

Countryside Sports Complex Field Lighting – Phase II

21-0006-PR

CONTRACT DOCUMENTS & SPECIFICATIONS

Prepared for



CLEARWATER
BRIGHT AND BEAUTIFUL • BAY TO BEACH

June 2021

**City of Clearwater, Florida
Countryside Sports Complex Field Lighting –
Phase II
21-0006-PR**

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Prepared in the Office of the City Engineer

SECTION 1

INVITATION TO BID NOTICE TO CONTRACTORS

COUNTRYSIDE SPORTS COMPLEX FIELD LIGHTING – PHASE II

Documents, plans, schedule and virtual meeting details for Project #21-0006-PR are available at <https://www.myclearwater.com/business/engineering-construction-bids>. The work includes: Remove & relocate existing light poles which consist of 2 light poles being relocated, two new poles and adding light fixtures to existing poles and other electrical works to provide a complete functional sport lighting system to a minimum 30-foot candles of the northeast soccer field of the sports complex per contract drawings, specifications and to the satisfaction of the Owner. Address project questions to LEROY.CHIN@myclearwater.com.

Pre-Bid Meeting: ON-SITE – Wednesday, June 16, 2021 at 10:00 AM (EST)

Pre-qualification Application Submittal:

Due: Wednesday, June 23, 2021

Category: Electrical

Pre-qualification Amount: \$200,000 (Two Hundred Thousand Dollars)

Bid Opening – Due Date: Virtual

Thursday, July 8, 2021 at 2:00 PM (EST)

FedEx or Drop off bids to:

City of Clearwater, Attn: Lori Vogel

Project # 21-0006-PR

Procurement Office, 3rd Floor

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

Issued by Lori Vogel, CPPB, Procurement Manager

For additional information contact Engineering 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.

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 (2014), 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:

Any actual bidder who is aggrieved in connection with the solicitation or award of a contract may seek resolution of his/her complaints initially with the Purchasing Manager, and if not satisfied, with the City Manager, in accordance with protest procedures set forth in this section.

19.2. PROTEST PROCEDURE:

- A. A protest with respect to the specifications of an invitation for bid or request for proposal shall be submitted in writing a minimum of five (5) work days prior to the opening of the bid or due date of the request for proposals, unless the aggrieved person could not have been reasonably expected to have knowledge of the facts giving rise to such protest prior to the bid opening or the closing date for proposals. Opening dates for bids or due dates for requests for proposal will be printed on the bid/request document itself.
- B. Protests in respect to award of contract shall be submitted in writing a maximum of five (5) workdays after notice of intent to award is posted, or is mailed to each bidder, whichever is earlier. Notice of intent to award will be forwarded to bidders upon telephonic or written request. Protests of recommended award should cite specific portions of the City of Clearwater Code of Ordinances that have allegedly been violated.
- C. Exceptions to the five (5) day requirements noted in both A and B above may be granted if the aggrieved person could have not been reasonably expected to have knowledge of the facts giving rise to such protest prior to the bid opening, posting of intent to award, or due date for requests for proposals. Request for exceptions should be made in writing, stating reasons for the exception.
- D. The Purchasing Manager shall respond to the formal written protest within five (5) workdays of receipt. The Purchasing Manager's response will be fully coordinated with the appropriate Department Director and the Assistant City Manager.
- E. If the protestor is not satisfied with the response from the Purchasing Manager, he/she may then submit in writing within five (5) work days of receipt of that response his/her reason for dissatisfaction, along with copies of his/her original formal protest letter and the response from the Purchasing Manager, to the City Manager.
- F. The City Manager as Purchasing Agent for the City has the final authority in the matter of protests. The City Manager will respond to the protestor within ten (10) workdays of receipt of the appeal.

19.3. PROTEST FEE:

When filing a formal protest, the protesting vendor must include a fee in the amount of 5% of the selected vendor's total bid to offset the City's additional expenses related to the protest. This fee shall not exceed \$2,500 nor be less than \$50. If either the Purchasing Manager or the City Manager upholds the protest, the City will refund 100% of the fee paid.

19.4. STAY OF PROCUREMENT DURING PROTEST:

In the event of a timely protest, the Purchasing Manager shall not proceed with the solicitation or award of contract until all administrative remedies have been exhausted or until the City Manager makes written determination that the award of contract without delay is necessary to protect the best interest of the City.

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

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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

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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,

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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

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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

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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 though 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

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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.

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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 be 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

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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,

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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 Contactor 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.

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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 or 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

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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-Builts 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

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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 blueline prints, the Contractor shall prepare supplemental drawings, on same size sheets as the blueline 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

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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.

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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@mclearwater.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

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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

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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

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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

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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 Contractors 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

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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

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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

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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 contact 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

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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.

