one (1) coat of primer.
35
- 36 D. Paint all bolts and nuts that will be underground in accordance with these
37 Contract Documents.
38
- 39 E. All piping and fittings shall have its surface prepared and painted as
40 specified in Sections 09865 and 09900.
41

42 3.07 SUPPLIER'S FIELD SERVICE

43

44 Contractor shall, at no additional cost to Owner, arrange for pipe Manufacturer's
45 field representative to be on-site and provide instruction to each crew working
46 during the installation of a minimum of four push-on joints and four restrained joints

1 The Manufacturer's field representative shall certify that the installations observed
2 were satisfactorily completed and all pipe installation crews were familiar with the
3 proper methods and procedures for the pipeline installations.
4

5 3.08 FLUSHING AND TESTING
6

7 A. The Contractor shall remove all sand and foreign matter from the pipeline
8 as work progresses. The ends of all pipes shall be suitably closed at each
9 break or pause in pipe laying, and at the end of each work day, so as to
10 minimize the amount of materials that can enter the pipe.
11

12 B. Prior to pressure testing, all 24-inch and smaller mains shall be flushed to
13 remove all sand and other foreign matter. The velocity of the flushing water
14 shall not be less than 2 feet per second. Flushing shall be terminated at the
15 direction of the Engineer. The Contractor shall dispose of the flushing water
16 without causing property damage or violation of environmental regulations
17 or permits.
18

19 C. Prior to pressure testing, all 30-inch and larger mains shall be televised. All
20 dirt and foreign matter shall be removed and the pipe shall be cleaned. After
21 cleaning, the mains shall be re-televised. Pre-and post-cleaning videotapes
22 shall be furnished to the Owner.
23

24 D. Testing of lines shall be as specified in Section III.
25
26

27 END OF SECTION
28

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1 SECTION 15094

2
3 PIPE HANGERS AND SUPPORTS

4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. It is the intent of the project to remove existing pipe supports, hangers, and
10 straps and furnish and install new pipe supports, hangers, and straps as
11 shown on the Drawings.
12
13 B. Furnish all labor, materials, equipment and incidentals and install hangers,
14 supports, concrete inserts, and anchor bolts, including metallic hanging and
15 supporting devices for supporting exposed piping.
16
17 C. All new pipe supports, hangers, straps hardware, clips, unistrut, and
18 anchors shall be 304 stainless steel and shall match the number, type,
19 location, and capacity of the existing supports.
20

21 1.02 QUALIFICATIONS

- 22
23 A. Hangers and supports shall be of standard design and shall be adequate to
24 maintain the supported load in proper position under all operating
25 conditions. The minimum working factor for pipe supports shall be five (5)
26 times the ultimate tensile of the material, assuming 10 feet of water filled
27 pipe being supported.
28
29 B. All pipe and appurtenances connected to equipment shall be supported in
30 such a manner as to prevent any strain being imposed on the equipment.
31 When manufacturers have indicated requirements that piping loads shall
32 not be transmitted to their equipment, the Contractor shall submit a
33 certification stating that such requirements have been complied with.
34

35 1.03 SUBMITTALS

- 36
37 A. Submit to the Engineer for review, as provided in the General Conditions,
38 shop drawings of all items to be furnished under this section.
39
40 B. Submit to the Engineer, for review, samples of all materials specified herein.
41

42 PART 2 – PRODUCTS

43
44 2.01 GENERAL

- 1 A. All pipe and tubing shall be supported as required to prevent significant
 2 stresses in the pipe or tubing material, valves and fittings, and to support
 3 and secure the pipe in the intended position and alignment. All supports
 4 shall be designed to adequately secure the pipe against excessive
 5 dislocation due to thermal expansion and contraction, internal flow forces,
 6 and all probable external forces such as equipment, pipe and personnel
 7 contact. All pipe supports shall be reviewed by the Engineer prior to
 8 installation.
 9
- 10 B. All materials used in manufacturing hangers and supports shall be capable
 11 of meeting, the respective ASTM Standard Specifications with regard to
 12 tests and physical and chemical properties, and be in accordance with MSS
 13 SP-58.
 14
- 15 C. Hangers and supports shall be spaced in accordance with ANSI B31.1.0
 16 that the maximum unsupported span shall not exceed 10 feet otherwise
 17 specified herein.
 18
- 19 D. Unless otherwise specified herein, pipe hangers and supports shall be
 20 manufactured by Piping Technology & Products, Inc. or equal. Any
 21 reference to a specific figure or number is for the purpose of establishing a
 22 type and quality of and shall not be considered as proprietary.
 23

24 2.02 PIPE HANGERS AND SUPPORTS FOR METAL PIPE
 25

- 26 A. Suspended single pipes shall be supported by 304 SS hangers suspended
 27 by steel from 304 SS concrete inserts, beam clamps or ceiling mounting as
 28 follows:
 29

30 1. Hangers:

Pipe Size, Inches	Piping Technology & Products Fig. No.
1/2" to 3"	50
3" to 30"	83
Above 30"	See SPECIAL SUPPORTS, Paragraph 2.04

- 37
- 38 2. Hanger rods shall be rolled 304 stainless steel machine threaded
 39 with load ratings conforming to ASTM Specifications and the strength
 40 of the rod shall be based on root diameter. Hanger rods shall have
 41 the following minimum diameters:
 42

Pipe Size, Inches	Min. Rod Diameter, In.
Less than 2-1/2	3/8
2-1/2 though 4	1/2
4	5/8

1	6	3/4
2	8-12	7/8
3	14-16	1
4	20-30	1-1/2
5	Above 30	See SPECIAL SUPPORTS,
6		Paragraph 2.04

3. Where applicable, structural attachments shall be beam clamps. Beam clamps, for rod sizes 1/2-inch through 3/4-inch shall be equal to Grinnell Fig. No. 229, and for rod sizes 7/8-inch through 1-1/4 inches shall be equal to Grinnell Fig. No. 228 or equal.
4. Concrete inserts for pipe hangers shall be designed to be used in ceilings, walls or floors, spot inserts for individual pipe hangers or ceiling mounting bolts for individual pipe hangers, and shall be as manufactured by Ramset/Red Head, or equal, and shall be as follows:
 - a. 304 SS Multi Set II drop in style anchors shall be used where applicable and shall be used for hanger rods up to and including 7/8-inch diameter.
 - b. Ceiling mounting plates shall be used, where applicable, and be for hanger rod sizes 1-inch through and including 1-1/4 inches, shall be Fig. 47, Fig. 49 or Fig. 52 as manufactured by Grinnell or equal. All pipe hangers shall be capable of vertical adjustment under load and after erection. Turnbuckles, as required and where applied, shall 304 SS be equal to Grinnell Fig. No. 230. Wall or column supported pipes shall be supported by welded steel brackets equal to Grinnell Fig. 194, 195, and 199, as required, for pipe sizes up to and including 20-inch diameter. Additional wall bearing plates shall be provided where required.
5. Where the pipe is located above the bracket, the pipe shall be set on a 0.5-inch neoprene pad and U-bolt assembly supported by the bracket for pipes 4-inches and larger or by a U-bolt for pipes smaller than 4-inches. U-bolts shall be equal to Grinnell Fig. 120 and 137.
6. Where the pipe is located below the bracket, the pipes shall be supported by pipe hangers suspended by steel rods from the bracket. Hangers and steel rods shall be as specified above.
7. Wall or column supported pipes 8-inches and smaller may be supported by hangers equal to Grinnell Figures 103, as required.

1 B. Floor supported pipes 3-inches and larger in diameter shall be supported
2 by either cast-in-place concrete supports or adjust-able pipe saddle
3 supports as directed by the Engineer. In general, concrete supports shall
4 be used when lateral displacement of the pipes is probable (unless lateral
5 support is provided), and adjustable pipe saddle type supports shall be used
6 where lateral displacement of the pipes is not probable.
7

8 1. Each concrete support shall conform to the details shown on the
9 Drawings. Concrete shall be poured after the pipe is in place with
10 temporary supports. Top edges and vertical corners of each
11 concrete support shall have 1-inch bevels. Each pipe shall be
12 secured on each concrete support by a wrought iron or steel anchor
13 strap anchored to the concrete with cast-in-place bolts or with
14 expansion bolts. Where directed by the Engineer, vertical
15 reinforcement bars shall be grouted into drilled holes in the concrete
16 floor to prevent overturning or lateral displacement of the concrete
17 support. Unless otherwise directed by the Engineer, maximum
18 height shall be five (5) feet.
19

20 2. Concrete piers used to support base elbows and tees shall be similar
21 to that specified above. Piers may be square or rectangular.
22

23 3. Adjustable pipe saddle support shall be screwed or welded to the
24 corresponding size 150 lb. companion flanges or slip-on welding
25 flanges respectively. Supporting pipe shall be of Schedule 40 steel
26 pipe construction of the size recommended by the pipe support
27 manufacturer. Each flange shall be secured to the concrete floor by
28 a minimum of two (2) expansion bolts per flange. Adjustable saddle
29 supports shall be equal to Grinnell Fig. No. 259. Where used under
30 base fittings, a suitable flange shall be substituted for the saddle.
31 Floor supported pipes less than 3-inches shall be supported by
32 fabricated steel supports.
33

34 C. Vertical piping shall be supported as follows:
35

36 1. Where pipes change from horizontal to vertical, the pipes shall be
37 supported on the horizontal runs within 2 feet of the change in
38 direction by pipe supports as previously specified herein.
39

40 2. For vertical runs exceeding 15 feet pipes and greater than eight-
41 inches in diameter shall be supported by the fabricated pipe support
42 as shown in the drawings.
43

44 3. Where vertical piping passes through a steel floor sleeve, the pipe
45 shall be supported by a friction type pipe clamp which is supported
46 by the pipe sleeve. Pipe clamps shall be equal to Grinnell Fig. 262.

1 Anchor bolts shall be equal to Kwik-Bolt as manufactured by the
2 McCulloch Industries, Minneapolis, Minnesota or Wej-it
3 manufactured by Wej-it Expansion Products, Inc., Bloomfield,
4 Colorado.

- 5
6 D. All rods, hangers, inserts, brackets, and components shall be 304 Stainless
7 Steel.

8
9 2.03 PIPE HANGERS AND SUPPORTS FOR PLASTIC PIPE

- 10
11 A. Single plastic pipes shall be supported by pipe supports as previously
12 specified herein.
13
14 B. Multiple, suspended, horizontal plastic pipe runs, where possible, and
15 rubber hose shall be supported by ladder type cable trays such as the
16 Electray Ladder by Husky-Burndy, the Globetray by the Metal Products
17 Division of United States Gypsum, or equal. Ladder shall be of mild steel
18 construction. Rung spacing shall be approximately 18 inches for plastic
19 pipe and 12 inches for rubber hose. Tray width shall be approximately 6
20 inches for single runs of rubber hose and 12 inches for double runs of rubber
21 hose. Ladder type cable trays shall be furnished complete with all hanger
22 rods, rod couplings, concrete inserts, hanger clips, etc., required for a
23 complete support system. Individual plastic pipes shall be secured to the
24 rungs of the cable tray by strap clamps fasteners equal to Globe Model
25 M-CAC, Husky-Burndy Model SCR or equal. Spacing between clamps shall
26 not exceed 9 feet. The cable shall provide continuous support along the
27 length of the pipe.
28
29 C. Individual clamps, hangers, and supports in contact plastic pipe shall
30 provide firm support, but not so firm as to prevent longitudinal due to thermal
31 expansion and contraction.

32
33 2.04 SPECIAL SUPPORTS

- 34
35 A. Pipes, requiring special supports as defined in this specification or shown
36 on the drawing, shall be supported by means of a supporting framework
37 anchored into the floor or curbing. The vertical piping shall be suitably
38 secured to horizontal support members connected at each end vertical
39 support members and spaced as required to provide a rigid installation.
40
41 1. The complete supporting system shall be as manufactured by the
42 Unistrut Corporation, Globe-Strut as manufactured by the Metal
43 Products Division of U.S. Gypsum, or equal. Vertical and horizontal
44 supporting members shall be U-shaped channels similar to Unistrut
45 Series P1000.
46

- 1 2. Vertical piping shall be secured to the horizontal members by pipe
- 2 clamps or pipe straps equal to Unistrut Series P1100M and Series
- 3 P2558. All components shall be of 304 stainless steel.
- 4
- 5 3. The assemblies shall be furnished complete with all nuts, bolts, and
- 6 fittings required for a complete assembly.
- 7
- 8 4. The design of each individual framing system shall be the
- 9 responsibility of the Contractor. Shop drawings shall be submitted
- 10 and shall show all details of the installation including dimensions and
- 11 types of supports.
- 12

13 B. Any required pipe supports for which the supports specified in this Section
 14 are not applicable, including pipe supports for above 30-inch diameter pipe;
 15 high temperature and high pressure (greater than 150 psi) shall be
 16 fabricated or constructed from standard aluminum shapes in accordance
 17 with Specifications, concrete and anchor hardware similar to items
 18 previously specified herein and shall meet the minimum requirements listed
 19 below and be subject to review by the Engineer.

- 20
- 21 1. Pipe support systems shall meet all requirements of this Section and
- 22 all related Sections of this Specification.
- 23
- 24 2. Complete design details of the entire pipe support systems shall be
- 25 provided, for review by the Engineer.
- 26
- 27 3. The pipe support system shall not impose loads on the supporting
- 28 structures, in excess of the loads for which the supporting structure
- 29 is designed.
- 30

31 Hanger rods for above 30-inch pipe shall be a minimum of 1-1/2-inch
 32 diameter and shall not exceed the Manufacturer's standard maximum
 33 recommended safe load.

34

35 2.05 PIPE HANGER AND SUPPORT SPACING

36

37 Pipe hanger and support spacing shall be in accordance with ANSI B31.1.1.0 and
 38 MSS SP-69. In no case shall the spacing of hangers or supports exceed the
 39 following:

40

41 Maximum Unsupported Pipe Span (feet)

Nominal Pipe Size - Inches	Ductile Iron	Steel	PVC-1 and PVC-2 (Sch. 80)
1/2	N/A	5	3.5
3/4	N/A	6	3.5
1	N/A	7	3.8

1-1/4	N/A	7	4.0
1-1/2 - 3	N/A	9	4.0
4	7	10	5.5
5-10	10	10	10
12-48	10	per manufacturer or as shown on drawings	10

1
2
3 PART 3 – EXECUTION

4
5 3.01 INSTALLATION

- 6
7 A. All pipes, horizontal and vertical, shall be rigidly supported from the building
8 structure with supports. Supports shall be provided at changes in direction
9 and elsewhere as shown in the Drawings or specified herein. No piping
10 shall be supported from other piping or from metal stairs, ladders and
11 walkways, unless it is so indicated on the Drawings, or specifically directed
12 or authorized by the Engineer.
13
- 14 B. All pipe supports shall be designed with liberal strength and stiffness to
15 support the respective pipes under the maximum combination of peak
16 loading conditions to include pipe weight, liquid weight, liquid movement,
17 and pressure forces, thermal expansion and contraction, vibrations and all
18 probable externally applied forces. Prior to installation, all pipe supports
19 shall be reviewed by the Engineer.
20
- 21 C. Pipe supports shall be provided to minimize lateral forces through valves,
22 both sides of split type couplings, and sleeve type couplings and to minimize
23 all pipe forces on pump housings. Pump housings shall not be utilized to
24 support connecting pipes.
25
- 26 D. Pipe supports shall be provided as follows:
27
- 28 1. Cast iron and ductile iron shall be supported at a maximum support
29 spacing of 10 feet-0-inches with a minimum of one support per pipe
30 section at the joints.
31
 - 32 2. Supports for multiple PVC pipes shall be continuous wherever
33 possible. Individually supported PVC pipes shall be supported as
34 recommended by the manufacturer except that support spacing shall
35 not exceed five (5) feet.
36
 - 37 3. Support spacing for galvanized steel pipe and copper tubing shall not
38 exceed five (5) feet.
39

1 4. All vertical pipes shall be supported at each floor or at intervals of at
2 least 15 feet by pipe collars, clamps, brackets or wall rests, and at all
3 points necessary to insure rigid construction.
4

5 E. Pipe supports shall not result in point loadings, but shall distribute pipe loads
6 evenly along the pipe circumference.
7

8 F. Effects of thermal expansion and contraction of the pipe shall be accounted
9 for in pipe support selection and installation.
10

11 G. Inserts for pipe hangers and supports shall be installed on forms before
12 concrete is poured. Before setting these items, all Drawings and figures
13 shall be checked which have a direct bearing on the pipe location.
14 Responsibility for the proper location of pipe supports is included under this
15 Section.
16

17 H. Continuous metal inserts shall be embedded flush with the concrete
18 surface.
19

20 3.02 PRIME COATING
21

22 A. Prior to prime coating, all pipe hangers and supports shall be thoroughly
23 clean, dry, and free from all mill-scale, rust, grease, dirt, paint and other
24 foreign substances to the satisfaction of the Engineer.
25

26 B. All submerged pipe supports shall be prime coated with Koppers 654 Epoxy
27 Primer or equal. All other pipe supports shall be prime coated with Rust-
28 Inhibitive Primer No. 621 as manufactured by Koppers Company, Inc.,
29 Pittsburgh, Pa. or equal.
30

31 C. Finish coating shall be compatible with the prime coating used and shall be
32 applied, as specified in Section 09900.
33

34 3.03 PROTECTION AGAINST ELECTROLYSIS
35

36 A. Where dissimilar metals are used in conjunction with each other, suitable
37 insulation shall be provided between adjoining surfaces to eliminate direct
38 contact and any resulting electrolysis. The insulation shall be bituminous
39 impregnated felt, heavy bituminous coatings, nonmetallic separators or
40 washers.
41

42
43 END OF SECTION
44
45

1 SECTION 15100

2 VALVES AND APPURTENANCES

3
4
5 PART 1 – GENERAL

6
7 1.01 SCOPE OF WORK

- 8
9 A. Furnish all labor, materials, equipment and incidentals required for complete
10 and ready operation of all valves and appurtenances shown on the Construction
11 Drawings and as specified herein.
12
13 B. All valves and appurtenances shall be of the size shown on the drawings.
14
15 C. All new valves 3-inch and larger shall be provided by the same manufacturer.
16
17 D. All new pneumatic actuators shall be provided by the same manufacturer.
18
19 E. All valves and appurtenances shall have the name of the manufacturer cast in
20 raised letters on some appropriate part of the body.
21
22 F. The equipment shall include, but not be limited to, the following:
23
24 1. Eccentric Plug Valves
25 2. Swing Check Valves
26 3. Knife Gate Valves
27 4. Valve Actuators
28 5. Gauges
29 6. Flange Adapter Couplings

30
31 1.02 DESCRIPTION OF SYSTEMS

- 32
33 A. All of the equipment and materials specified herein are intended to be standard
34 for use in controlling the flow of wastewater, waste activated sludge, return
35 activated sludge, scum, etc., depending on the application.
36
37 B. Unless otherwise specified herein or on the drawings all resilient seats, seals,
38 and other sealing components of valves and flexible fittings shall be of EPDM
39 construction.
40
41 C. All replacement valves are to be provided with an actuator to match the type of
42 the existing actuator and mounted in an identical fashion as the existing
43 actuator.
44
45 D. In the case of existing valves that are being replaced with new valves, all
46 replacement valves shall have the identical lay length as the existing valves.
47 This applies to all types of valves. Prior to ordering any replacement valve, the

1 contractor shall notify the Engineer if the valve in questions has to be special
2 manufactured or ordered because of a non-standard lay length.