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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

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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.

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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.

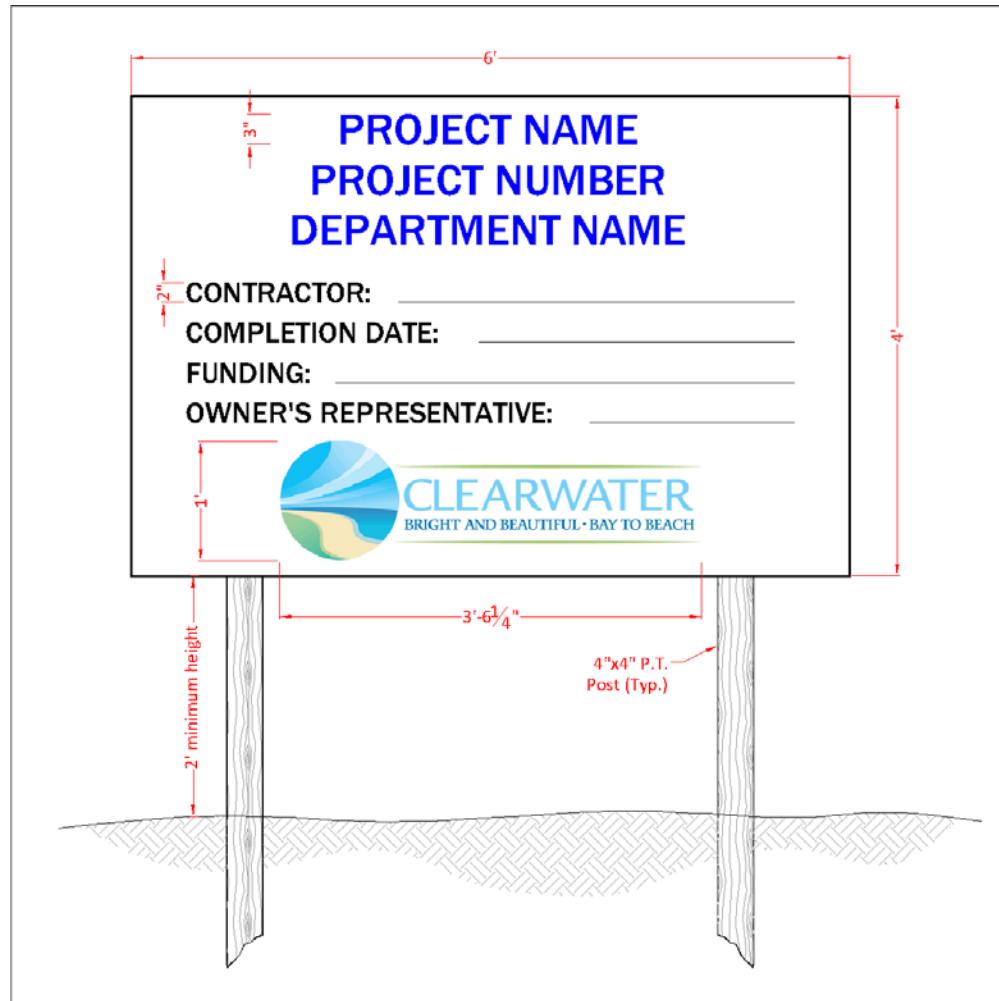
23.6. SIGN PLACEMENT

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

SECTION III – General Conditions

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.

SECTION III – General Conditions

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

SECTION IV

TECHNICAL SPECIFICATIONS

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100 SERIES: GENERAL

101. SCOPE OF WORK

Project Name:	<u>Countryside Sports Complex Field Lighting – Phase II</u>	
Project Number:	<u>21-0006-PR</u>	Permit Number: <u>BCP2021-010760</u>

Scope of Work:

1. The proposed renovation of the existing sport lighting system of northeast soccer field is located at:
 - a. Countryside Sports Complex
Renovation of Northeast Soccer Field
3060 McMullen Booth Road
Clearwater FL 33761
2. This work shall also include furnishing and installing new electrical cabinetry for the purposes of lighting control.
3. The Contractor shall provide copies of a current Contractor License/Registration with the state of Florida and Pinellas County in the bid response.
4. The Contractor shall provide 1 Fixed project sign as described in SECTION III, ARTICLE 23 of the Contract Documents.
5. Countryside Sport Complex
 - a. Northeast Soccer field consist of 2 existing sport light poles to be relocated on to new concrete footer bases.
 - b. Provide new light poles and concrete bases.
 - c. Relocate and install new sport light fixtures.
 - d. Other electrical works to provide a complete functional sport lighting system to a minimum 30-foot candles of the northeast soccer field of the sports complex per contract drawings, specifications and to the satisfaction of the Owner.
6. Construction documents developed by
Griner Engineering, Inc.
Contact Person Sajid Ali Khan
3125 5th Avenue North, Suite 300
St. Petersburg FL 33713
phone 727-822-2335
Countryside Sports Complex Soccer Field Lighting – Phase II

Drawing Index

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Sheet No.1	Cover Sheet	12-04-2020
Sheet No. E0	Legend, General Notes	12-04-2020
Sheet No. E1	Electrical Existing Condition-Demo Plan	12-04-2020
Sheet No. E2	Proposed Electrical Site Plan	12-04-2020
Sheet No. E3	Enlarged Revised Electrical Yard Plan	12-04-2020
Sheet No. E4	Power Riser Diagram, General Notes, Details	12-04-2020
Sheet No. E5	MUSCO Photometric Site Plan, Schedule, Details	12-04-2020

‘As-Built’ Reference Drawings – Countryside Sports Complex – Field 3 & 4 Renovation

SECTION IV – Technical Specifications

Sheet No EO	Legend, General Notes/Cover Sheet	11-24-2019
Sheet No. E1	Electrical Existing Condition -Demo Plan	11-24-2019
Sheet No. E2	Electrical Site Plan	11-24-2019
Sheet No. E3	Electrical Yard and Schedules	11-24-2019
Sheet No. E4	Electrical Riser Diagram	11-24-2019
Sheet No. E5	Photometric Performance Data	11-24-2019

- a. MUSCO cost for sport lighting system which includes 10-year warranty and maintenance of their lighting system.

Electrical Technical Specifications:

SECTION	DESCRIPTION
26 00 10	Basic Division 26 Requirements
26 05 19	Low Voltage Electrical Power Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 34	Raceway and Boxes for Electrical Systems
26 05 35	Boxes and Cabinets
26 05 53	Electrical Identification
26 05 75	Conduit Rough-In Systems
26 24 16	Panelboards
26 27 26	Wiring Devices Sports Lighting Existing Controls Proposed Controls Warranty

- 7. Contractor shall be prequalified under Commodity Number 8 – Electrical amount of qualification \$200,000.00 please go to Myclearwater.com/Engineering/Contractor Pre-Qualifications for form. Contractor must be pre-qualified 14 days prior to bid opening.
- 8. Countryside Sports Complex Soccer Field Lighting – Phase II from date of Notice to Proceed complete the work within 90 calendar days.
- 9. Owner recommends contractor to video site for actual site conditions prior to beginning work.
- 10. Countryside Sports Complex will remain open for activity during installation/renovations of renovation of the sport lighting system of existing soccer fields. Activity shall continue at. Electrical Contactor shall provide all necessary safety precautions of all patrons and staff during the performance of his electrical works.
- 11. Contractor shall be required to perform his own project survey layout and ‘as built’ drawings at completion of project. These as built drawings shall submit to the Owner and Engineer to close out the project.
- 12. Contractor shall contact 811 for underground utility locate 48 hours prior to any excavations on site. Contractor shall be required to provide third party for locate of underground utilities for this site of the work area. A underground company City has used in the pass is Blood Hound LLC, 9919 Commodity Cir. Suite 23, Orlando, Florida 32819, contact person Timothy Chester, email Timothychester@BHUG.com, cell 561-261-1877, office 407658-1030, fax 407-658-1380 or similar like company.

13. Contractor shall be required to provide all material testing by a third-party geotechnical laboratory for the project works. Original copy shall be provided to the Owner and Engineer within 7 days from date of testing.
14. Laydown area for contractor shall be determined at the preconstruction meeting. The contractor and his employees shall not park vehicles or equipment within 10 feet of any existing trees canopy drip line on site.
15. Should the contractor decide to use roll off dumpsters, they must be ordered from City of Clearwater – Solid Waste 727-562-4820 per city ordinance. Contractor shall be required to dispose of all construction debris off site at a proper disposal facility.
16. All disturbed area shall be fine graded and edges cutout along existing grass edge to allow new laid Tiffway 419 Bermuda sod to lay in flush with existing grass surfaces. All installed sod shall be rolled with 2,000-pound roller.
17. Construction site shall be kept clean always of any construction debris. Daily trash from employee during lunch and rest breaks shall be put in a trash receptacle and disposed off site weekly.
18. Contractor shall provide his own sanitation facilities for his employees.
19. Electrical Contractor shall install temporary construction fencing to secure his work area. Owner shall provide 6'x12' temporary fence panels, stands and clamping hardware on a trailer for installation of the temporary fence by the electrical contractor to fence off work area. Electrical contractor shall provide one sandbag will with sand to place on the stands. This temporary construction fencing shall be placed to secure the work area from the user groups of the soccer fields. The temporary fencing shall be removed after completion of the project and place back on the Owner's trailer to haul away. Temporary Construction Fencing shall be discussed in greater detail at the pre-bid meeting and at the preconstruction meeting.