3
4 1.03 QUALIFICATIONS

5
6 All of the types of valves and appurtenances shall be products of well-established
7 reputable firms who are fully experienced and qualified in the manufacture of the
8 particular equipment to be furnished. The equipment shall be designed, constructed
9 and installed in accordance with the best practices and methods and shall comply with
10 these Specifications, as applicable.

11
12 1.04 SUBMITTALS

13
14 Complete shop drawings of all valves and appurtenances shall be submitted to the
15 Engineer for review.

16
17 1.05 TOOLS

18
19 Special tools, if required for normal operation and maintenance, shall be supplied with
20 the equipment.

21
22 1.06 VALVE INDICES

23
24 The Contractor shall submit a valve schedule containing all valves required for the
25 work. The schedule shall the location, type, a number, words to identify the valve's
26 function, and the normal operating position for each valve.

27
28 PART 2 – PRODUCTS

29
30 2.01 ECCENTRIC PLUG VALVES

31
32 A. Replacement plug valves shall be supplied with end connections identical to
33 those valves they are replacing and have identical lay lengths as those valves
34 they are replacing.

35
36 B. All plug valves shall be manufactured and installed in accordance with standard
37 ANSI/AWWA C517 Table 1, Resilient-Seated Cast-Iron Eccentric Plug Valves,
38 of the latest revision unless otherwise specified. MANUFACTURER shall
39 provide affidavit of compliance with AWWA Standard. Valves shall be as
40 manufactured by DeZurik, Val-Matic, Homestead or equal.

41
42 C. Plug valves shall be tested in accordance with AWWA C504, latest edition.
43 Each valve shall be performance tested in accordance with Paragraph 5.2 of
44 the above reference and shall be given a leakage test and hydrostatic test as
45 described in Paragraphs 5.2.2 and 5.2.3 of the above reference. The leakage
46 test shall be applied to the face of the plug tending to unseat the valve. The
47 manufacturer shall furnish certified copies of reports covering proof of design

1 testing as described in Section 5.2.4 of the above reference.

- 2
- 3 D. Valves shall be of the non-lubricated eccentric type with resilient faced plugs
4 and shall be furnished with end connections as shown on the plans. The metal
5 plug shall meet the standards of ANSI/FCI 70-2 Class IV. Flanged valves shall
6 be faced and drilled to the ANSI B16.1 125/150 lb. standard. Mechanical joint
7 ends shall be in full compliance with ANSI/ AWWA C111/A21.11. Screwed ends
8 shall be to the NPT standard.
- 9
- 10 E. Valve bodies shall be of ASTM A126 Class B or ASTM A48, Class 40 cast iron.
- 11
- 12 F. Port areas for valves 20 inches and smaller shall be a minimum of 80 percent
13 of full pipe area. Valves 24-inch and larger shall have a minimum port area of
14 100 percent of full nominal pipe area.
- 15
- 16 G. The plug shall have a cylindrical seating surface eccentrically offset from the
17 center of the shaft. Plug shall not contact the seat until at least 90% closed.
- 18
- 19 H. All exposed nuts, bolts, springs, washers, etc., shall be zinc or cadmium plated.
20 Valve plugs shall be constructed of ASTM A-48, Class 40 cast iron or ASTM A-
21 536 ductile iron. Resilient plug facings shall be of Neoprene.
- 22
- 23 I. Valves shall be furnished with permanently lubricated stainless steel,
24 oil-impregnated bronze or non-metallic upper and lower plug stem bearings.
- 25
- 26 J. Valve seats shall be either nickel or stainless steel. Epoxy seats are not
27 acceptable. Seats shall be 1/8" thick welded overlay of not less than 95% pure
28 nickel. Seat shall be at least 1/2" wide, 1/8" thick through entire width and raised.
29 The raised surface shall be completely covered with nickel to insure that the
30 resilient plug face contacts only the nickel seat.
- 31
- 32 K. Plug valves greater than 6 inches in diameter shall be supplied with manual
33 gear actuators unless otherwise shown on the Drawings.
- 34
- 35 L. Bearings shall be sleeve type and made of 316 stainless steel, ASTM A743
36 Grade CF8M through 36".
- 37
- 38 M. Shaft seals shall be of the multiple V-ring type with a packing gland follower.
39 Shaft seals shall be externally adjustable and repackable without removing the
40 actuator or bonnet from the valve.
- 41
- 42 N. Valves shall have a factory-applied, internal and external, fusion bonded epoxy
43 resin coating with a minimum thickness of 8 mils, conforming to all applicable
44 requirements of the American Water Works Association Standard C550-90
45 entitled "Protective Interior Coatings for Valves and Hydrants".
- 46
- 47

1 2.03 SWING CHECK VALVES

- 2
- 3 A. Air cushioned check valves shall be APCO Series 6000, as manufactured by
- 4 DeZURIK, or approved equal.
- 5 B. Air cushion shall be totally enclosed. The cylinder shall have an anodized
- 6 aluminum alloy cap, head and barrel. The bottom cylinder head shall be hinged
- 7 mounted to follow the change of angular force as the lever rises and lowers.
- 8 C. Swing check valves body shall be ASTM A536 ductile iron. End connections
- 9 shall be flanged class 125/150 or 250/300 per ASME B16.1. Valves 6" and
- 10 larger shall have a drain plug located on the bottom of the valve.
- 11 D. Body seat shall be 316 stainless steel per ASTM A276 with an O-ring seal, and
- 12 locked into place with stainless steel screws.
- 13 E. Disc and Disc Arm shall be ASTM A536 ductile iron. The disc shall be attached
- 14 to the disc arm with a double clevis hinge to assure self-leveling and even load
- 15 distribution upon closure, minimizing seat wear. Disc shall have an independent
- 16 adjustable full open stop. The disc arm, valve body or cover is not to be used
- 17 as the disc stop. Disc seat shall be nitrile butadiene (NBR) and field replaceable
- 18 without use of special tools.
- 19 F. Pivot shaft shall be a large one-piece 303 stainless steel per ASTM A582,
- 20 protruding through the body with a lever and weight mounted on one side. The
- 21 pivot shaft shall have an integral retainer to prevent axial shaft movement. The
- 22 pivot shaft shall have O-Ring seals on both sides of the shaft. Braided type
- 23 packing is not acceptable. Valve is to be tested by the manufacturer as a
- 24 complete assembly per AWWA C508.
- 25 G. Valve shall be warranted by the manufacturer for defects in materials and
- 26 workmanship for a period of two years from date of shipment.
- 27

28 2.04 Knife Gate Valves

- 29
- 30 A. Knife gate valves shall be H200-B, as manufactured by DeZURIK, or approved
- 31 equal.
- 32 B. The valve shall meet the applicable requirements of MSS SP-81, MSS SP-135,
- 33 or AWWA C520.
- 34 C. The valve should have a relief groove to allow the gate to push solid particles
- 35 aside to prevent material packing in the seat area. If required, groove flush ports
- 36 shall be provided and fabricated from the same material as the wetted parts.
- 37 D. Valve shall have a pressure retaining bonnet that fully encloses the gate. The
- 38 bonnet shall be rated at the same pressure as the valve body and shall not
- 39 include an internal gate packing or gate wiper. A packing gland shall be located
- 40 at the top of the bonnet to provide a tight seal around the stem. The packing
- 41 shall be replaceable without disassembling the valve or removing the valve from
- 42 the pipeline.
- 43 E. The valve stem shall have an integral back-seating ring to allow repacking under
- 44 pressure. The back-seating ring sealing surface shall be designed to mate with
- 45 the bottom of the packing gland.
- 46 F. The valve stem shall Acme threaded.
- 47 G. Metal-seated valves shall be full-port design with the clear port ID to or greater

- 1 than the pipe ID.
- 2 H. Resilient seals shall be designed to fit in a self-retaining groove that is cut into
3 the seat ring and be replaceable without removing the valve from the pipeline.
4 The seal shall not require mechanical fasteners or sealants to hold it in place.
- 5 I. Provide gate guides for valves where the valve stem is not installed in the
6 vertical position. Gate guides shall fully support the gate and allow it to seat as
7 required.
- 8 J. The pressure class of valve flanges shall be equal to or greater than the
9 pressure rating of the valve.
- 10 K. Maximum rim pull to seat and unseat valve at rated valve pressure is 60lbf.
- 11 L. For a maximum handwheel rim pull greater than 60 pounds at the rated valve
12 pressure, a bevel gear operator shall be provided. The bevel gear operator shall
13 have fully enclosed steel gears, be permanently lubricated, and possess a gear
14 ratio such that the maximum handwheel rim pull at the rated valve pressure
15 does not exceed 60 pounds. Bevel gear operator shall be IP68 rated continuous
16 duty to 50 ft and shall be Rotork model IB-RAW-FB, or approved equal.
- 17 M. The bonneted knife gate valve shall be installed in a vertical orientation, per
18 valve Manufacturer's installation instructions.
- 19
20

21 2.05 VALVE ACTUATORS

22 A. General

- 23
- 24
- 25 1. All valve actuators shall conform to the latest version of Section 3.8 of
26 AWWA Standard Specification C504, and shall be manual, motor-
27 operated, or air operated and shall match the existing valve operator.
- 28
- 29 2. Actuators shall be capable of seating and unseating the disc against the
30 full design pressure and velocity, as specified for each class, into a dry
31 system downstream, and shall transmit a minimum torque to the valve.
32 Actuators shall be rigidly attached to the valve body.
- 33
- 34 4. The Contractor and the actuator manufacturer are responsible for
35 providing actuators of adequate size, pressure, and torque ratings for the
36 respective application.
- 37
- 38 5. The Contractor is responsible for handling and installing the valve and
39 actuator in strict accordance with manufacturer's instructions. The
40 Contractor shall replace any damaged actuator without cost to the
41 Owner.
- 42
- 43 6. Valves located seven (7) feet or more above the floor level shall be
44 equipped with an actuator that allows operation of the valve less than five
45 (5) feet from floor level. Manual operators shall have a chainwheel and
46 electric actuator shall have a remote mounted control panel.
- 47

1 B. Manual Actuators

- 2
- 3 1. Manual actuators shall have permanently lubricated, totally enclosed
- 4 gearing with handwheel and gear ratio sized on the basis of required
- 5 opening and closing torque values. Actuators shall be equipped with
- 6 handwheel, position indicator, and mechanical stop-limiting locking
- 7 devices to prevent over travel in the open and closed positions. They
- 8 shall turn counter-clockwise to open valves. Manual actuators shall be
- 9 of the traveling nut, self-locking type and shall be designed to hold the
- 10 valve in any intermediate position between fully open and fully closed
- 11 without creeping or fluttering. Actuators shall be fully enclosed and
- 12 designed to produce the specified torque with a maximum pull of 80
- 13 pounds on the handwheel or chainwheel. Actuator components shall
- 14 withstand an input of 450-foot pounds for 30" and smaller and 300-foot
- 15 pounds for larger than 30" size valves at extreme actuator positions
- 16 without damage. Valves located above grade shall have handwheel or
- 17 chain wheel and position indicator, and valves located below grade shall
- 18 be equipped with a 2-inch square AWWA operating nut located at ground
- 19 level and cast iron extension type valve box. Valve actuators shall
- 20 conform to AWWA C504, latest revision.
- 21
- 22 2. Handwheels or chainwheels shall be turned left or counterclockwise to
- 23 open the valves. Handwheels shall be of ample size and shall have an
- 24 arrow and the word OPEN cast thereon to indicate the direction of
- 25 opening.
- 26
- 27 3. Chainwheels shall be provided for valves 6 feet or more above the
- 28 operator walkway. Process air piping valves in the aeration basins shall
- 29 have actuators and handle extensions to allow actuation of the valve a
- 30 minimum of 24 inches above the operator walkway.
- 31

32

33 2.06 PRESSURE AND VACUUM GAUGES

34

- 35 A. All pumps furnished under this contract shall have pressure/ vacuum gauges
- 36 installed on their respective suction lines and pressure gauges installed on their
- 37 discharge lines. All pressure and vacuum gauges furnished under this Contract
- 38 shall be mounted per manufacturer requirements using tapping saddles and
- 39 sleeves specified in Section 15100, 2.19.
- 40
- 41 B. Each gauge shall be direct mounted, phenolic, shock resistant or 304 stainless
- 42 steel case with a 4-1/2-inch diameter dial and furnished with a clear glass crystal
- 43 window, 1/4-inch shut-off valve, and a bronze pressure snubber. Provide
- 44 stainless steel diaphragm seals between shut-off valve and pressure gauge on
- 45 all lines with unclear matter in suspension of solution. All gauges shall be
- 46 weatherproofed. The face dial shall be white finished aluminum with jet black
- 47 graduations and figures. The face dial shall read in units of both pounds per

1 square inch and feet of head.

2
3 C. Suction gauges shall read from 10 inches of mercury vacuum to 50 feet of head.
4 Discharge gauges shall read from zero feet of head to the expected shutoff head
5 of the respective pump.

6
7 D. Gauges shall be as manufactured by H.O. Trerice Co., Marshalltown
8 Instruments, Dwyer, Ametek, Ashcroft, Helicoid, Wekslar or equal
9

10 2.07 FLANGE ADAPTER COUPLINGS

11 A. Flange adapter couplings shall be of the sizes shown on the Drawings.

12 B. Flange adapter couplings shall have a 150 psi minimum pressure rating.

13
14 C. All couplings shall be restrained and shall have a sufficient number of anchor
15 studs to meet or exceed the test pressure rating for this project, 150 psi
16 minimum.
17

18
19 D. Couplings shall be EBAA Iron Series 2100 Megaflange Restrained Flange
20 Adapter, JCM Model 301R, or equal.
21
22

23 PART 3 – EXECUTION

24 3.01 INSTALLATION

25
26 A. All valves and appurtenances shall be installed in the locations shown, true to
27 alignment and rigidly supported. Any damage to the above items shall be
28 repaired to the satisfaction of the Engineer before they are installed.
29

30
31 B. After installation, all valves and appurtenances shall be tested at least 2 hours
32 at the working pressure corresponding to the class of pipe, unless a different
33 test pressure is specified. If any joint proves to be defective, it shall be repaired
34 to the satisfaction of the Engineer.
35

36
37 C. Install all floor boxes, brackets, extension rods, guides, the various types of
38 operators and appurtenances as shown on the Drawings that are in masonry
39 floors or walls, and install concrete inserts for hangers and supports as soon as
40 forms are erected and before concrete is poured. Before setting these items,
41 the Contractor shall check all plans and figures which have a direct bearing on
42 their location and he shall be responsible for the proper location of these valves
43 and appurtenances during the construction of the structures.
44

45 D. Pipe for use with flexible couplings shall have plain ends as specified in the
46 respective pipe sections in Division 15.
47

- 1 E. Flanged joints shall be made with high strength, low alloy Corten bolts, nuts and
2 washers. Mechanical joints shall be made with mild corrosion resistant alloy
3 steel bolts and nuts. All exposed bolts shall be painted the same color as the
4 pipe. All buried bolts and nuts shall be heavily coated with two (2) coats (14-20
5 mils DFT) of bituminous paint comparable to Carboline Bitumastic 300M,
6 Tnemec Series 46H-413 Tneme-Tar, or equal.
7
- 8 F. Prior to assembly of split couplings, the grooves, as well as other parts, shall be
9 thoroughly cleaned. The ends of the pipes and outside of the gaskets shall be
10 moderately coated with petroleum jelly, cup grease, soft soap or graphite paste,
11 and the gasket shall be slipped over one pipe end. After the other pipe has
12 been brought to the correct position, the gasket shall be centered properly over
13 the pipe ends with the lips against the pipes. The housing sections then shall
14 be placed. After the bolts have been inserted, the nuts shall be tightened until
15 the housing sections are firmly in contact, metal-to-metal, without excessive bolt
16 tension.
17
- 18 G. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned
19 thoroughly for a distance of 8 inches. Soapy water may be used as a gasket
20 lubricant. A follower and gasket, in that order, shall be slipped over each pipe
21 to a distance of about 6 inches from the end, and the middle ring shall be placed
22 on the substantial completion date unless otherwise requested by the Owner.
23
- 24 H. Valve boxes with concrete bases shall be installed as shown on the
25 Construction Drawings. Mechanical joints shall be made in the standard
26 manner. Valve stems shall be vertical in all cases. Place cast iron box over
27 each stem with base bearing on compacted fill and top flush with final grade.
28 Boxes shall have sufficient bracing to maintain alignment during backfilling.
29 Knobs on cover shall be parallel to pipe. Remove any sand or undesirable fill
30 from valve box.
31

32 3.02 SHOP PAINTING

33

34 Ferrous surfaces of above ground valves and appurtenances to be painted shall
35 receive a coating of rust-inhibitive primer compatible to paint system specified in
36 Section 09900. All pipe connection openings shall be capped to prevent the entry of
37 foreign matter prior to installation.
38

39 3.03 FIELD PAINTING

40

41 All metal valves and appurtenances specified herein and exposed to view, except ball
42 valves, shall be painted as part of the work in Section 09900.
43

44 3.04 INSPECTION AND TESTING

45

46 Completed pipe shall be subjected to a hydrostatic pressure and leakage in
47 accordance with pipe specifications. All leaks shall be repaired and lines retested.

1 Prior to testing, the pipelines shall be supported in a manner to prevent movement
2 during tests.

3

4

5

6

END OF SECTION

1
2
3
4

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1 SECTION 16010

2
3 BASIC ELECTRICAL REQUIREMENTS

4
5 PART 1 - GENERAL

6
7 1.01 RELATED DOCUMENTS:

8
9 Drawings and general provisions of Contract, including General and
10 Supplementary Conditions, Divisions 00 & 01 Specification sections, apply to
11 work of this Section.

12
13 1.02 CODES

14
15 A. The work shall be in conformance with the latest adopted version of the
16 following:

17 NFPA National Fire Protection Association Codes
18 NFPA 70 National Electrical Code
19 FBC Florida Building Code
20

21 B. The installation shall also comply with all applicable rules and regulations
22 of local and state laws and ordinances. Include in the work, without extra
23 cost, any labor, materials, services, apparatus and drawings required to
24 comply with all applicable laws, ordinances, rules and regulations. Inform
25 the architect of any work or materials which conflict with any of the
26 applicable codes, standards, laws, and regulations before submitting their
27 bid.
28

29 1.03 ROUGH-IN

30
31 A. Verify final locations for rough-ins with field measurements and with the
32 requirements of the actual equipment to be connected.

33
34 B. Refer to equipment specifications in for rough-in requirements.
35

36 1.04 ELECTRICAL INSTALLATIONS

37
38 A. Existing services shall not be interrupted without prior consent of the
39 owner's authorized representative and may be interrupted only at, and for,
40 the specific time designated by the owner's authorized representative.
41

42 B. Make a thorough examination of the site and the contract documents. No
43 claim for extra compensation will be recognized if difficulties are
44 encountered which an examination of site conditions and contract
45 documents prior to executing contract would have revealed.
46

- 1 C. Coordinate electrical equipment and materials installation with other
2 building components.
- 3 D. Verify all dimensions by field measurements.
- 4
- 5 E. Arrange for chases, slots, and openings in other building components to
6 allow for electrical installations.
- 7
- 8 F. Coordinate the installation of required supporting devices and sleeves to
9 be set in poured-in-place concrete and other structural components, as
10 they are constructed. Sequence, coordinate, and integrate installations of
11 electrical materials and equipment for efficient flow of the work. Give
12 particular attention to large equipment requiring positioning prior to
13 closing-in the building.
- 14
- 15 G. Coordinate the cutting and patching of building components to
16 accommodate the installation of electrical equipment and materials.
- 17
- 18 H. Install electrical equipment to facilitate maintenance and repair or
19 replacement of equipment components. As much as practical, connect
20 equipment for ease of disconnecting, with minimum of interference with
21 other installations.
- 22
- 23 I. Coordinate the installation of electrical materials and equipment above
24 ceilings with suspension system, mechanical equipment and systems, and
25 structural components.
- 26
- 27 J. Temporary electrical service and construction lighting shall be provided
28 under this section. Provide for all electrical service for construction
29 period, making all connections and removal of same at job conclusion.
30 Furnish and install temporary lighting for construction period. At job
31 completion, all temporary lamps shall be removed and replaced with new
32 lamps.
- 33
- 34 K. All existing and new conduit/raceways within the project area shall be
35 properly supported; minimum spacing of conduit supports shall be 4 feet.
36 Add support to existing conduit as required to comply with the NEC.
- 37
- 38 L. All enclosures for new electrical equipment shall be NEMA 4X stainless
39 steel (type 316). All outdoor enclosures for Programmable Logic
40 Controllers (PLC), Control Panels, Process Monitoring Panels shall have
41 solar shield panels located at top, bottom, back and sides of enclosures.
42 All enclosures shall be painted white to match existing. All enclosures
43 shall have internal mounting plates for components and an interior safety
44 door.
- 45
- 46 M. All conduits entering wet wells, pits, tanks, aerators and similar vessels or

1 containment structures shall have conduit seals installed as prescribed by
2 the NEC.

- 3 N. There shall be no penetrations of existing clarifier tank or process basin
4 walls. All conduits shall be run surface mounted or on top of walls.
5 Conduit supports or associated hardware shall NOT penetrate existing
6 clarifier tank walls or process basin walls.
7

8 1.05 CUTTING AND PATCHING
9

- 10 A. Do not endanger or damage installed work through procedures and
11 processes of cutting and patching.
12
13 B. Arrange for repairs required to restore other work because of damage
14 caused as a result of electrical installations.
15
16 C. No additional compensation will be authorized for cutting and patching
17 work that is necessitated by ill-timed, defective, or non-conforming
18 installations.
19
20 D. Perform cutting, fitting, and patching of electrical equipment and materials
21 required to:
22
23 1. Uncover work to provide for installation of ill-timed work.
24
25 2. Remove and replace defective work.
26
27 3. Remove and replace work not conforming to requirements of the
28 contract documents.
29
30 4. Remove samples of installed work as specified for testing.
31
32 5. Install equipment and materials in existing structures.
33
34 6. Upon written instructions from the architect/engineer, uncover and
35 restore work to provide for architect/engineer observation of
36 concealed work.
37
38 E. Cut, remove and legally dispose of, selected electrical equipment,
39 components, and materials as indicated; including, but not limited to,
40 removal of electrical items indicated to be removed and items made
41 obsolete by the new work.
42
43 F. Protect the structure, furnishings, finishes, and adjacent materials not
44 indicated or scheduled to be removed.
45
46 G. Provide and maintain temporary partitions or dust barriers adequate to

1 prevent the spread of dust and dirt to adjacent areas.
2

- 3 H. Locate, identify, and protect electrical services passing through
4 remodeling or demolition area and serving other areas required to be
5 maintained operational. When transit services must be interrupted,
6 provide temporary services for the affected areas and notify the owner
7 prior to changeover.
8

9 1.06 ELECTRICAL SUBMITTALS
10

- 11 A. Refer to the Section 01300 for submittal definitions, requirements, and
12 procedures.
13
14 B. Submittal of shop drawings, product data, and samples will be accepted
15 only when submitted by the contractor. Data submitted from
16 subcontractors and material suppliers directly to the architect/engineer will
17 not be processed.
18
19 C. As a minimum, shop drawings shall be furnished for the following; control
20 panels, cables, conductors, Variable Frequency Drives, Soft Starters,
21 raceways, conduits, supports and accessories, grounding devices and
22 hardware, surge protectors, motors, wiring devices, connection lugs, outlet
23 and pull boxes, identification devices and materials, lights and control
24 stations.
25

26 1.07 PRODUCT OPTIONS AND SUBSTITUTIONS
27

28 Refer to the Section 01670 for requirements in selecting products and requesting
29 substitutions.
30

31 1.08 PRODUCT LISTING
32

- 33 A. Prepare listing of major electrical equipment and materials for the project.
34
35 B. Submit this listing as a part of the submittal requirement specified in
36 Section 01300.
37
38 C. When two or more items of the same material or equipment are required,
39 they shall be of the same manufacturer. Product manufacturer uniformity
40 does not apply to raw materials, bulk materials, wire, conduit, fittings,
41 sheet metal, steel bar stock, welding rods, solder, fasteners, motors for
42 dissimilar equipment units, and similar items used in work, except as
43 otherwise indicated.
44
45 D. Provide products which are compatible within systems and other
46 connected items.

- 1
2 E. No substitution will be considered unless written request has been
3 submitted to the architect at least ten (10) days prior to the date for receipt
4 of bids.
5
6 F. If the architect approves any proposed substitutions, such approval will be
7 set forth in an addendum.
8

9 1.09 DELIVERY, STORAGE, AND HANDLING
10

- 11 A. Deliver products to project properly identified with names, model numbers,
12 types, grades, compliance labels, and similar information needed for
13 distinct identifications; adequately packaged and protected to prevent
14 damage during shipment, storage, and handling.
15 B. Store equipment and materials at the site, unless off-site storage is
16 authorized in writing. Protect stored equipment and materials from
17 damage.
18
19 C. Coordinate deliveries of electrical materials and equipment to minimize
20 construction site congestion. Limit each shipment of materials and
21 equipment to the items and quantities needed for the smooth and efficient
22 flow of installation.
23

24 1.10 RECORD DOCUMENTS (AS-BUILTS)
25

- 26 A. Refer to Section 01720 for requirements. The following paragraphs
27 supplement the requirements of Division 01.
28
29 1. Mark drawings to indicate revisions to conduit size and location,
30 both exterior and interior; actual equipment locations, dimensioned
31 from column lines; concealed equipment, dimensioned to column
32 lines; distribution and branch electrical circuitry; fuse and circuit
33 breaker size and arrangements; support and hanger details;
34 change orders; concealed control system devices. Wiring diagram
35 and/or schedule shall be furnished indicating identification of all
36 wiring run and labeled from point-to-point (power source to end-of-
37 use).
38
39 2. Mark Specifications to indicate approved substitutions; change
40 orders; actual equipment and materials used.
41
42 3. Contractor shall provide engineer with record drawings (AutoCAD
43 compatible file format) and one set of blueprints.
44
45 4. Furnish one set of conductor meggar readings as listed in Section
46 16120

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1.11 WARRANTIES

- A. Refer to Section 01740 for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.
- B. Compile and assemble the warranties specified in Division 16 into a separated set of vinyl- covered, three-ring binders, tabulated and indexed for easy reference.
- C. Provide complete warranty information for each item to include product or equipment; date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.12 CLEANING

- A. Refer to Section 01700 for general requirements for final cleaning.
- B. Clean all light fixtures, lamps, and lenses prior to final acceptance. Replace all inoperative lamps.

END OF SECTION

1 SECTION 16110

2 RACEWAYS

3
4
5 PART 1 – GENERAL

6
7 1.01 RELATED DOCUMENTS

- 8
9 A. Drawings and general provisions of Contract, including General and
10 Supplementary Conditions and Division 1 specification sections, apply to
11 work of this Section.
12
13 B. This Section is a Division 16 Basic Electrical Materials and Methods
14 section and is part of each Division 16 section making reference to
15 electrical raceways specified herein.
16

17 1.02 DESCRIPTION OF WORK

- 18
19 A. Extent of raceway work is indicated by drawings and schedules.
20
21 B. Types of raceways specified in this section include the following:
22
23 Heavy Wall Aluminum
24 PVC Schedule 80
25 Liquid-tight flexible PVC coated metal conduit
26

27 1.03 QUALITY ASSURANCE

- 28
29 A. Manufacturers: Firms regularly engaged in manufacture of raceway
30 systems of types and sizes require, whose products have been in
31 satisfactory use in similar service for not less than five (5) years.
32
33 B. Installer's Qualifications: Firms with at least three (3) years of successful
34 installation experience on projects with electrical raceway work similar to
35 that required for this project.
36
37 C. Codes and Standards:
38
39 1. UL Compliance Labeling: Comply with applicable requirements of
40 UL safety standards pertaining to electrical raceway systems.
41 Provide raceway products and components which have been UL
42 listed and labeled.
43
44
45

1 PART 2 – PRODUCTS

2
3 2.01 METAL CONDUIT AND TUBING

- 4
5 A. General: Provide aluminum conduit, tubing and fittings of types, grades,
6 sizes and weights (wall thickness) for each service indicated.
7
8 B. Where types and grades are not indicated, provide proper selection
9 determined by installer to fulfill wiring requirements and comply with
10 applicable portions of NEC for raceways.
11
12 C. Rigid aluminum Conduit: Provide rigid aluminum, heavy wall, threaded
13 type.
14
15 D. Liquid-Tight Flexible Metallic Conduit: Provide liquid-tight flexible PVC
16 coated metallic conduit for all motor connections.
17
18 E. Conduit Fittings: Couplings and connectors for conduit sizes 2” and
19 smaller shall be aluminum hex-nut, expansion-gland type. Aluminum set
20 screw type fittings may be used for conduit sizes 2½” and larger.
21

22 2.02 NONMETALLIC CONDUIT AND DUCTS

- 23
24 A. General: Provide nonmetallic conduit, ducts and fittings of types, sizes
25 and weights for each service indicated. Where types and grades are not
26 indicated, provide proper selection determined by installer to fulfill wiring
27 requirements which comply with provisions for NEC for raceways.
28
29 B. Electrical Plastic Conduit:
30
31 1. Heavy Wall Conduit: Schedule 80, 90°C, UL-rated, constructed of
32 Schedule 80, 90 polyvinyl chloride. For direct burial, UL listed and
33 in conformity with NEC Article 347.
34
35 C. Conduit and Tubing Accessories: Provide conduit, tubing and duct
36 accessories of types, sizes and materials, complying with manufacturer’s
37 published product information, which mate and match conduit and tubing.
38
39 D. Conduit Bodies: Provide aluminum cast-metal conduit bodies of types,
40 shapes and sizes as required to fulfill job requirements and NEC
41 requirements. Construct conduit bodies with threaded conduit-entrance
42 ends, removable covers, either cast or galvanized aluminum and
43 corrosion-resistant screws.
44

45 PART 3 – EXECUTION

1 3.01 OBSERVATION
2

- 3 A. Examine areas and conditions under which raceways are to be installed
4 and substrate which will support raceways. Notify contractor in wiring of
5 conditions detrimental to proper completion of the work. Do not proceed
6 with work until unsatisfactory conditions have been corrected in manner
7 acceptable to installer.
8

9 3.02 INSTALLATION OF RACEWAYS
10

- 11 A. General: Raceways run below grade, under floors on grade or in concrete
12 shall be PVC heavy wall type (Schedule 80) conduit, provided rigid
13 aluminum conduit is used on elbows and risers to boxes, cabinets, etc.
14

- 15 B. Sizes of raceways shall be not less than NEC requirements and shall not
16 in any case be less than indicated on drawings. Larger size raceways
17 and/or pull boxes shall be installed if there is excessive length unbroken
18 run or excessive number of bends. Combining of circuits other than those
19 indicated on the drawings will not be permitted.
20

- 21 C. Coordinate with other work, including wires/cables, boxes and panel work
22 as necessary to interface installation of electrical raceways and
23 components with other work.
24

- 25 1. Avoid use of dissimilar metals throughout system to eliminate
26 possibility of electrolysis. Where dissimilar metals are in contact,
27 coat surfaces with corrosion inhibiting compound before
28 assembling.
29

- 30 2. Use roughing-in dimensions of electrically operated unit furnished
31 by supplier. Set conduit and boxes for connection to units only
32 after receiving review of dimensions and after checking location
33 with other trades.
34

- 35 3. Provide nylon pullcord in empty conduits where indicated. Test all
36 empty conduits with ball mandrel. Clear any conduit which rejects
37 ball mandrel. Pay costs involved for restoration of conduit and
38 surrounding surfaces to original condition.
39

- 40 4. Use liquid-tight flexible conduit where subjected to one or more of
41 the following conditions:
42

- 43 a. Exterior location.
44 b. Moist or humid atmosphere where condensate can be
45 expected to accumulate.
46 c. Corrosive atmosphere.

- 1 d. Subjected to water spray or dripping oil, water or grease.
2
3 D. Cut conduits straight, ream properly and cut threads for heavy wall conduit
4 deep and clean.
5
6 E. Field-bend conduit with benders designed for purpose so as not to distort
7 nor vary internal diameter.
8
9 F. Fasten conduit terminations in sheet metal enclosures by two (2) locknuts
10 and terminate with bushing. Install lock nuts inside and outside enclosure.
11
12 G. Conduits are not to cross pipe shafts or ventilating duct openings.
13
14 H. Keep conduits a minimum distance of 6" from parallel runs of flues, hot
15 water pipes or other sources of heat. Do not install horizontal raceway
16 runs below water and steam piping.
17
18 I. Support riser conduit at each floor level with clamp hangers.
19
20 J. Use of running threads at conduit joints and terminations is prohibited.
21 Where required, use 3-piece union or split couplings.
22
23 K. Complete installation of electrical raceways before starting installation of
24 cables/wires within raceways.
25
26 L. Concealed Conduits:
27
28 1. Metallic raceways installed underground or in floors below grade, or
29 outside are to have conduit threads painted with corrosion-inhibiting
30 compound before couplings are assembled. Draw up coupling and
31 conduit sufficiently tight to ensure water tightness.
32
33 2. For floors-on-grade, install conduits under concrete slab.
34
35 3. Install underground conduits a minimum of 24" below finished
36 grade.
37
38 4. All conduits installed below grade or under concrete slab to be
39 minimum of 3/4 inch.
40
41 M. Conduits in Concrete Slab:
42
43 1. Place conduits between bottom reinforcing steel and top reinforcing
44 steel. Place conduits either parallel or at 90° to main reinforcing
45 steel.
46

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2. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.
 3. Conduits crossing in slab must be reviewed for proper cover by engineer.
 4. Embedded conduit diameter is not to exceed one-third (1/3) of slab thickness.
- 10 N. Install conduits as not to damage or run through structural members.
11 Avoid horizontal or cross runs in building partitions or side walls.
12
- 13 O. Exposed Conduits:
14
- 15 1. Install exposed conduits and extensions from concealed conduit
16 systems neatly, parallel with or at right angles to walls of building.
17
 - 18 2. Install exposed conduit work as not to interfere with ceiling inserts,
19 lights or ventilation ducts or outlets.
20
 - 21 3. Support exposed conduits by use of hangers, clamps or clips.
22 Support conduits minimum of 18" on each side of bends and outlet
23 boxes and on spacing not to exceed 6'-0".
24
 - 25 4. Run conduits for outlets on waterproof walls exposed. Set anchors
26 for supporting conduit on waterproof wall in waterproof cement.
27
 - 28 5. Above requirements for exposed conduits also apply to conduits
29 installed in space above hung ceilings and in crawl spaces.
30
 - 31 6. Provide rigid aluminum, heavy wall, threaded type for all exposed
32 and in-wall installations.
33
- 34 P. Non-Metallic Conduits:
35
- 36 1. Make solvent cemented joints in accordance with recommendations
37 of manufacturer.
38
 - 39 2. Install PVC conduits in accordance with NEC and in compliance
40 with local utility practices.
41
- 42 Q. Conduit Fittings:
43
- 44 1. Construct locknuts for securing conduit to metal enclosure with
45 sharp edge for digging into metal and ridged outside circumference
46 for proper fastening.