Sport Lighting System

1. Sport lighting system drawings have been developed and submitted for Building Permit and permit number BCP2021-010760. Contractor shall be required to collect the building permit at City of Clearwater - Planning & Development Services – 100 S. Myrtle Ave. 2nd Floor, Clearwater, FL 33756. There will be no fee for the building permit. Contractor shall be required to call in for inspections at proper intervals and close outbuilding permit to collect final payment from the Owner. Contractor shall provide Certificate of Completion to the Owner.
2. Contractor shall provide one-year warranty on workmanship and date will start on date of Certificate of Completion document from the Building Dept.
3. Contractor shall note soccer fields lighting system bases of design is MUSCO Sport Lighting System or equal system.
4. Provide a complete electrical operating tennis court sport lighting system.
5. Contractor shall utilize existing electrical service located on site. See contract drawings.
6. Other miscellaneous electrical work shall be included such as connection to GFI electrical duplex outlets as shown on drawings.
7. Electrical contractor shall provide all materials not included in MUSCO Sport Lighting and provide a complete operational tennis court lighting system.

Payment for work performed.

SECTION IV – Technical Specifications

1. Under no circumstances shall any work additional work be performed without a change directive. Contractor shall provide proposal for any additional work not shown on the drawing in writing to the Owner and written approval must be received from the Owner prior to being any additional work.
2. A schedule of value shall be in AIA format and shall itemize each work item or an approved pay application payment schedule by the Electrical Contractor. A separate contingency item shall contain to amount. Each change directive shall be numbered in consecutive order and a sum for change directive amount shall be indicated for contractor to draw from when work is incrementally collected monthly. A total start shall be located at the beginning of the contingency item body. Its noted any line item not fully utilized shall be transferred in to the contingency item by a change directive to increase the contingency amount. Under no circumstances shall fund of base bid items shall be utilized to offset other items in the base bid.
3. The Contractor shall submit pay application of the 25th of each month of work performed the pass 30 days.
4. A pencil draft of the pay application shall be provided to the Engineer and Owner at one of the progress meeting for review. Upon approval the Contractor shall submit an electronic pay application for approval and upon approval by the Engineer shall send electronic copy to the Owner for payment.
5. Payment of request for payment shall be made within 30 days from date of invoice and payment shall be made to the Contractor's mailing address. No check will be provided by hand delivering and only delivery by U. S. Postal Service.
6. Final payment shall be made as stipulated in the contract documents.
7. 5% retainage of total project cost shall be retained by the Owner until the following schedule of items are completed:
 - a. Substantial completion of the project:
 - b. Close out of Building Permit Final
 - c. Obtain Certificate of Completion
 - d. Preliminary walk through by Engineer & Owner
 - e. Punch list has been provided to the Contractor to perform punch list.
 - f. Punch list items are completed and request for final walk through by the Owner and Engineer and approval punch list items are completed & O & M Manual has been reviewed and approved by Engineer, turned over to the Owner.
 - g. Hard Copies of the O & M Manual
 - h. Index page
 - i. Spread Sheet - List of Material Suppliers, Sub Contractors with contract information (contact person, address, telephone number, cell phone number, fax number, email address)
 - j. Building permit and Certificate of Completion
 - k. Final Pay Application, Change Directives and Change Order
 - l. Warranties
 - m. Architect's Supplemental Information
 - n. Material Submittals
 - o. 1 Hard copy set of red lined As Built drawings

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, ARTICLE 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 Owner due to the Contractor's schedule of work.

Contract Period: 90 Consecutive Calendar Days
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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

SECTION IV – Technical Specifications

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)
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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. Sheetings shall be plumb and securely braced and tied in position. Sheetings 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 to 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., Structural Fill</i>)	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., Structural Fill</i>)	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., Common Fill</i>)	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 manufacturer'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 1/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 waste-water 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 invert 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 Manufacture's/Licensor'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-television 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 POLYURIDHANE, 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: <ul style="list-style-type: none"> 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 $\frac{1}{4}$ " w x $\frac{1}{4}$ " 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 $\frac{1}{4}$ " w x $\frac{1}{4}$ " 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 $\frac{1}{4}''$ x $\frac{1}{4}''$ 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 warrantee 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)

- 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 or 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 APPURTEANCES

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. Restriction 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. Restriction 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. Restriction 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 ADPATERS)

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 splicing 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 LINESTOPS

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 Thrust Blocks: Concrete thrust blocks shall not under any circumstances be allowed on the Project for thrust restraint at fittings.
- D. Concrete Thrust 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, reseat 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, reseat 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 coliform-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. BACTERIALOGICAL 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 used 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% flatting 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 selvedges. 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 $\frac{1}{4}$ " 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 ($\frac{1}{4}$ ") 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. POTHOLES

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, guarantees, 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 Built), 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 ($\frac{1}{2}$ ").
- 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 or 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 of 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 racked, 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 buildup 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.

Countryside Soccer Field Lighting Phase II

Electrical Specifications

Prepared For:

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December 18, 2020

GEI Project No. 20182

Jose A. Rosario, P.E. 74457
Electrical Engineer
Dated: December 18, 2020

<u>SECTION</u>	<u>DESCRIPTION</u>
26 00 10	Basic Division 26 Requirements
26 05 19	Low Voltage Electrical Power Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 34	Raceway and Boxes for Electrical Systems
26 05 35	Boxes and Cabinets
26 05 53	Electrical Identification
26 05 75	Conduit Rough-In Systems
26 24 16	Panelboards
26 27 26	Wiring Devices
	Sports Lighting
	Existing Controls
	Proposed Controls
	Warranty

SECTION 26 00 10

BASIC DIVISION 26 REQUIREMENTS

PART 1 - GENERAL

1.1 RULES AND REGULATIONS

- A. Requirements of Division 20 Section "Common Work Results, Division 21 through 28" apply to this Division.
- B. Work and materials shall conform to and be executed, inspected and tested in accordance with the latest edition of the National Electric Code and with the governing rules and regulations of federal, state and local governmental agencies. References to "NEC" within the Division 26 Sections shall be considered synonymous to this electrical code.
- C. Other codes which will apply to this installation include the current editions of:
 - 1. ANSI C2 - National Electrical Safety Code.
 - 2. NEMA Standards.
 - 3. NFPA 70E – Standard for Electrical Safety Requirements for Employee Workspaces.
 - 4. NFPA 101 - Life Safety Code.
 - 5. Underwriters Laboratories.
- D. Where governing codes indicate the Drawings and Specifications do not comply with the minimum requirements of applicable codes, be responsible for either notifying the Architect in writing during the bidding period of the revisions required to meet code requirements, or providing an installation which will comply with the code requirements.

1.2 SUMMARY

- A. This Section includes general administrative, material, and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:
 - 1. Electrical product general requirements and accesses.
 - 2. Substitutions.
 - 3. Submittals.
 - 4. Coordination drawings.
 - 5. Record documents.

6. Maintenance manuals.
 7. Rough-ins.
 8. Electrical installations.
 9. Cutting and patching.
- B. Related Sections: The following sections contain requirements that relate to this section:
1. Requirements of Division 20 Section "Common Work Results, Division 21 through 28" apply to this Division.
 2. Division 23 Section "Electrical Requirements for Mechanical Equipment," for factory-installed motors, controllers, accessories, and connections.
 3. Coordinate with Division 21 - 28 for requirements for fully Integrated Facility Control System (IFCS) to combine building sub systems into one overall system. Provide a fully coordinated single seat interface to system operators. Utilize the existing Andover Continuum web based network. Provide complete control of building sub systems through a graphical, map-driven interface with further detail available on any sub system by clicking through a more focused graphic display for a particular system. Reference 25 0600 "Integrated Facility Control System" along with all other applicable specification sections. Submit list of existing operational systems demonstrating integration and information exchange with Andover Continuum Controls Platform.

1.3 SUBSTITUTIONS

- A. The materials, products, and equipment described in the Bidding Documents establish a standard of required functions, dimensions, appearance, and quality to be met by any proposed substitution.
- B. No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect/Engineer at least ten (10) days prior to the date for receipt of Bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance, test data and warranties, and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment or other work for incorporation of the substitute shall be included. The burden of proof of the merit of the proposed substituted is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

- C. If the Architect approved any proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. This Addendum shall then be issued to all Bidders.
- D. Requests for substitution shall be made only by a Bidder. Requests for substitution received by the Architect from sales representative, vendors, suppliers, etc., are not acceptable.
- E. Refer to "Division 01" for instructions on substitutions.

1.4 SUBMITTALS

- A. General: Follow the procedures specified in Division 01 Section "Submittals."
- B. Submit coordination drawings for the areas specified and those areas defined as "problem" coordination areas during construction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.6 QUALITY ASSURANCE

- A. Manufacturers of equipment shall be firms regularly engaged in manufacturing factory fabricated systems and equipment whose products have been in satisfactory use in similar service for not less than three (3) years.