2. Bushings for terminating conduits smaller than 1” and are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.
3. Install insulated type bushings for terminating conduits 1” and larger. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.
4. Bushing of standard or insulated type to have screw type grounding terminal.
5. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings and plugs to be specifically designed for their particular application.

3.03 FIELD QUALITY CONTROL

- A. General: Mechanically assemble metal enclosures and raceways for conductors to form continuous electrical conductor and connect to electrical boxes, fittings and cabinets as to provide effective electrical continuity and rigid mechanical assembly.
- B. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion-inhibiting compound before assembling.
- C. Install expansion fittings in all raceways wherever structural expansion joints are crossed.
- D. Make changes in direction of raceway run with proper fittings supplied by raceway manufacturer. No field bends of raceway sections will be permitted.
- E. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported.
- F. Use boxes as supplied by raceway manufacturer wherever junction, pull, or device boxes are required. Standard electrical “handy” boxes, etc. shall not be permitted for use with surface raceway installations.
- G. Raceway penetrations of fire-rated walls and/or floors shall be sealed to maintain integrity of construction. All products, materials and methods of installation shall be UL approved and meet NFPA requirements.
- H. Unless otherwise noted on drawings, notified by engineer and/or authorities having jurisdiction, the following materials may be used:

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1. Rock Wool: Minimum four pound cubic foot density; flame spread 15, smoke developed 0, fuel contribution 0 by ASTM 384; minimum melting point 2000°F.
 2. Concrete and masonry are also approved fire stop materials by NFPA 90A.
 3. UL approved products such as Nelson Type CLK Silicon Sealant. Manufacturer's recommendations shall be strictly followed.
- I. Submit complete data on fire-stopping materials and construction methods for review by engineer before proceeding with work.

END OF SECTION

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1 SECTION 16120

2
3 WIRES AND CABLES

4
5 PART 1 – GENERAL

6
7 1.01 RELATED DOCUMENTS

- 8
9 A. Drawings and general provisions of Contract, including General and
10 Supplementary Conditions, Divisions 00 & 01 Specification sections, apply
11 to work of this Section.
12
13 B. This Section is a Division 16 Basic Electrical Materials and Methods
14 section, and is part of each Division 16 section making reference to wires
15 and cables specified herein.
16

17 1.02 DESCRIPTION OF WORK

- 18
19 A. Extent of electrical wire and cable work is indicated by drawings and
20 schedules.
21
22 B. Types of electrical wire, cable, and connectors specified in this Section
23 include the following:
24
25 Copper conductors (copper only conductors)
26 Split-bolt connectors
27 Polaris insulated type lug splice connectors
28
29 C. Applications of electrical wire, cable, and connectors required for project
30 are as follows:
31
32 1. For power distribution circuits
33 2. For motor-branch circuits
34 3. For equipment circuits
35 4. For control circuits
36

37 1.03 QUALITY ASSURANCE

- 38
39 A. Manufacturers: Firms regularly engaged in manufacture of electrical wire
40 and cable products of types, sizes, and ratings required, whose products
41 have been in satisfactory use in similar service for not less than five years.
42
43 B. Installer's Qualifications: Firm with at least three years of successful
44 installation experience with projects utilizing electrical wiring and cabling
45 work similar to that required for this project.
46

- 1 C. NEC Compliance: Comply with NEC requirements as applicable to
2 construction, installation, and color-coding of electrical wires and cables.
3
4 D. IEEE Compliance: Comply with applicable requirements of IEEE Stds. 82,
5 "Test Procedures for Impulse Voltage Tests on Insulated Conductors",
6 and Std. 241, "IEEE Recommended Practice for Electric Power Systems
7 in Commercial Buildings" pertaining to wiring systems.
8
9 E. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2,
10 3, 8 and D-753. Provide copper conductors with conductivity of not less
11 than 98% at 20°C (68°F).
12
13 F. The following systems of color-coding shall be strictly adhered to:
14 Isolated Grounded Leads Green and Yellow
15 Grounded Leads Green
16 Grounded Neutral Leads White
17
18 277/480 Volt, Ungrounded Phase Wires (Brown, Orange and Yellow)
19 120/208 Volt, Ungrounded Phase Wires (Red, Blue, Black)
20
21 G. The color code assigned to each phase wire shall be consistently followed
22 throughout.
23
24 H. Where existing base building color-coding differs from color-coding
25 assigned herein. Contractor shall use existing color coding as required to
26 maintain consistency. Advise engineer in writing of color-coding to be
27 used.
28
29 I. All conductors (power and controls) shall be labeled at all termination
30 locations, pull boxes and cabinets and panels. Labels shall include
31 identification of circuit, instrument number, or equipment terminal number;
32 or other means for identifying the equipment/system served.
33

34 1.04 DELIVERY, STORAGE, AND HANDLING
35

- 36 A. Deliver wire and cable properly packaged in factory-fabricated type
37 containers, or wound on NEMA specified type wire and cable reels.
38
39 B. Store wire and cable in clean dry space in original containers. Protect
40 products from weather, damaging fumes, construction debris and traffic.
41
42 C. Handle wire and cable carefully to avoid abrading, puncturing and tearing
43 wire and cable insulation and sheathing. Ensure that dielectric resistance
44 integrity of wires/cables is maintained.
45

1 PART 2 – PRODUCTS

2
3 2.01 BUILDING WIRES

- 4
5 A. All conductors shall be copper and be rated for 600 volt use. Provide
6 factory-fabricated wires of sizes, ampacity ratings, and materials for
7 applications and services indicated.
8
9 B. Conductor insulation shall be dual type THHN/THWN 75°C (167°F) for
10 dry, damp, and wet locations. Conductor insulation with single type
11 marking THHN 90°C (194°F) may be used for above grade and dry
12 locations only.
13

14 PART 3 – EXECUTION

15
16 3.01 INSTALLATION OF WIRES AND CABLES

- 17
18 A. General: Install electrical cables, wires and wiring connectors as
19 indicated, in compliance with applicable requirements of NEC, NEMA, UL,
20 and NECA's "Standard of Installation" and in accordance with recognized
21 industry practices.
22
23 B. Unless otherwise noted, all branch circuit conductors shall be No. 12
24 AWG. Branch circuits over 75 feet in length shall be No. 10 AWG unless
25 noted otherwise.
26
27 C. Install UL Type XHHW wiring in conduit, for feeders and branch circuits.
28
29 D. Pull conductors simultaneously where more than one is being installed in
30 same raceway.
31
32 E. Use pulling compound or lubricant, where necessary. Compound used
33 must not deteriorate conductor or insulation.
34
35 F. Use pulling means including, fish tape, cable, rope, and basket weave
36 wire/cable grips which will not damage cables or raceway.
37
38 G. Keep conductor splices to minimum.
39
40 H. Install splices and tapes which possess equivalent-or-better mechanical
41 strength and insulation ratings than conductors being spliced. Use splices
42 and tap connectors which are compatible with conductor material.
43

44 3.02 FIELD QUALITY CONTROL

45

- 1 A. Prior to energization of circuitry, check installed feeder wires and cables
2 with megohm meter to determine insulation resistance levels to ensure
3 requirements are fulfilled. Readings shall be taken at 30 second, 1
4 minute, and 3 minutes (at a 1 kV) at test voltage applied. A list of feeders
5 tested shall be submitted to the engineer indicating the insulation
6 resistance level for each cable. As a minimum the following feeders shall
7 be tested:
8 • New VFD feeders
9 • Branch circuit conductors in excess of 100 feet
10 • Pump motor feeders
11
12 B. Prior to energization, test wires and cables for electrical continuity and for
13 short-circuits.
14
15 C. Subsequent to wire and cable hook-ups, energize circuitry and
16 demonstrate functioning in accordance with requirements. Where
17 necessary, correct malfunctioning units, and then retest to demonstrate
18 compliance.
19
20
21

END OF SECTION

1 SECTION 16135

2
3 ELECTRICAL BOXES, CONTROL PANELS AND FITTINGS

4
5 PART 1 – GENERAL

6
7 1.01 RELATED DOCUMENTS

- 8
9 A. Drawings and general provisions of Contract, including General and
10 Supplementary Conditions , Divisions 00 & 01 Specification sections,
11 apply to work of this Section.
12
13 B. This Section is a Division 16 Basic Electrical Materials and Methods
14 section, and is a part of each Division 16 section making reference to
15 electrical wiring boxes and fittings specified herein.
16

17 1.02 DESCRIPTION OF WORK

- 18
19 A. Extent of electrical box and associated fitting work is indicated by
20 drawings and schedules.
21
22 B. Types of electrical boxes and fittings specified in this Section include the
23 following:
24 Pump Control Panels
25 Outlet boxes
26 Junction boxes
27 Pull boxes
28

29 1.03 QUALITY ASSURANCE

- 30
31 A. Manufacturers: Firms regularly engaged in the manufacture of electrical
32 boxes and fittings of types, sizes, and capacities required, whose products
33 have been in satisfactory use in similar service for not less than three (3)
34 years.
35
36 B. Installer's Qualifications: Firms with at least three (3) years of successful
37 installation experience on projects utilizing electrical boxes and fittings
38 similar to those required for this project.
39
40 C. NEC Compliance: Comply with NEC as applicable to construction and
41 installation of electrical wiring boxes and fittings.
42
43 D. UL Compliance: Comply with applicable requirements of UL 50, UL 514-
44 Series, and UL 886 pertaining to electrical boxes and fittings. Provide
45 electrical boxes and fittings which are UL listed and labeled.
46

- 1 E. ASTM C857: Comply with applicable requirements for design load
2 capability for concrete pull boxes, covers and supporting members.
3

4 1.04 CODES
5

- 6 A. The work shall be in conformance with the latest adopted version of the
7 following:
8

9 NFPA 70

10 National Electric Code

11 FBC - Florida Building Code
12

- 13 B. The installation shall also comply with all applicable rules and regulations
14 of local and state laws and ordinances. Include in the work, without extra
15 cost, any labor, materials, services, apparatus and drawings required to
16 comply with all applicable laws, ordinances, rules and regulations. Inform
17 the architect of any work or materials which conflict with any of the
18 applicable codes, standards, laws, and regulations before submitting their
19 bid.
20

21 PART 2 – PRODUCTS
22

23 2.01 FABRICATED MATERIALS
24

- 25 A. Outlet Boxes: Provide galvanized coated flat-rolled sheet-steel outlet
26 wiring boxes, of shapes, cubic inch capacities, and sizes (including box
27 depths as indicated), suitable for installation at respective locations.
28 Construct outlet boxes with mounting holes and with cable and conduit-
29 size knockout openings in bottom and sides. Exterior located boxes shall
30 be cast metal boxes with suitable stainless steel gasketed covers, or, if
31 located in a classified hazardous area, NEMA 7 box.
32

- 33 1. Outlet Box Accessories: Provide outlet box accessories as required
34 for each installation; including box supports, mounting ears and
35 brackets, wallboard hangers, box extension rings, fixture studs,
36 cable clamps and metal straps for supporting outlet boxes, which
37 are compatible with outlet boxes being used to fulfill installation
38 requirements for individual wiring situations.
39

- 40 2. Ceiling boxes shall be 4" square or octagonal, 1¹/₈" deep for
41 exposed work or furred ceiling work and 3" deep for concrete work.
42 Plaster rings and/or fixture studs shall be provided where required.
43

- 44 B. Device Boxes: Provide galvanized coated flat-rolled sheet-steel, non-
45 gangable device boxes, of shapes, cubic inch capacities, and sizes
46 (including box depths as indicated), suitable for installation at respective

1 locations. Construct device boxes for flush mounting with mounting holes,
2 and with cable-size knockout openings in bottom and ends and with
3 threaded screw holes in end plates for fastening devices. Provide cable
4 clamps and corrosion-resistant screws for fastening cable clamps and for
5 equipment type grounding. Exterior located boxes shall have suitable
6 stainless steel gasketed covers, or, if located in a classified hazardous
7 area, NEMA 7 box.
8

9 1. Device Box Accessories: Provide device box accessories as
10 required for each installation; including mounting brackets, device
11 box extensions, switch box supports, plaster ears, and plaster
12 board expandable grip fasteners, which are compatible with device
13 boxes being utilized to fulfill installation requirements for individual
14 wiring situations.
15

16 2. Flush mounted wall outlets shall be 4" square boxes or gang
17 boxes, not less than 1½" deep. Boxes shall be provided with
18 extension rings and/or covers with sufficient depth to bring the
19 covers flush with the finished wall.
20

21 3. Boxes for flush mounting in concrete block work with one or two
22 devices shall have covers with square corners on the raised portion
23 of the cover. The covers shall have a sufficient amount of depth to
24 be flush with the face of the block. Covers shall be Steel City 52-C
25 series. Boxes for more than two devices shall be Steel City "GW"
26 gang boxes. The bottom side of the covers or boxes shall be
27 installed at the masonry course nearest to the dimension specified
28 or noted.
29

30 4. Outlet boxes for exposed wall mounting and outdoor installation
31 shall be cast metal type "FS" or "FD" boxes with suitable cast
32 aluminum covers. Weatherproof receptacle covers shall have
33 spring hinged lids.
34

35 C. Rain-Tight Outlet Boxes: Provide corrosion-resistant, cast-metal, rain-tight
36 outlet wiring boxes; of types, shapes and sizes (including depth of boxes),
37 with threaded conduit holes for fastening electrical conduit, stainless steel
38 face plates with spring-hinged watertight caps suitably configured for each
39 application, including face plate gaskets and corrosion-resistant stainless
40 steel plugs and fasteners. All hardware shall be stainless steel.
41

42 D. Junction and Pull Boxes: Provide stainless steel junction and heavy
43 walled PVC pull boxes, with screw-on covers; of types, shapes and sizes,
44 to suit each respective location and installation; with stainless steel nuts,
45 bolts, screws and washers.
46

1 E. In-Grade Pull Box: Provide concrete pull box, minimum of 13 inches wide
2 by 24 inches long, 18 inches deep with cast iron bolted down cover, open
3 bottom. Pull box shall be capable of withstand 8,000 pounds of live load
4 and comply with AASHTO and ASTM C857 design load of 22,568
5 pounds.

6
7 F. Control Panels/Enclosures:

8
9 1. The control panel/enclosures shall contain, as a minimum, devices
10 and equipment indicated on the drawings or other sections of these
11 specifications. All control panel/enclosures shall contain interior
12 mounting plate.

13
14 2. The control panel enclosure shall be NEMA 4X stainless steel (type
15 316), Underwriters Laboratories (UL) 50 type 4 listed.

16
17 3. There shall be permanently affixed to the interior side of the
18 exterior enclosure door both a nameplate and a 10" x 12" pocket
19 for drawing storage. The nameplate shall contain the following
20 information: voltage, phase, date manufactured and intended use
21 – equipment service or function.

22
23 4. Inner safety door (dead front) shall be aluminum.

24 5. Provide surge arrestor per county requirements.

25
26 6. Contractor shall furnish shop drawings for control panel. Include
27 dimension, mounting and material requirements of control panel.
28 Furnish wiring diagrams of all internal components and devices.
29 Schematic diagram of system and PLC connection diagrams and
30 data sheet and programming functions. Furnish operating and
31 maintenance and programming manuals.

32
33 PART 3 - EXECUTION

34
35 3.01 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

36
37 A. General: Install electrical boxes and fittings as indicated, in accordance
38 with manufacturer's written instructions, applicable requirements of NEC,
39 and in accordance with recognized industry practices to fulfill project
40 requirements.

41
42 B. Coordinate installation of electrical boxes and fittings with wire/cable,
43 wiring devices, and raceway installation work.

44
45 C. Provide weather-tight outlets for interior and exterior locations exposed to

1 weather or moisture.
2

3 D. Provide knockout closures to cap unused knockout holes where blanks
4 have been removed.
5

6 E. Install electrical boxes in those locations which ensure ready accessibility
7 to enclosed electrical wiring. All existing and new junction boxes within
8 the project area shall be made accessible. Relocate existing junction
9 boxes as required to comply with the NEC.
10

11 F. Metallic and approved nonmetallic electrical outlet boxes may be installed
12 in vertical fire resistive assemblies classified as 2-hour or less without
13 affecting the fire classification, provided such openings occur on one side
14 only in each framing space and that openings do not exceed 16 square
15 inches. Boxes located opposite sides of walls or partitions shall be
16 separated by a horizontal distance of 24".
17

18 G. In openings larger than 16 square inches, the wall shall be built around
19 openings so as not to interfere with the integrity of the wall rating.
20

21 H. All clearances between such boxes and the gypsum board shall be
22 completely filled with joint compound or other approved material.
23

24 I. Position recessed outlet boxes accurately to allow for surface finish
25 thickness.
26

27 J. Fasten electrical boxes firmly and rigidly to substrates, or structural
28 surfaces to which attached, or solidly embed electrical boxes in concrete
29 or masonry.
30

31 K. Subsequent to installation of boxes, protect boxes from construction
32 debris and damage.
33

34 L. For in grade concrete pull boxes; excavate approximately 6 inches deeper
35 than the overall height of the pull box. The length and width of the
36 excavation shall be determined by adding 4 to 6 inches to the overall
37 length and width of the pull box. Place approximately 6 inches of
38 compacted fine gravel; level compacted gravel so that the top of the pull
39 box is flush with finished grade. Place fine sand backfill into the
40 excavation and compact the material.
41

42
43
END OF SECTION

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1 SECTION 16142

2
3 ELECTRICAL CONNECTIONS FOR EQUIPMENT

4
5 PART 1 – GENERAL

6
7 1.01 RELATED DOCUMENTS

- 8
9 A. Drawings and general provisions of Contract, including General and
10 Supplementary Conditions, Divisions 00 & 01 Specification sections, apply
11 to work of this Section.
12
13 B. This Section is a Division 16 Basic Electrical Materials and Methods
14 section, and is part of each Division 16 section making reference to
15 electrical connections for equipment specified herein.
16

17 1.02 DESCRIPTION OF WORK

- 18
19 A. Extent of electrical connections for equipment is indicated by drawings
20 and schedules. Electrical connections are hereby defined to include
21 connections used for providing electrical power to equipment.
22
23 B. Electrical connections for equipment, not furnished as integral part of
24 equipment, are specified in other Division 16 sections, and are work of
25 this Section.
26
27 C. Motor starters and controllers not furnished as integral part of equipment
28 are specified in applicable Division 16 sections and are work of this
29 Section.
30
31 D. Junction boxes and disconnect switches required for connecting motors
32 and other electrical units of equipment are specified in applicable Division
33 16 sections, and are work of this Section.
34
35 E. Electrical identification for wire/cable conductors is specified in Division 16
36 section, "Electrical Identification", and is work of this Section.
37
38 F. Raceways and wires/cables required for connecting motors and other
39 electrical units of equipment are specified in applicable Division 16
40 sections, and are work of this Section.
41

42 1.03 QUALITY ASSURANCE

- 43
44 A. Manufacturers: Firms regularly engaged in manufacture of electrical
45 connectors and terminals, of types and ratings required, and ancillary

1 connection materials, including electrical insulating tape, soldering fluxes,
2 and cable ties; whose products have been in satisfactory use in similar
3 service for not less than five (5) years.
4

5 B. Installer's Qualifications: Firms with at least two (2) years of successful
6 installation experience with projects utilizing electrical connections for
7 equipment similar to that required for this project.
8

9 C. NEC Compliance: Comply with applicable requirements of NEC as to
10 type products used and installation of electrical power connections
11 (terminals and splices) for junction boxes, motor starters, and disconnect
12 switches.
13

14 D. UL Compliance: Comply with UL Std 486A, "Wire Connectors and
15 Soldering Lugs for Use With Copper Conductors" including, but not limited
16 to, tightening of electrical connectors to torque values indicated. Provide
17 electrical connection products and materials which are UL listed and
18 labeled.
19

20 PART 2 – PRODUCTS

21 2.01 MATERIALS AND COMPONENTS

22 A. General: For each electrical connection indicated, provide complete
23 assembly of materials; including, but not necessarily limited to, pressure
24 connectors, terminals (lugs), electrical insulating tape, cable ties,
25 solderless wirenuts, and other items and accessories as needed to
26 complete splices and terminations of types indicated.
27
28

29 B. Conduit and Fittings, General: Provide PVC conduit and fittings of types,
30 grades, sizes and weights (minimum sch 80 for above grade installation)
31 indicated for each type service. Where types and grades are not
32 indicated, provide proper selection as determined by installer to fulfill
33 wiring requirements and comply with NEC requirements for raceways.
34 Provide products complying with Division 16 Basic Electrical Materials and
35 Methods section "Raceways", and in accordance with the following listing
36 of metal conduit, tubing and fittings:
37

38 PVC Schedule 80 for underground installation
39

40 C. Wires, Cables, and Connectors:
41

42 1. General: Provide wires, cables, and connectors complying with
43 Division 16 Basic Electrical Materials And Methods section "Wires
44 and Cables".
45

1
2 2. Wires/Cables: Unless otherwise indicated, provide wires/cables
3 (conductors) for electrical connections which match (including sizes
4 and ratings) wires/cables which are supplying electrical power.
5 Provide copper conductors with conductivity of not less than 98% at
6 20°C (68°F).
7

8 D. Connectors and Terminals: Provide electrical connectors and terminals
9 which mate and match (including sizes and ratings) with equipment
10 terminals, and are recommended by equipment manufacturer for intended
11 applications. All conductor connections shall be made with terminal lugs,
12 #PSR type, as manufactured by Polaris; or equal.
13

14 PART 3 – EXECUTION

15 3.01 OBSERVATION

16
17
18 A. Observe area and conditions under which electrical connections for
19 equipment are to be installed and notify contractor in writing of conditions
20 detrimental to proper completion of the work. Do not proceed with the
21 work until unsatisfactory conditions have been corrected in a manner
22 acceptable to installer.
23

24 3.02 INSTALLATION OF ELECTRICAL CONNECTIONS

25
26 A. Install electrical connections as indicated; in accordance with equipment
27 manufacturer's written instructions, with recognized industry practices, and
28 complying with applicable requirements of UL and NEC to ensure that
29 products fulfill requirements.
30

31 B. Coordinate with other work, including wires/cables, raceway, and
32 equipment installation as necessary to properly interface installation of
33 electrical connections for equipment with other work.
34

35 C. Connect electrical power supply conductors to equipment conductors in
36 accordance with equipment manufacturer's written instructions and wiring
37 diagrams. Mate and match conductors of electrical connections for proper
38 interface between electrical power supplies and installed equipment.
39

40 D. Maintain existing electrical service and feeders to occupied areas and
41 operational facilities unless otherwise indicated, or when authorized
42 otherwise in writing by owner or architect/engineer. Provide temporary
43 service during interruptions to existing facilities. When necessary,
44 schedule momentary outages for replacing existing wiring systems with

1 new wiring systems. When that "cutting-over" has been successfully
2 accomplished, remove, relocate, or abandon existing wiring as indicated.

3
4 E. Cover splices with electrical insulating material equivalent to, or of greater
5 insulation resistivity rating, than electrical insulation rating of those
6 conductors being spliced.

7
8 F. Prepare cables and wires by cutting and stripping covering armor, jacket,
9 and insulation properly to ensure uniform and neat appearance where
10 cables and wires are terminated. Exercise care to avoid cutting through
11 tapes which will remain on conductors. Also avoid "ringing" copper
12 conductors while skinning wire.

13
14 G. Trim cables and wires as short as practicable and arrange routing to
15 facilitate inspection, testing, and maintenance.

16
17 H. Provide flexible conduit for motor connections and other electrical
18 equipment connections where subject to movement and vibration.

19
20 I. Provide liquid-tight flexible conduit for connection of motors and other
21 electrical equipment where subject to movement and vibration; and also
22 where connections are subjected to one or more of the following
23 conditions:

- 24
25 1. Exterior location.
26 2. Moist or humid atmosphere where condensate can be expected to
27 accumulate.
28 3. Corrosive atmosphere.
29 4. Water spray.
30 5. Dripping oil, grease, or water.

31
32 3.03 FIELD QUALITY CONTROL

33
34 A. Upon completion of installation of electrical connections, and after circuitry
35 has been energized with rated power source, test connections to
36 demonstrate capability and compliance with requirements. Ensure that
37 direction of rotation of each motor fulfills requirement. Correct
38 malfunctioning units at site, then retest to demonstrate compliance.

39
40 3.04 INSTALLATION OF WIRING DEVICES

41
42 A. Install wiring devices as indicated, in accordance with manufacturer's
43 written instructions, applicable requirements of NEC, NECA's "Standard of
44 Installation", and in accordance with recognized industry practices to fulfill
45 project requirements.

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- B. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.
- C. Install wiring devices after wiring work is completed.
- D. Install wallplates after painting work is completed.

3.05 PROTECTION OF WALLPLATES AND RECEPTACLES

- A. Upon installation of wallplates and receptacles, advise contractor regarding proper and cautious use of convenience outlets. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.06 GROUNDING

- A. Provide equipment grounding connections for all wiring devices, unless otherwise indicated.

3.07 TESTING

- A. Prior to energizing circuitry, test wiring for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

END OF SECTION

1 SECTION 16143

2
3 WIRING DEVICES

4
5 PART 1 – GENERAL

6
7 1.01 RELATED DOCUMENTS

- 8
9 A. Drawings and general provisions of Contract, including General and
10 Supplementary Conditions, Divisions 00 & 01 Specification sections, apply
11 to work of this Section.
12
13 B. This Section is a Division 16 Basic Electrical Materials and Methods
14 section, and is part of each Division 16 section making reference to wiring
15 devices specified herein.
16

17 1.02 DESCRIPTION OF WORK

- 18
19 A. The extent of wiring device work is indicated by drawings and schedules.
20 Wiring devices are defined as single discrete units of electrical distribution
21 systems which are intended to carry but not utilize electric energy.
22
23 B. Types of electrical wiring devices in this section include the following:

24
25 Receptacles
26 Ground-fault circuit interrupters
27 Wallplates
28 Switches
29

30 1.03 QUALITY ASSURANCE

- 31
32 A. Manufacturers: Firms regularly engaged in manufacture of electrical
33 wiring devices, of types, sizes, and ratings required, whose products have
34 been in satisfactory use in similar service for not less than three (3) years.
35
36 B. Installer's Qualifications: Firm with at least two (2) years of successful
37 installation experience on projects utilizing wiring devices similar to those
38 required for this project.
39
40 C. NEC Compliance: Comply with NEC as applicable to installation and
41 wiring of electrical wiring devices.
42
43 D. UL Compliance: Provide wiring devices which are UL listed and labeled.
44

45 1.04 SUBMITTALS

- 1 A. Product Data: Submit manufacturer's data on electrical wiring devices per
2 Section 01300.

3
4 PART 2 – PRODUCTS

5
6 2.01 ACCEPTABLE MANUFACTURERS

- 7
8 A. Manufacturers: Subject to compliance with requirements, manufacturers
9 providing wiring devices which may be incorporated in the work include;
10 but are not limited to, the following (for each type and rating of wiring
11 device):

12
13 Arrow-Hart, Cooper Industries
14 Harvey Hubbell Inc.
15 Pass and Seymour Inc.

16
17 2.02 FABRICATED WIRING DEVICES:

- 18
19 A. General: Provide factory-fabricated wiring devices, in types, colors, and
20 electrical ratings for applications indicated and which comply with NEMA
21 Stds. Pub/No. WD1. Provide ivory color devices except as otherwise
22 indicated.

- 23
24 B. Receptacles:

- 25
26 1. Duplex receptacles for 20 ampere, 120 volt service shall be two-
27 pole, three-wire receptacles, rated 20 amperes at 125 volts.
28 Receptacles shall be Harvey Hubbell, Inc., Catalog No. 5362-I.
29
30 2. Single receptacles for 20 amps, 120 volts service shall be two-pole,
31 three-wire rated 20 amperes at 125 volts. Receptacles shall be
32 Harvey Hubbell Inc., Catalog No. 5361-I.
33

34 2.03 WIRING DEVICE ACCESSORIES

- 35
36 A. 'In Use' covers for receptacles.

- 37
38 B. Weatherproof caps for switches.
39

40 PART 3 – EXECUTION

41
42 3.01 INSTALLATION OF WIRING DEVICES

- 43
44 A. Install wiring devices as indicated, in accordance with manufacturer's
45 written instructions, applicable requirements of NEC, NECA's "Standard of

1 Installation", and in accordance with recognized industry practices to fulfill
2 project requirements.

3
4 B. Install wiring devices only in electrical boxes which are clean; free from
5 excess building materials, dirt, and debris.

6
7 C. Install wiring devices after wiring work is completed.

8
9 D. Install wallplates after painting work is completed.

10
11 3.02 PROTECTION OF WALLPLATES AND RECEPTACLES

12
13 A. Upon installation of wallplates and receptacles, advise contractor
14 regarding proper and cautious use of convenience outlets. At time of
15 substantial completion, replace those items which have been damaged,
16 including those burned and scored by faulty plugs.

17
18 3.03 GROUNDING

19
20 A. Provide equipment grounding connections for all wiring devices, unless
21 otherwise indicated.

22
23 3.04 TESTING

24
25 A. Prior to energizing circuitry, test wiring for electrical continuity and for
26 short-circuits. Ensure proper polarity of connections is maintained.
27 Subsequent to energization, test wiring devices to demonstrate
28 compliance with requirements.

29
30
31 END OF SECTION
32

1 SECTION 16170

2
3 CIRCUIT AND MOTOR DISCONNECTS

4
5 PART 1 - GENERAL

6
7 1.01 RELATED DOCUMENTS:

- 8
9 A. Drawings and general provisions of Contract, including General and
10 Supplementary Conditions and Division 1 Specification sections, apply to
11 work of this Section.
12
13 B. This Section is a Division 16 Basic Electrical Materials and Methods
14 section, and is part of each Division 16 section making reference to circuit
15 and motor disconnects specified herein.
16

17 1.02 DESCRIPTION OF WORK:

- 18
19 A. Extent of circuit and motor disconnect switch work is indicated on
20 drawings and schedules.
21
22 B. Types of circuit and motor disconnect switches in this Section include the
23 following:
24
25 Equipment disconnects.
26 Appliance disconnects.
27 Motor-circuit disconnects.
28
29 C. Wires/cables, raceways, and electrical boxes and fittings required in
30 connection with circuit and motor disconnect work are specified in other
31 Division 16 Basic Electrical Materials and Methods sections.
32

33 1.03 QUALITY ASSURANCE:

- 34
35 A. Manufacturers: Firms regularly engaged in manufacture of circuit and
36 motor disconnect switches of types and capacities required, whose
37 products have been in satisfactory use in similar service for not less than
38 three (3) years.
39
40 B. Installer's Qualifications: Firm with at least three (3) years of successful
41 installation experience with projects utilizing circuit and motor disconnect
42 work similar to that required for this project.
43
44 C. NEC Compliance: Comply with NEC requirements pertaining to
45 construction and installation of electrical circuit and motor disconnect
46 devices.

- 1 D. UL Compliance: Comply with requirements of UL 98, "Enclosed and
2 Dead-Front Switches." Provide circuit and motor disconnect switches
3 which have been UL listed and labeled.
4
- 5 E. NEMA Compliance: Comply with applicable requirements of NEMA Stds.
6 Pub No. KS 1, "Enclosed Switches" and 250, "Enclosures for Electrical
7 Equipment (1000 Volts Maximum)."
8

9 1.04 SUBMITTALS:
10

- 11 A. Product Data: Submit manufacturer's data on circuit and motor
12 disconnect switches.
13
- 14 B. Submit shop drawings in booklet form with separate sheet for each circuit
15 and motor disconnect with proposed switch and accessories clearly
16 identified on each sheet. Identify each device with corresponding names,
17 abbreviations (numbers and lettering) to match terminology of contract
18 documents.
19

20 PART 2 - PRODUCTS
21

22 2.01 ACCEPTABLE MANUFACTURERS:
23

- 24 A. Available Manufacturers: Subject to compliance with requirements,
25 manufacturers offering circuit and motor disconnects which may be
26 incorporated in the work are limited to:
27

28 Square D Company.
29 Westinghouse/Cutler-Hammer
30 General Electric Co.
31

32 2.02 FABRICATED SWITCHES:
33

- 34 A. Heavy-Duty Safety Switches: Provide surface-mounted, heavy-duty type,
35 NEMA 4X stainless steel enclosed safety switches, of types, sizes and
36 electrical characteristics indicated; incorporating quick-make, quick-break
37 type switches. Construct so that switch blades are visible in OFF position
38 with door open. Equip with operating handle which is integral part of
39 enclosure base and whose operating position is easily recognizable, and
40 is padlockable in OFF position. Construct current carrying parts of high-
41 conductivity copper, with silver-tungsten type switch contacts.
42
43
44
45
46

1 PART 3 - EXECUTION

2
3 3.01 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECT SWITCHES:

- 4
5 A. Install circuit and motor disconnect switches as indicated, complying with
6 manufacturer's written instructions, applicable requirements of NEC,
7 NEMA, NECA's "Standard of Installation", and in accordance with
8 recognized industry practices.
9
10 B. Install disconnect switches for use with motor-driven appliances and
11 motors and controllers within sight of controller position unless otherwise
12 indicated.
13
14 C. Unless otherwise indicated, protective devices shall be mounted with top
15 of cabinet or enclosure 6'-6" above finished floor; shall be properly
16 aligned; and shall be adequately supported independently of the
17 connecting raceways and other equipment. All steel shapes, etc.,
18 necessary for the support of the equipment shall be furnished and
19 installed where the building structure is not suitable for mounting the
20 equipment directly thereon. Unless otherwise indicated, all branch circuit
21 protective devices enclosures shall be NEMA type I, general purpose
22 type. Branch circuit protective devices installed outdoors or exposed to
23 the weather shall have weatherproof enclosures, NEMA Type 4X.
24

25 3.02 GROUNDING:

- 26
27 A. Provide equipment grounding connections sufficiently tight to assure a
28 permanent and effective ground for electrical disconnect switches where
29 indicated.
30

31 3.03 FIELD QUALITY CONTROL:

- 32
33 A. Subsequent to completion of installation of electrical disconnect switches,
34 energize circuitry and demonstrate capability and compliance with
35 requirements. Where possible, correct malfunctioning units at project site,
36 then retest to demonstrate compliance. Otherwise remove and replace
37 with new units and retest.
38
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41 END OF SECTION 16170
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1 SECTION 16190

2
3 SUPPORTING DEVICES

4
5 PART 1 – GENERAL

6
7 1.01 RELATED DOCUMENTS

- 8
9 A. Drawings and general provisions of Contract, including General and
10 Supplementary Conditions, Divisions 00 & 01 Specification sections, apply
11 to work of this Section.
12
13 B. This Section is a Division 16 Basic Electrical Materials and Methods
14 section, and is a part of each Division 16 section making reference to
15 electrical supporting devices specified herein.
16

17 1.02 DESCRIPTION OF WORK

- 18
19 A. Extent of supports, anchors, sleeves, and seals is indicated by drawings
20 and schedules and/or specified in other Division 16 sections.
21
22 B. Types of supports, anchors, sleeves, and seals specified in this Section
23 include the following:
24 Concrete Posts.
25 Clevis hangers.
26 One-hole conduit straps.
27 Two-hole conduit straps.
28 Round steel rods.
29 Expansion anchors.
30 Toggle bolts.
31 Wall and floor seals.
32 U-Channel Strut.
33 Steel/Aluminum Pipes/Angles.
34
35 C. Supports, anchors, sleeves, and seals furnished as part of factory
36 fabricated equipment are specified as part of that equipment assembly in
37 other Division 16 sections.
38

39 1.03 QUALITY ASSURANCE

- 40
41 A. Manufacturers: Firms regularly engaged in manufacture of supporting
42 devices, of types, sizes, and ratings required, whose products have been
43 in satisfactory use in similar service for not less than three (3) years.
44
45
46

- 1 B. Installer's Qualifications: Firm with at least three (3) years of successful
2 installation experience with projects utilizing electrical supporting device
3 work similar to that required for this project.
4
5 C. NECA Compliance: Comply with National Electrical Contractors
6 Association's "Standard of Installation", pertaining to anchors, fasteners,
7 hangers, supports, and equipment mounting.
8
9 D. UL Compliance: Provide electrical components which are UL listed and
10 labeled.