1.7 WIRING AND CONTROLS

- A. Wiring and controls associated with equipment shall be furnished, installed and wired in accordance with the manufacturer's recommendations and applicable standards and codes. Provide installation instructions, locating dimensions and wiring diagrams for the other trades. Supervise the installation and start-up and test the equipment unless otherwise specified.
- B. Equipment Furnished by Other Divisions: Equipment specified in other divisions and requiring electrical supply shall be erected, aligned, leveled

and prepared for operation. Provide required controls and accessories along with installation instructions, diagrams, dimensions and supervision of installation and start-up. Provide the required electrical rough-ins and confirm the electrical controls and accessories furnished under the specifications for the other divisions. Install those controls and accessories not located in the mechanical piping and ductwork. Provide additional electrical controls, accessories, fittings and devices not specified under the equipment but required for a finished, operating job. Make final electrical connections. Participate in the start-up and test services.

1.8 PERMIT AND INSPECTIONS

- A. Permits: Obtain and pay for all permits, bonds, licenses, tap-in fees, etc., required by the City, State or other authority having jurisdiction over the work, as a part of the work of the affected sections.
- B. Inspections: Arrange and pay for all inspections required by the above when they become due as part of the work of the sections affected. Conceal no work until approved by these governing authorities. Present the Engineer with properly signed certificate of final inspection.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials, unless otherwise specified, shall be new and be the standard products of the manufacturer. Seconds, rejects, or damaged materials will be rejected.
- B. The equipment to be provided under these Specifications shall be essentially the standard commercial grade product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer.
- C. The listing of a manufacturer for certain equipment and systems does not indicate acceptance of a standard or catalogued item of equipment. All equipment and systems shall conform to the Specifications.

2.2 U.L. LISTING

- A. All equipment shall bear the Underwriter's Laboratories (UL), or other approved agency, listing label. Acceptable alternates include:
 1. Intertek Testing Service NA, Inc. (ITSNA) (formerly ETL).

2. Wherein an item of equipment is specified to be U.L. Listed, the entire assembly shall be listed by Underwriters Laboratories, Inc. Any modifications to suit the intent of the Specifications shall be performed in accordance with the National Electrical Code and listed by U.L.
- B. Definitions:
1. Listed: Equipment or materials included in a list published by an organization acceptable to the authority having jurisdiction and concerned with product evaluation, that maintain periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets appropriate designated standards or has been tested and found suitable for use in a specified manner.
 2. Labeled: Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicated compliance with appropriate standards or performance in a specified manner.

2.3 LEAP YEAR SOFTWARE PROTECTION

- A. All software supplied with new equipment shall be warranted against leap year program failure.

PART 3 - EXECUTION

3.1 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 02 through 28 for rough-in requirements.

3.2 GENERAL REQUIREMENTS

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.3 COORDINATION

- A. Coordinate arrangement, mounting, and support of Division 26 equipment:
 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 3. To allow right of way for piping and conduit installed at required slope.
 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
 1. Submit coordination drawings indicating proposed access door locations for review per Division 26 Section "Basic Division 26 Requirements."
 2. Ensure access doors are sized to permit complete access for any concealed and/or inaccessible junction boxes, control and monitoring devices, elevator shaft and duct mounted fire alarm detectors and other items of equipment requiring access, maintenance, and/or operation.
 - a. Assure access to devices per codes and local authorities having

jurisdiction.

3.4 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
1. The Architect shall control the placement of wall and ceiling mounted electrical devices, luminaires and outlets. The intent is to aesthetically locate luminaires/outlets by providing rough-in hardware, boxes and/or mounting plates, as required, when stud or furring may not be readily available for direct mounting. When drawing details are not available, consult with Architect's representative for actual placement.
 2. Coordinate electrical systems, equipment, and materials installation with other building components. Be responsible for any changes in openings and locations necessitated by the equipment installed.
 3. Verify all dimensions by field measurements.
 4. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
 5. Coordinate the installation of required supporting devices and sleeves to be set in poured- in-place concrete and other structural components, as they are constructed.
 6. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 7. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
 9. Distribution Equipment Assembly Selection: The Drawings indicate sizes, profiles, and dimensional requirements of assembly equipment. Equipment having equal performance characteristics and complying with indicated maximum dimensions and profiles may be considered, provided deviations do not change the design concept, intended performance, or code/future extension provision