11
12 1.04 SUBMITTALS

- 13
14 A. Product Data: Submit manufacturer's data on supporting devices,
15 including catalog cuts, specifications, and installation instructions for each
16 type of support, anchor, sleeve, and seal per Section 01300.
17

18 PART 2 – PRODUCTS

19
20 2.01 MANUFACTURED SUPPORTING DEVICES

- 21
22 A. General: Provide stainless steel supporting devices with stainless steel
23 hardware which comply with manufacturer's standard materials, design
24 and construction, in accordance with published product information and as
25 required for complete installation and as herein specified. Where more
26 than one type of supporting device meets indicated requirements,
27 selection is installer's option.
28
29 B. Supports (Interior locations): Provide supporting devices of types, sizes,
30 and materials indicated and having the following construction features:
31
32 1. Clevis Hangers: For supporting conduit; stainless steel with ½"
33 diameter hole for round steel rod, approximately 54 pounds per 100
34 units.
35
36 2. Reducing Couplings: A stainless steel rod reducing coupling, ½" by
37 5/8", approximately 16 pounds per hundred 100 units.
38
39 3. One-Hole Conduit Straps: For supporting conduit; stainless steel.
40
41 4. Two-Hole Conduit Straps: For supporting conduit; stainless steel.
42
43 5. Hexagon Nuts: For ½" rod size, stainless steel.
44
45 6. Round rod: ½" diameter, stainless steel.
46

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- 7. Offset Conduit Clamps: For supporting 2" rigid metal conduit; stainless steel.
 - C. Anchors: Provide anchors of types, sizes, and materials indicated with the following construction features: (all stainless steel)
 - 1. Expansion Anchors: ½".
 - 2. Toggle Bolts: Springhead, 3/16" by 4".
 - D. Sleeves and Seals: Provide sleeves and seals (all as manufactured by 3M), of types, sizes and materials indicated, with the following construction features:
 - 1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated, suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with PVC sleeves, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws. Seals shall be fire-rated where required.
 - E. U-Channel Strut Systems for exterior locations: Provide U-channel strut system for supporting electrical equipment on walls or from ceilings. All materials shall be stainless steel of types and sizes required. Construct with 3/16" diameter holes, 8" O.C. on top surface, and with the following fittings which mate and match with U-channel:
 - Channel hangers.
 - End caps.
 - Beam clamps.
 - Wiring studs.
 - Rigid conduit clamps.
 - Conduit hangers.

35 2.02 FABRICATED SUPPORTING DEVICES

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46
- A. Pipe Sleeves: Provide pipe sleeves of PVC Pipe: Fabricate from schedule 40 PVC pipe. Remove burrs.
 - B. Sleeve Seals: Provide sleeves for piping which penetrate foundation walls below grade or exterior walls. Caulk between sleeve and pipe with nontoxic, UL classified caulking material to ensure watertight seal. Seals shall be fire-rated where required.
 - C. Stainless steel pipe, 6061-TS, Schedule 40, Plates, angles and struts. Stainless steel bolts, washers and nuts shall be used to fasten stainless

1 steel supports. See drawings for details.

2
3 PART 3 – EXECUTION

4
5 3.01 INSTALLATION OF SUPPORTING DEVICES

- 6
7 A. Install hangers, anchors, sleeves, and seals as indicated, in accordance
8 with manufacturer's written instructions and with recognized industry
9 practices to insure supporting devices comply with requirements. Comply
10 with requirements of NECA and NEC for installation of supporting devices.
11
12 B. Coordinate with other electrical work, including raceway and wiring work,
13 as necessary to interface installation of supporting devices with other
14 work.
15
16 C. Install hangers, supports and attachments to support piping properly from
17 building structure. Arrange for grouping of parallel runs of horizontal
18 conduits to be supported together on trapeze type hangers where
19 possible. Install supports with spacing indicated and in compliance with
20 NEC requirements.
21

22
23 END OF SECTION

1 SECTION 16195

2
3 ELECTRICAL IDENTIFICATION

4
5 PART 1 – GENERAL

6
7 1.01 RELATED DOCUMENTS

- 8
9 A. Drawings and general provisions of Contract, including General and
10 Supplementary Conditions and Division 1 Specification sections, apply to
11 work of this Section.
12
13 B. This Section is a Division 16 Basic Electrical Materials and Methods
14 section, and is part of each Division 16 section making reference to
15 electrical identification specified herein.
16

17 1.02 DESCRIPTION OF WORK

- 18
19 A. Extent of electrical identification work is indicated by drawings and
20 schedules.
21
22 B. Types of electrical identification work specified in this Section include the
23 following:
24
25 Equipment/panels/boxes/conduit//system identification signs.
26

27 PART 2 – PRODUCTS

28
29 2.01 ELECTRICAL IDENTIFICATION MATERIALS

- 30
31 A. Engraved Plastic-Laminate Signs
32
33 1. General: Provide engraving stock melamine plastic laminate in
34 sizes and thicknesses indicated, engraved with engraver's standard
35 letter style of sizes and wording indicated; black face and white
36 core plies (letter color) except as otherwise indicated, punched for
37 mechanical fastening.
38
39 2. Signs shall be black face with white core plies (letter color).
40
41 a. Thickness: $1/16$ ", except as otherwise indicated.
42
43 b. Fasteners: Self-tapping stainless-steel screws, except
44 contact-type permanent adhesive where screws cannot, or
45 should not, penetrate substrate. Screens shall be sealed
46 with high temperature RTV sealant.
47
c. Nameplates shall be furnished and installed for VFDs,

1 Terminal Boxes, power panels, control panels, PLC
2 cabinets, equipment disconnect switches and pull boxes.
3

4 2.02 LETTERING AND GRAPHICS
5

- 6 A. General: Coordinate names, abbreviations, and other designations used
7 in electrical identification work with corresponding designations shown,
8 specified, or scheduled. Provide numbers, lettering and wording as
9 indicated or, if not otherwise indicated, as recommended by manufacturer
10 or as required for proper identification and operation/maintenance of
11 electrical systems and equipment.
12

13 PART 3 – EXECUTION
14

15 3.01 APPLICATION AND INSTALLATION
16

17 A. General Installation Requirements
18

- 19 1. Install electrical identification products as indicated, in accordance
20 with manufacturer's written instructions and requirements of NEC.
21
22 2. Coordination: Where identification is to be applied to surfaces
23 which require finish, install identification after completion of
24 painting.
25
26 3. Regulations: Comply with governing regulations and requests of
27 governing authorities for identification of electrical work.
28

29 B. Equipment/System Identification
30

- 31 1. General: Install engraved plastic-laminate sign on each major unit
32 of electrical equipment in building; including central or master unit
33 of each electrical system including communication/ control/signal
34 systems, unless unit is specified with its own self-explanatory
35 identification or signal system. Provide text matching terminology
36 and numbering of the contract documents and shop drawings.
37 Provide signs for each unit of the following categories of electrical
38 work:
39
40 a. Electrical cabinets and enclosures.
41 b. Access panels/doors to electrical facilities.
42 c. Disconnect switches, motor starters, contactors, including
43 current origination.
44
45 2. Install signs at locations indicated or, where not otherwise
46 indicated, at location for best convenience of viewing without

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interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not, or cannot, penetrate substrate.

3. Emergency Systems: Where the grounded circuit conductor from an emergency source is connected to a grounding electrode conductor anywhere except at the source, install an engraved plastic-laminate sign stating "WARNING: STANDBY AND NORMAL POWER SYSTEMS BOTH GROUNDED AT THIS LOCATION". Install at the location of the remote grounding connection.

END OF SECTION

1
2

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1 SECTION 16452

2
3 GROUNDING

4
5 PART 1 – GENERAL

6
7 1.01 RELATED DOCUMENTS

- 8
9 A. Drawings and general provisions of Contract, including General and
10 Supplementary Conditions, Divisions 00 & 01 Specification sections, apply
11 to work of this Section.
12
13 B. This Section is a Division 16 Basic Materials and Methods section, and is
14 part of each Division 16 Section making reference to grounding specified
15 herein.
16

17 1.02 SUMMARY

- 18
19 A. The extent of electrical grounding and bonding work is indicated by
20 drawings and schedules, and as specified herein. Grounding and bonding
21 work is defined to encompass systems, circuits, and equipment. All new
22 grounding electrodes (rods) and new ground conductors shall be bonded
23 to the existing grounding grid at four locations, minimum. All new control
24 panels, electrical panels and cabinets shall be grounded with new ground
25 rods and shall also be bonded to the existing grounding grid. All new
26 connections to the existing grounding grid shall be made by exothermic
27 weld process. Contractor shall obtain approval the grounding connections
28 from owner before installation. Contractor shall furnish and install one
29 grounding test station at each control panel. Test station shall include in
30 grade box with removable lid to exposed top of ground rod and grounding
31 conductor; all connections in test station shall be mechanical type – not
32 exothermic weld.
33
34 B. The type of electrical grounding and bonding work specified in this Section
35 includes the following:
36
37 Solidly grounded system.
38
39 C. Applications of electrical grounding and bonding work in this Section
40 include the following:
41
42 Electrical power systems.
43 Grounding electrodes.
44 Separately derived systems.
45 Raceways.
46 Enclosures/Control Panels/PLC.

1 Equipment.

- 2
3 D. Refer to other Division 16 sections for wires/cables, electrical raceways,
4 boxes and fittings, and wiring devices which are required in conjunction
5 with electrical grounding and bonding work; not work of this section.
6

7 1.03 SUBMITTALS

- 8
9 A. Product Data: Submit manufacturer's data on grounding and bonding
10 products (Ground rods, connectors, clamps, exothermic welds and
11 grounding conductors) and associated accessories per Section 01300.
12

13 1.04 QUALITY ASSURANCE

- 14
15 A. Manufacturer's Qualifications: Firms regularly engaged in the
16 manufacture of grounding and bonding products, of types and ratings
17 required, and ancillary grounding materials; including stranded cable,
18 copper braid and bus, grounding electrodes and plate electrodes, and
19 bonding jumpers; whose products have been in satisfactory use in similar
20 service for not less than five (5) years.
21

- 22 B. Installer's Qualifications: Firm with at least three (3) years of successful
23 installation experience on projects with electrical grounding work similar to
24 that required for project.
25

- 26 C. Codes and Standards:
27

28 1. Electrical Code Compliance: Comply with applicable local electrical
29 code requirements of the authority having jurisdiction and NEC as
30 applicable to electrical grounding and bonding, pertaining to
31 systems, circuits, and equipment.
32

33 2. UL Compliance: Comply with applicable requirements of UL
34 Standards No.'s 467, "Electrical Grounding and Bonding
35 Equipment", and 869, "Electrical Service Equipment", pertaining to
36 grounding and bonding of systems, circuits, and equipment. In
37 addition, comply with UL Std. 486A, "Wire Connectors and
38 Soldering Lugs for Use with Copper Conductors." Provide
39 grounding and bonding products that are UL listed and labeled for
40 their intended usage.
41

42 PART 2 – PRODUCTS

43
44 2.01 GROUNDING AND BONDING

- 45
46 A. Materials and Components, General: Except as otherwise indicated,
47 provide electrical grounding and bonding systems to all new electrical

1 equipment (power and controls) with assembly of materials, including, but
2 not limited to, cables/wires, connectors, solderless lug terminals,
3 grounding electrodes and plate electrodes, bonding jumper braid, surge
4 arresters, and additional accessories needed for a complete installation.
5 Where more than one type component product meets indicated
6 requirements, selection is installer's option. Where materials or
7 components are not indicated, provide products that comply with NEC and
8 UL, requirements, and with established industry standards for those
9 applications indicated.

- 10
11 B. Conductors: Unless otherwise indicated, provide electrical grounding
12 conductors for grounding system connections that match power supply
13 wiring materials and are sized according to NEC. All conductors shall be
14 copper.
15
16 C. Bonding Plates, Connectors, Terminals and Clamps: Provide copper
17 bonding plates, connectors, terminals, lugs, and clamps as recommended
18 by bonding plate, connector, terminal, and clamp manufacturers for
19 indicated applications.
20
21 D. Ground Electrodes: Solid copper, 5 Ohms, three-quarter inch ($\frac{3}{4}$ "
22 diameter by twenty feet (20').
23

24 PART 3 – EXECUTION

25 26 3.01 EXAMINATION

- 27
28 A. Examine areas and conditions under which electrical grounding and
29 bonding connections are to be made, and notify contractor in writing of
30 conditions detrimental to proper completion of work. Do not proceed with
31 work until unsatisfactory conditions have been corrected in a manner
32 acceptable to installer.
33

34 3.02 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

- 35
36 A. General: Install electrical grounding and bonding systems as indicated, in
37 accordance with manufacturer's instructions; applicable portions of NEC,
38 NECA's "Standard of Installation", and in accordance with recognized
39 industry practices, to ensure that products comply with requirements.
40
41 B. All power, lighting, control circuits shall have a fully sized insulated copper
42 conductor run the entire length of the circuit. The raceway/conduit system
43 shall not be used as a means of the grounding system.
44
45 C. Coordinate with other electrical work as necessary to interface installation
46 of electrical grounding and bonding system work with other work.
47

- 1 D. All raceways with No. 10 or 12 AWG phase conductors for receptacles,
2 lighting fixtures, and similar circuits shall be provided with a parity-sized
3 (same size as phase conductor) green equipment ground conductor.
4 Ground conductor shall be installed in entire raceway system, including
5 wall switches and flexible conduit to light fixtures. Equipment ground
6 conductor sizes for circuits with phase conductors larger than No. 12
7 AWG are indicated on drawings. Ground conductors shall be connected
8 to ground buss in panelboards.
9
- 10 E. Terminate feeder and branch circuit insulated equipment-grounding
11 conductors with grounding lug, bus, or bushing. Conductors looped under
12 screw or bolt heads will not be permitted.
13
- 14 F. All raceways with No. 10 or 12 AWG phase conductors for receptacles,
15 lighting fixtures, and similar circuits shall be provided with a parity-sized
16 green equipment ground conductor. Ground conductor shall be installed
17 in entire raceway system, including wall switches and flexible conduit to
18 light fixtures. Equipment ground conductor sizes for circuits with phase
19 conductors larger than No. 12 AWG are indicated on drawings. Ground
20 conductors shall be connected to ground buss in panelboards.
21
- 22 G. Install clamp-on connectors on clean metal contact surfaces to ensure
23 electrical conductivity and circuit integrity.
24
- 25 H. Provide a grounding bushing and a continuous copper bonding jumper
26 from the bushing to the equipment ground bus in all feeders. The bonding
27 jumper shall be the same size as the equipment ground conductor.
28
- 29 I. Connect together system neutral, service equipment enclosures, exposed
30 noncurrent carrying metal parts of electrical equipment, metal raceway
31 systems, grounding conductor in raceways and cables, receptacle ground
32 connectors, and piping systems.
33

34 3.03 FIELD QUALITY CONTROL 35

- 36 A. Upon completion of new installation of electrical grounding and bonding
37 systems, test ground resistance with ground resistance tester. Where
38 tests show resistance-to-ground is over ten (10) ohms, take appropriate
39 action to reduce resistance to ten (10) ohms or less by driving additional
40 ground rods; then retest to demonstrate compliance.
41
- 42 B. Submit test results (3 copies) to engineer of record. Test results shall
43 include grounding test method used, equipment used (manufacturer and
44 model number) with certification of calibration and data results.
45
46

END OF SECTION

1 SECTION 16480

2
3 MOTORS

4
5 PART 1 – GENERAL

6
7 1.01 DESCRIPTION

8
9 Furnish and install the motors as hereinafter specified and as called for in other
10 sections of these Specifications.

11
12 1.02 QUALIFICATIONS

13
14 Motor shall be sufficient size for the duty to be performed and shall not exceed
15 their full-rated load when the driven equipment is operating at specified capacity.

16
17 1.03 SUBMITTALS

18
19 A. The motor manufacturer shall submit to the Engineer certified dimension
20 prints showing nameplate data and outline dimensions within three weeks
21 of the date they receive the order.

22
23 B. Submit Operation and Maintenance Manual and parts lists as specified in
24 Division 1 PROJECT CLOSEOUT.

25
26 C. Guarantee: All equipment furnished and installed under this Section shall
27 be guaranteed against defects of workmanship, materials and improper
28 installation for a period of eighteen month from date of acceptance. All
29 such equipment or parts proven defective, due to the above noted causes,
30 shall be replaced in the machines by the CONTRACTOR at no expense to
31 the Owner.

32
33 D. Provide equipment warranty in accordance with Division 1.

34
35 PART 2 - PRODUCTS

36
37 2.01 RATING

38
39 A. Unless otherwise noted, all motors shall be of the low voltage type. All
40 motors 2 through 100 horsepower shall be rated 230/460 volt, 3 phase, 60
41 Hertz A.C.; motors 125 horsepower through 300 horsepower shall be
42 rated 460 volt, 3-phase, 60 Hertz, and motors below 2 horsepower shall
43 be rated 115/230 volt, 1 phase, 60 Hertz A.C.