- clearances. The burden of proof of equality is on the proposer a minimum of 10 days prior to bid.
10. Protect all equipment and materials from the elements, dirt and other damage from the time it is removed from the point of storage until final acceptance.
 11. Equipment shall include the component parts thereof such as disconnect switches, motor controllers, motors, drives, and guards necessary to the satisfactory and safe operation of the equipment.
 12. Installation shall include setting equipment to accurate line and grade, leveling equipment, aligning equipment components, providing and installing couplings, bolts, guards, and anchor bolts.
 13. All tolerances in alignment and leveling, and the quality of workmanship for each class and stage of work shall be subject to manufacturer's installation instructions.
 14. All manufacturers' finished equipment surfaces damaged during construction shall be brought to an "as new" condition by touch up or repainting. Any rust shall be completely removed and the surface primed prior to repainting.
 15. Workmanship shall conform to the "Standard of Installation" published by the National Electrical Contractors Association.
 16. Provide all trench and conduit excavation and backfilling required for his work inside and outside the building, including repairing of finished surfaces, all required shoring, bracing, pumping, and all protection for safety of persons and property. In addition, check the indicated elevations of the utilities entering and leaving the building. If such elevations require excavations lower than the footing levels, the Architect shall be notified of such conditions and a redesign shall be made before excavations are commenced. Make the excavations at the minimum required depths in order not to undercut the footings.
 17. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises. These items shall be removed from the premises when no longer required.
 18. No electrical equipment, raceways or other work of any kind shall be covered up or hidden from view before it has been examined and approved. Any unsatisfactory work or materials shall be removed and corrected immediately.
 19. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
 20. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with

minimum of interference with other installations.

21. Coordinate installation of access panel or doors where units are concealed behind finished surfaces.
22. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.5 COORDINATION WITH LOCAL ELECTRICAL AND TELECOMMUNICATION UTILITIES AND SERVICES

- A. Coordinate connection of electrical and telecommunication systems with exterior underground and overhead utilities and services and meet all of their schedules so that the electrical services proceeds in a timely and orderly fashion. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- B. Locations and details required by Division 26 for the utility rough-in shall be the responsibility of Division 26.

3.6 MANUFACTURER'S DIRECTIONS AND SUPERVISION

- A. Where supervision by a manufacturer is specified, follow all instructions, recommended manufacturer and specified field tests, and other recommendations of the manufacturer. The manufacturer shall supervise the installation, connection, start-up, testing, adjustment, instruction of the Owner and final tests of such equipment or system. Where two or more manufacturer's equipment are interrelated, take responsibility to coordinate their work and provide supervision.
- B. Have the manufacturer instruct the Owner in the proper operation and maintenance techniques of all equipment, systems, etc., at the time of completion of all work.
- C. Prior to final acceptance by the Owner, prepare and submit to the Architect for review three copies of operation and maintenance (O and M) instructions in printed form for each item of equipment or system installed in the building. Complete instructions for each system shall be assembled and bound in a brochure. Detailed contents of the O and M manuals are as hereinafter specified. Refer to appropriate Division 01 sections for general requirements affecting this work.

3.7 PAINTING

- A. Provide the prime painting of all equipment and materials furnished under Division 26 specifications, unless specifically stated otherwise. In general, all equipment except raceways and galvanized boxes that are not provided with a factory-applied final finish shall be delivered to the job site with a shop-applied prime coat of paint. Refer to Division 09 Section "Interior and Exterior Painting."

3.8 TEST AND INSPECTION

- A. Upon completion of the work, notify the Architect in writing, that the entire electrical installation has been examined, inspected, tested, calibrated or adjusted as specified and that it is ready for final inspection. Work to be connected prior to final inspection and also to include all of the work specified for "Manufacturers' Directions and Supervision." Include documentation of specified testing and inspection.
- B. Prior to each inspection, provide a written certification that each system or piece of equipment to be operated during that test has been tested and does meet design performance criteria of the Contract Documents.
- C. On completion of the work, obtain Certificates of Compliance, and approval or acceptance from all authorities having jurisdiction over the work, and deliver these certificates to the Architect. The work shall not be deemed to have reached a state of completion until the certificates have been delivered.

3.9 LOOSE EQUIPMENT

- A. Provide four keys for every different piece of electrical equipment which is equipped with a lock.
- B. Provide all other loose equipment specified/supplied for use with all systems.

3.10 SUBMITTALS

- A. Refer to Division 01 for quantities and types of submittals.
- B. Required submittals shall be submitted in groups by systems. For example, all lighting fixtures, lamps, ballasts and accessories shall be submitted simultaneously in one package.
- C. Division 26 Submittals required:

1. Batteries and battery chargers (submit with associated system).
 2. Conduit fittings.
 3. Contactors.
 4. Disconnect switches.
 5. Motor controllers.
 6. Protective devices.
 7. Surface raceways.
 8. Wiring devices.
- D. Submittals submitted for other than those listed above or specifically required in the appropriate Specification Section will not be reviewed or returned.
- E. Contractor Certificates:
1. Contractor certification forms may be submitted in accordance with Division 01 Section "Submittal Procedures" in lieu of system shop drawing product data requirements except for the systems or products listed below:
 - a. Protective devices.