1
2 2.02 THREE PHASE INDUCTION MOTORS
3

- 4 A. Motors 25 HP and larger shall have a 120-volt space heater for moisture
5 control.
6
7 B. Unless specifically noted in other sections of these Specifications, all
8 motors shall have an efficiency as indicated in the table below. Motors
9 shall be "premium efficiency" type.
10

11 TABLE 1
12

Motor HP	Min. Eff.	Max. dba	Motor HP	Min. Eff.	Max. dba
1-2	84.0%	74	25-30	92.0%	92
3-5	86.5%	79	40-50	93.0%	97
7.5-10	90.2%	84	60-75	94.0%	100
15-20	91.0%	89	100	94.1%	102

- 13
14 C. Motors operating with variable frequency drives shall indicate on the
15 nameplate that they are suitable for their intended applications (Inverter
16 duty Rated) and they shall be provided with an integral temperature switch
17 that opens on high temperature. Motors operating with Variable
18 Frequency Drives (VFD's) shall meet the requirements of NEMA MG1
19 Part 31.
20

21 2.03 CONSTRUCTION
22

23 A. General:
24

- 25 1. All dripproof and weather protected Type I motors shall have epoxy
26 encapsulated windings. Totally enclosed motors shall not be
27 encapsulated. Motors not readily available with encapsulated
28 windings may be standard type. Motors exposed to the outside
29 atmosphere shall be totally enclosed fan cooled (TEFC) unless
30 otherwise specified.
31
32 2. Squirrel-cage rotors shall be made from high-grade steel
33 laminations adequately fastened together and to the shaft, or shall
34 be cast aluminum or bar-type construction with brazed end rings.
35

1 B. Low Voltage, Three Phase Motors:
2

- 3 1. Motors shall be of the squirrel-cage induction type, NEMA design
4 B. Horizontal, vertical solid shaft, vertical hollow shaft, normal
5 thrust and high thrust types shall be furnished as specified herein.
6 All motors shall be built in accordance with current NEMA, IEEE,
7 ANSI and AFBMA standards where applicable. Motors shall be of
8 the type and quality described by these Specifications, fully
9 capable of performing in accordance with manufacturer's
10 nameplate rating, and free from defective material and
11 workmanship.
12
- 13 2. Motors shall have normal or high starting torque (as required), low
14 starting current (not to exceed 600 percent full load current), and
15 low slip.
16
- 17 3. Outdoor motors shall be totally enclosed fan-cooled construction
18 with 1.15 service factor unless otherwise noted. Indoor motors
19 shall be ODP unless otherwise noted.
20
- 21 4. Outdoor motors shall be mill and chemical duty suitable for
22 operation in moist air with hydrogen sulphide gas present.
23
- 24 5. The output shaft shall be suitable for direct connection or belt drive
25 as required.
26
- 27 6. Motors shall have a Class B nonhygroscopic insulation system.
28 Class F insulation may be used but shall be limited to Class B
29 temperature rise.
30
- 31 7. All motors shall have a final coating of chemical resistant corrosion
32 and fungus protective epoxy fortified enamel finish sprayed over
33 red primer over all interior and exterior surfaces. Stator bore and
34 rotor of all motors shall be epoxy coated.
35
- 36 8. All fittings, bolts, nuts, and screws shall be 316 stainless steel.
37 Bolts and nuts shall have hex heads.
38
- 39 9. All machine surfaces shall be coated with rust inhibitor for easy
40 disassembly.
41
- 42 10. Conduit boxes shall be gasketed. Lead wires between motor frame
43 and conduit box shall be gasketed.
44
- 45 11. Totally enclosed motors shall be provided with condensate drain
46 hole and epoxy coated motor windings to protect against moisture.

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- 12. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts shall be supplied on all frames 254T and larger. Enclosures will have stainless steel screen and motors shall be protected for corrosion, fungus and insects.

- 13. Low voltage, three phase motors shall be manufactured by General Electric, U.S. Motors, Westinghouse or approved equal.

- 14. Fractional Horsepower:
 - a. Fractional horsepower motors shall be rigid, welded-steel, designed to maintain accurate alignment of motor components and provide adequate protection. End shields shall be reinforced, lightweight die-cast aluminum. Windings shall be of varnish-insulated wire with slot insulation of polyester film, baked-on bonding treatment to make the stator winding strongly resistant to heat, aging, moisture, electrical stresses and other hazards.
 - b. Motor shaft shall be made from high-grade, cold-rolled shaft steel with drive-shaft extensions carefully machined to standard NEMA dimensions for the particular drive connection.
 - c. All motors shall be equipped with vacuum-degassed (sealed) antifricition bearings made to AFBMA Standards, and be of ample capacity for the motor rating. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent lubrication, but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight, running fits or rotating seals to protect against the entrance of foreign matter into the bearings, or leakage of lubricant out of the bearing cavity.

- 15. Integral Horsepower:
 - a. Motor frames and end shields shall be cast iron or heavy fabricated steel of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type of enclosure employed.
 - b. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations.
 - c. The shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of the particular rating. Bearing journals shall be ground and polished.

- 1 d. Rotors shall be made from high-grade steel laminations
2 adequately fastened together, and to the shaft. Rotor
3 squirrel-cage windings may be copper or bar-type
4 construction with brazed end rings.
5 e. All motors shall be equipped with vacuum-degassed
6 (sealed) antifriction bearings made to AFBMA Standards,
7 and be of ample capacity for the motor rating. The bearing
8 housing shall be large enough to hold sufficient lubricant to
9 minimize the need for frequent lubrication, but facilities shall
10 be provided for adding new lubricant and draining out old
11 lubricant without motor disassembly. The bearing housing
12 shall have long, tight, running fits or rotating seals to protect
13 against the entrance of foreign matter into the bearings, or
14 leakage of lubricant out of the bearing cavity.
15 f. Bearings of high thrust motors will be locked for momentary
16 up thrust of 30% down thrust. All bearings shall have a
17 minimum B10 life rating of 100,000 hours in accordance with
18 AFBMA life and thrust values.
19 g. Vertical hollow-shaft motors will have nonreverse ratchets to
20 prevent backspin.
21

22 C. Low Voltage, Single Phase Motors:
23

- 24 1. Single phase motors shall be split-phase and capacitor-start
25 induction types rated for continuous horsepower at the rpm called
26 for on the Drawings. Motors shall be rated 115/230 volts, 60 Hertz,
27 single phase, open drip proof, or totally enclosed fan cooled as
28 called for on the Drawings, with temperature rise in accordance
29 with NEMA Standards for Class B insulation.
30
31 2. Totally enclosed fan cooled motors shall be designed for
32 severe-duty.
33
34 3. Motors shall have corrosion and fungus protective finish on internal
35 and external surfaces. All fittings shall have a corrosion protective
36 plating.
37
38 4. Mechanical characteristics shall be the same as specified for
39 polyphase fractional horsepower motors.
40

41 PART 3 - EXECUTION
42

43 3.01 INSTALLATION
44

- 45 A. Motor Connections: All motors shall be connected to the conduit system
46 by means of a short section of flexible conduit, 18 inch minimum and 60

1 inches maximum, unless otherwise indicated. For all motor connections,
2 the CONTRACTOR shall install a grounding conductor in the conduit and
3 terminate at the motor control center with an approved grounding clamp.
4

- 5 B. Connection to motor leads shall be compression type with 3M brand heat
6 shrink boot.
7

8 3.02 TESTS AND CHECKS
9

- 10 A. The following tests shall be performed on all motors after installation but
11 before putting motors into service.
12

- 13 1. The CONTRACTOR shall megger each motor winding before
14 energizing the motor, and, if insulation resistance is found to be
15 low, shall notify the Engineer and shall not energize the motor. The
16 CONTRACTOR shall check direction of rotation of all motors and
17 reverse connections if necessary. The following table gives
18 minimum acceptable insulation resistance in megohms at various
19 temperatures and for various voltages with readings being taken
20 after one minute of megger test run.
21

22 TABLE 2
23

Degree Winding Temperature		Voltage		
°F	°C	115V	230V	460V
37	3.9	60	108	210
50	10	32	60	120
68	20	13	26	50
86	30	5.6	11	21
104	45	2.4	4.5	8.8
122	50	1	2	3.7
140	60	.5	.85	1.6

- 24 2. The CONTRACTOR shall check each motor for correct clearances
25 and alignment and for correct lubrication, and shall lubricate if
26 required in accordance with manufacturer's instructions.
27
28

29 END OF SECTION

APPENDIX

FORMS AND OTHER PROJECT DOCUMENTATION

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VERIFICATION OF EMPLOYMENT ELIGIBILITY FORM.....	1
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VERIFICATION OF EMPLOYMENT ELIGIBILITY FORM

PER FLORIDA STATUTE 448.095, CONTRACTORS AND SUBCONTRACTORS MUST REGISTER WITH AND USE THE E-VERIFY SYSTEM TO VERIFY THE WORK AUTHORIZATION STATUS OF ALL NEWLY HIRED EMPLOYEES.

THIS FORM MUST BE COMPLETED AND SUBMITTED WITH THE BID/PROPOSAL. FAILURE TO SUBMIT THIS FORM AS REQUIRED MAY DEEM YOUR SUBMITTAL NONRESPONSIVE.

The affiant, by virtue of the signature below, certifies that:

1. The Contractor and its Subcontractors are aware of the requirements of Florida Statute 448.095.
2. The Contractor and its Subcontractors are registered with and using the E-Verify system to verify the work authorization status of newly hired employees.
3. The Contractor will not enter into a contract with any Subcontractor unless each party to the contract registers with and uses the E-Verify system.
4. The Subcontractor will provide the Contractor with an affidavit stating that the Subcontractor does not employ, contract with, or subcontract with unauthorized alien.
5. The Contractor must maintain a copy of such affidavit.
6. The City may terminate this Contract on the good faith belief that the Contractor or its Subcontractors knowingly violated Florida Statutes 448.09(1) or 448.095(2)(c).
7. If this Contract is terminated pursuant to Florida Statute 448.095(2)(c), the Contractor may not be awarded a public contract for at least 1 year after the date on which this Contract was terminated.
8. The Contractor is liable for any additional cost incurred by the City as a result of the termination of this Contract.

Authorized Signature

Printed Name

Title

Name of Entity/Corporation

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me by means of physical presence or online notarization on, this ____ day of _____, 20____, by _____ (name of person whose signature is being notarized) as the _____ (title) of _____ (name of corporation/entity), personally known _____, or produced _____ (type of identification) as identification, and who did/did not take an oath.

Notary Public

Printed Name

My Commission Expires: _____

NOTARY SEAL ABOVE

SECTION V

CONTRACT DOCUMENTS

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PUBLIC CONSTRUCTION BOND	1
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Bond No.: _____

PUBLIC CONSTRUCTION BOND

(1)

This bond is given to comply with § 255.05, Florida Statutes, and any action instituted by a claimant under this bond for payment must be in accordance with the notice and time limitation provisions in subsections (2) and (10).

Pursuant to § 255.05(1)(b), Florida Statutes, “**Before commencing the work** or before recommencing the work after a default or abandonment, **the contractor shall provide to the public entity a certified copy of the recorded bond.** Notwithstanding the terms of the contract or any other law governing prompt payment for construction services, the public entity may not make a payment to the contractor until the contractor has complied with this paragraph.”

CONTRACTOR

SURETY

OWNER

<u>[name]</u>	<u>[name]</u>	City of Clearwater Engineering 100 S. Myrtle Avenue Clearwater, FL 33756 (727) 562-4750
<u>[principal business address]</u>	<u>[principal business address]</u>	
<u>[phone number]</u>	<u>[phone number]</u>	

PROJECT NAME: East WRF Influent Pump Station Rehabilitation Project
PROJECT NO.: 13-0016-UT

PROJECT DESCRIPTION: The East Water Reclamation Facility Influent Pump Station Rehabilitation Project includes civil, mechanical, electrical, instrumental and controls improvements for the influent pump station, the influent meter assembly and the blower room inside the sludge handling building. The rehabilitated areas include, but not limited to the installation of a bypass manhole, replacements of influent pumps, a influent flow meter, piping, valves and appurtenances. For the influent wet well, a new baffle wall will be installed, as well as a spray cleaning system to break up the oil and grease (FOG) on top of the wastewater. In addition, a new large bubble mixing system will be installed to not only break up the FOG, but also keep solids suspended in the wet well to reduce maintenance requirements. The air compressor unit supplying the air for the large bubble system will be installed inside the blower room at the sludge handling building.

BY THIS BOND, We, _____, as Contractor, and _____, a corporation, as Surety, are bound to the City of Clearwater, Florida, herein called Owner, in the sum of \$[x,xxx,xxx.xx], for payment of which we bind ourselves, our heirs, personal representatives, successors, and assigns, jointly and severally.

THE CONDITION OF THIS BOND is that if Contractor:

1. Performs the contract dated _____, between Contractor and Owner for construction of [project name], the contract documents being made a part of this bond by reference (which include the Advertisement for Bids, Proposal, Contract, Surety Bond, Instructions to Bidders, General Conditions, Plans, Technical Specifications and Appendix, and such alterations as may be made in said Plans and Specifications as therein provided for), at the times and in the manner prescribed in the contract; and
2. Promptly makes payments to all claimants, as defined in Section 255.05(1), Florida Statutes, supplying Contractor with labor, materials, or supplies, used directly or indirectly by Contractor in the prosecution of the work provided for in the contract; and

Bond No.: _____

PUBLIC CONSTRUCTION BOND

(2)

- 3. Pays Owner all losses, damages, expenses, costs, and attorney’s fees, including appellate proceedings, that Owner sustains because of a default by Contractor under the contract; and
- 4. To the limits of § 725.06(2), Florida Statutes, shall indemnify and hold harmless Owner, their officers and employees, from liabilities, damages, losses and costs, including, but not limited to, reasonable attorney’s fees, to the extent caused by the negligence, recklessness, or intentional wrongful misconduct of Contractor and persons employed or utilized by Contractor in the performance of the construction contract; and
- 5. Performs the guarantee of all work and materials furnished under the contract for the time specified in the contract, then this bond is void; otherwise, it remains in full force.
- 6. Any action instituted by a claimant under this bond for payment must be in accordance with the notice and time limitation provisions in Section 255.05(2), Florida Statutes.
- 7. Any changes in or under the contract documents and compliance or noncompliance with any formalities connected with the contract or the changes does not affect Surety’s obligation under this bond, and Surety does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the specifications.

IN TESTIMONY WHEREOF, witness the hands and seals of the parties hereto this _____ day of _____, 20__.

*(If sole Ownership or Partnership, two (2) Witnesses required).
(If Corporation, Secretary only will attest and affix seal).*

[TYPE LEGAL NAME OF CONTRACTOR]

By: _____
Title: _____
Print Name: _____

WITNESS:

Corporate Secretary or Witness
Print Name: _____

(affix corporate seal)

WITNESS:

Print Name: _____

(Corporate Surety)

By: _____
ATTORNEY-IN-FACT
Print Name: _____

(affix corporate seal)

(Power of Attorney must be attached)

CONTRACT

(1)

This **CONTRACT** made and entered into this ___ day of _____, 20__ by and between the City of Clearwater, Florida, a municipal corporation, hereinafter designated as the "City", and _____, of the City of _____ County of _____ and State of Florida, hereinafter designated as the "Contractor".

[Or, if out of state:]

This **CONTRACT** made and entered into this ___ day of _____, 20__ by and between the City of Clearwater, Florida, a municipal corporation, hereinafter designated as the "City", and _____, a/an _____(State) Corporation authorized to do business in the State of Florida, of the City of _____ County of _____ and State of _____, hereinafter designated as the "Contractor".

WITNESSETH:

That the parties to this contract each in consideration of the undertakings, promises and agreements on the part of the other herein contained, do hereby undertake, promise and agree as follows:

The Contractor, and his or its successors, assigns, executors or administrators, in consideration of the sums of money as herein after set forth to be paid by the City and to the Contractor, shall and will at **their** own cost and expense perform all labor, furnish all materials, tools and equipment for the following:

PROJECT NAME: East WRF Influent Pump Station Rehabilitation Project

PROJECT NO.: 13-0016-UT

in the amount of \$_____

In accordance with such proposal and technical supplemental specifications and such other special provisions and drawings, if any, which will be submitted by the City, together with any advertisement, instructions to bidders, general conditions, technical specifications, proposal and bond, which may be hereto attached, and any drawings if any, which may be herein referred to, are hereby made a part of this contract, and all of said work to be performed and completed by the contractor and its successors and assigns shall be fully completed in a good and workmanlike manner to the satisfaction of the City.

If the Contractor should fail to comply with any of the terms, conditions, provisions or stipulations as contained herein within the time specified for completion of the work to be performed by the Contractor, then the City, may at its option, avail itself of any or all remedies provided on its behalf and shall have the right to proceed to complete such work as Contractor is obligated to perform in accordance with the provisions as contained herein.

CONTRACT

(2)

THE CONTRACTOR AND HIS OR ITS SUCCESSORS AND ASSIGNS DOES HEREBY AGREE TO ASSUME THE DEFENSE OF ANY LEGAL ACTION WHICH MAY BE BROUGHT AGAINST THE CITY AS A RESULT OF THE CONTRACTOR'S ACTIVITIES ARISING OUT OF THIS CONTRACT AND FURTHERMORE, IN CONSIDERATION OF THE TERMS, STIPULATIONS AND CONDITIONS AS CONTAINED HEREIN, AGREES TO HOLD THE CITY FREE AND HARMLESS FROM ANY AND ALL CLAIMS FOR DAMAGES, COSTS OF SUITS, JUDGMENTS OR DECREES RESULTING FROM ANY CLAIMS MADE UNDER THIS CONTRACT AGAINST THE CITY OR THE CONTRACTOR OR THE CONTRACTOR'S SUB CONTRACTORS, AGENTS, SERVANTS OR EMPLOYEES RESULTING FROM ACTIVITIES BY THE AFOREMENTIONED CONTRACTOR, SUB CONTRACTOR, AGENT SERVANTS OR EMPLOYEES, TO THE LIMITS OF § 725.06(2).

In addition to the foregoing provisions, the Contractor agrees to conform to the following requirements:

In connection with the performance of work under this contract, the Contractor agrees not to discriminate against any employee or applicant for employment because of race, sex, religion, color, or national origin. The aforesaid provision shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; lay off or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post hereafter in conspicuous places, available for employees or applicants for employment, notices to be provided by the contracting officer setting forth the provisions of the non-discrimination clause.

The Contractor further agrees to insert the foregoing provisions in all contracts hereunder, including contracts or agreements with labor unions and/or worker's representatives, except sub-contractors for standard commercial supplies or raw materials.

It is mutually agreed between the parties hereto that time is of the essence of this contract, and in the event that the work to be performed by the Contractor is not completed within the time stipulated herein, it is then further agreed that the City may deduct from such sums or compensation as may be due to the Contractor the sum of **\$1,000.00 per day** for each day that the work to be performed by the Contractor remains incomplete beyond the time limit specified herein, which sum of **\$1,000.00 per day** shall only and solely represent damages which the City has sustained by reason of the failure of the Contractor to complete the work within the time stipulated, it being further agreed that this sum is not to be construed as a penalty but is only to be construed as liquidated damages for failure of the Contractor to complete and perform all work within the time period as specified in this contract.

It is further mutually agreed between the City and the Contractor that if, any time after the execution of this contract and the public construction bond which is attached hereto for the faithful performance of the terms and conditions as contained herein by the Contractor, that the City shall at any time deem the surety or sureties upon such public construction bond to be unsatisfactory or if, for any reason, the said bond ceases to be adequate in amount to cover the performance of the work the Contractor shall, at his or its own expense, within ten (10) days after receipt of written notice from the City to do so, furnish an additional bond or bonds in such term and amounts and with such surety or sureties as shall be satisfactory to the City. If such an event occurs, no further payment shall be made to the Contractor under the terms and provisions of this contract until such new or additional security bond guaranteeing the faithful performance of the work under the terms hereof shall be completed and furnished to the City in a form satisfactory to it.

CONTRACT

(3)

In addition to all other contract requirements as provided by law, the contractor executing this agreement agrees to comply with public records law.

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, THE CONTRACTORS DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT. CONTACT THE CUSTODIAN OF PUBLIC RECORDS, Rosemarie Call, City Clerk, AT Rosemarie.Call@myclearwater.com, 727-562-4092, 600 Cleveland St. Clearwater, FL 33756.

The contractor's agreement to comply with public records law applies specifically to:

- a) Keep and maintain public records required by the City of Clearwater (hereinafter “public agency”) to perform the service being provided by the contractor hereunder.
- b) Upon request from the public agency’s custodian of public records, provide the public agency with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided for in Chapter 119, Florida Statutes, as may be amended from time to time, or as otherwise provided by law.
- c) Ensure that the public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of the contract if the contractor does not transfer the records to the public agency.
- d) Upon completion of the contract, transfer, at no cost, to the public agency all public records in possession of the contractor or keep and maintain public records required by the public agency to perform the service. If the contractor transfers all public records to the public agency upon completion of the contract, the contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the contractor keeps and maintains public records upon completion of the contract, the contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the public agency, upon request from the public agency’s custodian of public records, in a format that is compatible with the information technology systems of the public agency.
- e) A request to inspect or copy public records relating to a public agency’s contract for services must be made directly to the public agency. If the public agency does not possess the requested records, the public agency shall immediately notify the contractor of the request and the contractor must provide the records to the public agency or allow the records to be inspected or copied within a reasonable time.
- f) The contractor hereby acknowledges and agrees that if the contractor does not comply with the public agency’s request for records, the public agency shall enforce the contract provisions in accordance with the contract.
- g) A contractor who fails to provide the public records to the public agency within a reasonable time may be subject to penalties under Section 119.10, Florida Statutes.
- h) If a civil action is filed against a contractor to compel production of public records relating to a public agency’s contract for services, the court shall assess and award against the contractor the reasonable costs of enforcement, including reasonable attorney fees, if:
 1. The court determines that the contractor unlawfully refused to comply with the public records request within a reasonable time; and

CONTRACT

(4)

- 2. **At least 8 business days before filing the action, the plaintiff provided written notice of the public records request, including a statement that the contractor has not complied with the request, to the public agency and to the contractor.**
- i) **A notice complies with subparagraph (h)2. if it is sent to the public agency’s custodian of public records and to the contractor at the contractor’s address listed on its contract with the public agency or to the contractor’s registered agent. Such notices must be sent by common carrier delivery service or by registered, Global Express Guaranteed, or certified mail, with postage or shipping paid by the sender and with evidence of delivery, which may be in an electronic format.**
- j) **A contractor who complies with a public records request within 8 business days after the notice is sent is not liable for the reasonable costs of enforcement.**

IN WITNESS WHEREOF, the parties to the agreement have hereunto set their hands and seals and have executed this Agreement, the day and year first above written.

**CITY OF CLEARWATER
IN PINELLAS COUNTY, FLORIDA**

By: _____
Jennifer Poirrier
City Manager

(SEAL)

Attest:

Countersigned:

Rosemarie Call
City Clerk

By: _____
Brian J. Aungst Sr.
Mayor

Approved as to form:

Owen Kohler
Assistant City Attorney

Contractor must indicate whether:

_____ Corporation, _____ Partnership, _____ Company, or _____ Individual

(Contractor)

By: _____ (SEAL)
Print Name: _____
Title: _____

The person signing shall, in his own handwriting, sign the Principal's name, his own name, and his title; where the person is signing for a Corporation, he must, by Affidavit, show his authority to bind the Corporation – **provide Affidavit.**

CONSENT OF SURETY TO FINAL PAYMENT

TO OWNER: City of Clearwater PROJECT NAME: East WRF Influent Pump Station
 Rehabilitation Project

Engineering PROJECT NO.: 13-0016-UT

100 S. Myrtle Ave. CONTRACT DATE: [REDACTED]

Clearwater, FL 33756 BOND NO.: [REDACTED], recorded in O.R. Book [REDACTED],
 Page [REDACTED], of the Public Records of Pinellas County, Florida.

CONTRACTOR: [REDACTED]

Pursuant to § 255.05(11), Florida Statutes, and in accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the:

[insert name of Surety]
 [address]
 [address]

,SURETY,

on bond of

[insert name of Contractor]
 [address]
 [address]

,CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve Surety of any of its obligations to

City of Clearwater
 [Dept. owning project]
 100 S. Myrtle Ave.
 Clearwater, FL 33756

,OWNER,

as set forth in said Surety’s bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand this ___ day of _____, _____

(Surety)

(Signature of authorized representative)

(Printed name and title)

Attest:
(Seal):

PROPOSAL/BID BOND

(Not to be filled out if a certified check is submitted)

KNOWN ALL MEN BY THESE PRESENTS: That we, the undersigned, _____
_____ as Contractor, and _____
_____ as Surety, whose address is _____
_____, are held and firmly bound unto the City
of Clearwater, Florida, in the sum of _____ Dollars
(\$_____) (being a minimum of 10% of Contractor's total bid amount) for the payment of which,
well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors,
administrators, successors and assigns.

The condition of the above obligation is such that if the attached Proposal of _____
_____ as Contractor, and _____ as Surety, for
work specified as: _____

_____ all as stipulated in said Proposal, by doing all work incidental thereto, in accordance with the plans and
specifications provided herefor, all within Pinellas County, is accepted and the contract awarded to the
above named bidder, and the said bidder shall within ten days after notice of said award enter into a contract,
in writing, and furnish the required Public Construction Bond with surety or sureties to be approved by the
City Manager, this obligation shall be void, otherwise the same shall be in full force and virtue by law and
the full amount of this Proposal/Bid Bond will be paid to the City as stipulated or liquidated damages.

Principal must indicate whether:
_____ Corporation, _____ Partnership, _____ Company, or _____ Individual

Signed this _____ day of _____, 20____.

Contractor

Principal

By: _____
Title

Surety

The person signing shall, in his own handwriting, sign the Principal's name, his own name, and his title;
where the person is signing for a Corporation, he must, by Affidavit, show his authority to bind the
Corporation – **provide Affidavit.**

AFFIDAVIT

(To be filled in and executed if the bidder is a corporation)

STATE OF FLORIDA _____)

COUNTY OF _____)

_____, being duly sworn, deposes and says that he/she is Secretary of _____ a corporation organized and existing under and by virtue of the laws of the State of Florida, and having its principal office at:

(Street & Number) (City) (County) (State)

Affiant further says that he is familiar with the records, minute books and by-laws of

(Name of Corporation)

Affiant further says that _____ is _____
(Officer's Name) (Title)

of the corporation, is duly authorized to sign the Proposal for _____

or said corporation by virtue of _____
(state whether a provision of by laws or a Resolution of Board of Directors. If by Resolution give date of adoption).

Affiant

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

Notary Public

Type/print/stamp name of Notary

Title or rank, and Serial No., if any

NON-COLLUSION AFFIDAVIT

STATE OF FLORIDA)

COUNTY OF _____)

_____ being, first duly sworn, deposes and says that he is

_____ of _____,
the party making the foregoing Proposal or Bid; that such Bid is genuine and not collusive or sham: that said bidder is not financially interested in or otherwise affiliated in a business way with any other bidder on the same contract; that said bidder has not colluded, conspired, connived, or agreed, directly or indirectly, with any bidders or person, to put in a sham bid or that such other person shall refrain from bidding, and has not in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference, with any person, to fix the bid price or affiant or any other bidder, or to fix any overhead, profit or cost element of said bid price, or that of any other bidder, or to secure any advantage against the City of Clearwater, Florida, or any person or persons interested in the proposed contract; and that all statements contained in said proposal or bid are true; and further, that such bidder has not directly or indirectly submitted this bid, or the contents thereof, or divulged information or data relative thereto to any association or to any member or agent thereof.

Affiant

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

Notary Public

PROPOSAL

(1)

TO THE CITY OF CLEARWATER, FLORIDA, for

EAST WRF INFLUENT PUMP STATION REHABILITATION PROJECT (PROJECT #13-0016-UT)

and doing such other work incidental thereto, all in accordance with the contract documents, marked

EAST WRF INFLUENT PUMP STATION REHABILITATION PROJECT (PROJECT #13-0016-UT)

Every bidder must take notice of the fact that even though his proposal be accepted and the documents signed by the bidder to whom an award is made and by those officials authorized to do so on behalf of the City of Clearwater, Florida, that no such award or signing shall be considered a binding contract without a certificate from the Finance Director that funds are available to cover the cost of the work to be done, or without the approval of the City Attorney as to the form and legality of the contract and all the pertinent documents relating thereto having been approved by said City Attorney; and such bidder is hereby charged with this notice.

The signer of the Proposal, as bidder, also declares that the only person, persons, company or parties interested in this Proposal, are named in this Proposal, that he has carefully examined the Advertisement, Instructions to Bidders, Contract Specifications, Plans, Supplemental Specifications, General Conditions, Special Provisions, and Public Construction Bond, that he or his representative has made such investigation as is necessary to determine the character and extent of the work and he proposes and agrees that if the Proposal be accepted, he will contract with the City of Clearwater, Florida, in the form of contract; hereto annexed, to provide the necessary labor, materials, machinery, equipment, tools or apparatus, do all the work required to complete the contract within the time mentioned in the General Conditions and according to the requirements of the City of Clearwater, Florida, as herein and hereinafter set forth, and furnish the required surety bonds for the following prices to wit:

If the foregoing Proposal shall be accepted by the City of Clearwater, Florida, and the undersigned shall fail to execute a satisfactory contract as stated in the Advertisement herein attached, then the City may, at its option determine that the undersigned has abandoned the contract, and thereupon this Proposal shall be null and void, and the certified check or bond accompanying this Proposal, shall be forfeited to become the property of the City of Clearwater, Florida, and the full amount of said check shall be retained by the City, or if the Proposal Bond be given, the full amount of such bond shall be paid to the City as stipulated or liquidated damages; otherwise, the bond or certified check accompanying this Proposal, or the amount of said check, shall be returned to the undersigned as specified herein.

PROPOSAL

(2)

Attached hereto is a bond or certified check on _____
_____ Bank, for the sum of _____
_____ (\$_____)
(being a minimum of 10% of Contractor's total bid amount).

The full names and residences of all persons and parties interested in the foregoing bid are as follows:

(If corporation, give the names and addresses of the President and Secretary. If firm or partnership, the names and addresses of the members or partners. The Bidder shall list not only his name but also the name of any person with whom bidder has any type of agreement whereby such person's improvements, enrichment, employment or possible benefit, whether sub-contractor, materialman, agent, supplier, or employer is contingent upon the award of the contract to the bidder).

NAMES:

ADDRESSES:

_____	_____
_____	_____
_____	_____
_____	_____

Signature of Bidder: _____

The person signing shall, in his own handwriting, sign the Principal's name, his own name and his title. Where the person signing for a corporation is other than the President or Vice President, he must, by affidavit, show his authority, to bind the corporation.

Principal: _____

By: _____ Title: _____

Company Legal Name: _____

Doing Business As (if different than above): _____

Business Address of Bidder: _____

City and State: _____ Zip Code _____

Phone: _____ Email Address: _____

Dated at _____, this _____ day of _____, A.D., 20__.

CITY OF CLEARWATER
ADDENDUM SHEET

PROJECT: EAST WRF INFLUENT PUMP STATION REHABILITATION PROJECT

(PROJECT #13-0016-UT)

Acknowledgment is hereby made of the following addenda received since issuance of Plans and Specifications.

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

(Name of Bidder)

(Signature of Officer)

(Title of Officer)

(Date)

BIDDER’S PROPOSAL

PROJECT: EAST WRF INFLUENT PUMP STATION REHABILITATION PROJECT (PROJECT #13-0016-UT)

CONTRACTOR: _____

BIDDER'S GRAND TOTAL: \$ _____ (Numbers)

BIDDER'S GRAND TOTAL: _____

_____ (Words)

THE BIDDER'S GRAND TOTAL ABOVE IS HIS TOTAL BID BASED ON HIS UNIT PRICES AND LUMP SUM PRICES AND THE ESTIMATED QUANTITIES REQUIRED FOR EACH SECTION. THIS FIGURE IS FOR INFORMATION ONLY AT THE TIME OF OPENING BIDS. THE CITY WILL MAKE THE TABULATION FROM THE UNIT PRICES AND LUMP SUM PRICE BID. IF THERE IS AN ERROR IN THE TOTAL BY THE BIDDER, IT SHALL BE CHANGED AS ONLY THE UNIT PRICES AND LUMP SUM PRICE SHALL GOVERN.

THE CONTRACTOR SHALL PROVIDE COPIES OF A CURRENT CONTRACTOR LICENSE/REGISTRATION WITH THE STATE OF FLORIDA AND PINELLAS COUNTY IN THE BID RESPONSE.

BID FORM IS ATTACHED BELOW:

SECTION V – Contract Documents

Item No.	BID ITEMS	Unit of Measure	Quantity	Unit Price	Total Price
1	Mobilization/Demobilization	LS	1		
2	Demolition	LS	1		
3	Sitework	LS	1		
4	Pump Station Improvement	LS	1		
5	Large Bubble Mixing System	LS	1		
6	Tank Spray Cleaning System	LS	1		
7	Temporary Bypass Pumping	LS	1		
8	Electrical, Instrumentation & Controls	LS	1		
	SUB-TOTAL				
9	Permit Allowance	LS	1	\$ 5,000	\$ 5,000
10	Owner's Contingency (10% of Item 1 to 8)	LS	1		
	BID TOTAL				

**SCRUTINIZED COMPANIES AND BUSINESS OPERATIONS WITH
CUBA AND SYRIA CERTIFICATION FORM**

PER SECTION III, ITEM 25, IF YOUR BID IS \$1,000,000 OR MORE, THIS FORM MUST BE COMPLETED AND SUBMITTED WITH THE BID PROPOSAL. FAILURE TO SUBMIT THIS FORM AS REQUIRED, MAY DEEM YOUR SUBMITTAL NONRESPONSIVE.

The affiant, by virtue of the signature below, certifies that:

1. The vendor, company, individual, principal, subsidiary, affiliate, or owner is aware of the requirements of section 287.135, Florida Statutes, regarding companies on the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, or engaging in business operations in Cuba and Syria; and
2. The vendor, company, individual, principal, subsidiary, affiliate, or owner is eligible to participate in this solicitation and is not listed on either the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Sector List, or engaged in business operations in Cuba and Syria; and
3. Business Operations means, for purposes specifically related to Cuba or Syria, engaging in commerce in any form in Cuba or Syria, including, but not limited to, acquiring, developing, maintaining, owning, selling, possessing, leasing or operating equipment, facilities, personnel, products, services, personal property, real property, military equipment, or any other apparatus of business or commerce; and
4. If awarded the Contract (or Agreement), the vendor, company, individual, principal, subsidiary, affiliate, or owner will immediately notify the City of Clearwater in writing, no later than five (5) calendar days after any of its principals are placed on the Scrutinized Companies with Activities in Sudan List, the Scrutinized Companies with Activities in the Iran Petroleum Sector List, or engages in business operations in Cuba and Syria.

Authorized Signature

Printed Name

Title

Name of Entity/Corporation

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me on this _____ day of _____, 20____, by _____ (name of person whose signature is being notarized) as the _____ (title) of _____ (name of corporation/entity), personally known to me as described herein _____, or produced a _____ (type of identification) as identification, and who did/did not take an oath.

Notary Public

Printed Name

My Commission Expires: _____

NOTARY SEAL ABOVE

SCRUTINIZED COMPANIES THAT BOYCOTT ISRAEL LIST
CERTIFICATION FORM

PER SECTION III, ITEM 25, THIS FORM MUST BE COMPLETED AND SUBMITTED WITH THE BID PROPOSAL. FAILURE TO SUBMIT THIS FORM AS REQUIRED, MAY DEEM YOUR SUBMITTAL NONRESPONSIVE.

The affiant, by virtue of the signature below, certifies that:

1. The vendor, company, individual, principal, subsidiary, affiliate, or owner is aware of the requirements of section 287.135, Florida Statutes, regarding companies on the Scrutinized Companies that Boycott Israel List, or engaged in a boycott of Israel; and
2. The vendor, company, individual, principal, subsidiary, affiliate, or owner is eligible to participate in this solicitation and is not listed on the Scrutinized Companies that Boycott Israel List, or engaged in a boycott of Israel; and
3. “Boycott Israel” or “boycott of Israel” means refusing to deal, terminating business activities, or taking other actions to limit commercial relations with Israel, or persons or entities doing business in Israel or in Israeli-controlled territories, in a discriminatory manner. A statement by a company that it is participating in a boycott of Israel, or that it has initiated a boycott in response to a request for a boycott of Israel or in compliance with, or in furtherance of, calls for a boycott of Israel, may be considered as evidence that a company is participating in a boycott of Israel; and
4. If awarded the Contract (or Agreement), the vendor, company, individual, principal, subsidiary, affiliate, or owner will immediately notify the City of Clearwater in writing, no later than five (5) calendar days after any of its principals are placed on the Scrutinized Companies that Boycott Israel List, or engaged in a boycott of Israel.

Authorized Signature

Printed Name

Title

Name of Entity/Corporation

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me on this _____ day of _____, 20____, by _____ (name of person whose signature is being notarized) as the _____ (title) of _____ (name of corporation/entity), personally known to me as described herein _____, or produced a _____ (type of identification) as identification, and who did/did not take an oath.

Notary Public

Printed Name

My Commission Expires: _____
NOTARY SEAL ABOVE

APPENDIX – FORMS AND OTHER PROJECT DOCUMENTATION