3.11 COORDINATION DRAWINGS

- A. Prepare coordination drawings in accordance with Division 01 Section "Project Coordination," to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
1. Indicate the proposed locations of major raceway systems, equipment, and materials. Include the following:
 - a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
 - b. Exterior wall and foundation penetrations.
 - c. Wall and floor sleeve penetrations.
 - d. Floor box assembly installations.
 - e. Equipment connections and support details.
 - f. Sizes and location of required concrete pads and bases.
 2. Coordination drawings shall be provided by Division 26 for the following:
 - a. Access door locations and sizes (for installation by Division 08).
 - b. Communication rooms.

- c. Electrical equipment rooms.
 - d. Feeder routings.
 - e. Mechanical equipment rooms.
3. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
 4. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
 5. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, luminaires, communications systems components, sprinklers, and other ceiling-mounted devices.
- B. Contract Document Drawing copies may be used as base for coordination drawings, then marked to depict actual equipment sizes and other requirements of coordination drawings. Those not marked will be rejected.

3.12 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 01 Section "Project Closeout." In addition to the requirements specified in Division 01, indicate installed conditions for:
 1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
 2. Major equipment locations (exposed and concealed), dimensioned from prominent building lines.
 3. Contract Modifications and actual equipment and materials installed.
- B. Engage the services of a Land Surveyor or Professional Engineer registered in the state of Florida as specified in Division 01 Section "Execution" to record the locations and invert elevations of underground installations.

3.13 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 01 Section "Cutting and Patching." In addition to the requirements specified in Division 01, the following requirements apply:
 1. Perform cutting, fitting, and patching of electrical equipment and

materials required to:

- a. Uncover Work to provide for installation of ill-timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.
2. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 3. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
 4. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
 - a. Refer to Division 01 Section "Quality Requirements" for definition of experienced "Installer."

END OF SECTION 26 00 10

SECTION 26 05 19

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes conductors, cables, and connectors rated 100 to 600 volts.
- B. Requirements of the following Division 26 Sections apply to this section:
 1. Section "Basic Division 26 Requirements."
 2. Section "Boxes and Cabinets" for connectors for terminating cables in boxes and other electrical enclosures.
 3. Section "Hangers and Supports for Electrical Systems."
 4. Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling".
 5. Section "Electrical Identification" for labeling and cable ties.
 6. Section "Wiring Devices" for device types and connectors.
- C. Related Sections: The following Sections contain requirements that relate to this section:
 1. Division 07 Section "Penetration Firestopping" for penetrations of rated walls, ceilings, and floors.
 2. Division 31 Section "Earth Moving" for trenching and backfilling for direct buried cable.

1.2 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of contract, Division 01 Specification Sections, and Division 26 Section "Basic Division 26 Requirements."

1.3 ACTION SUBMITTALS

- A. Shop Drawings:
 1. Product data for multiconductor cables.
 2. Product data for prefabricated MC cable wiring system assemblies.
 3. Product data and system layouts for prewired MC cable modular wiring systems.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field quality control test reports.

1.5 CLOSEOUT SUBMITTALS

- A. Record Drawings:
 - 1. Indicate all feeder sizes on the record drawings riser diagrams.
 - 2. Indicated homerun junction box locations for all branch circuits.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with provisions of the following code:
 - 1. NFPA 20 Centrifugal Fire Pumps.
 - 2. NFPA 70 National Electrical Code.
 - a. Conform to applicable codes and regulations regarding toxicity of combustion products of insulating materials.
 - 3. UL Compliance: Provide components which are listed and labeled by UL under the following standards.
 - a. UL Std. 4 - Armored Cable.
 - b. UL Std. 83 - Thermoplastic-Insulated Wires and Cables.
 - c. UL Std. 183 - Modular Wiring Systems.
 - d. UL Std. 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
 - e. UL Std. 854 - Service Entrance Cable.
 - f. UL Std. 1569 - Metal-Clad Cable.
 - 4. NEMA/ICEA Compliance: Provide components which comply with the following standards:
 - a. WC-70.
 - 5. IEEE Compliance: Provide components which comply with the following standard:
 - a. Std. 82 - Test procedures for Impulse Voltage Tests on Insulated Conductors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Conductors and Cables:
 - a. AFC Cable Systems, Inc., a Division of Tyco.
 - b. Alcan Products Corporation; Alcan Cable Division.
 - c. American Insulated Wire Corp.; a Leviton Company.
 - d. Cerro Wire LCC.
 - e. Encore Wire Corporation.
 - f. General Cable Corp.
 - g. Nexans
 - h. Senator Wire & Cable Co.
 - i. Southwire Company.
2. Connectors and Splices for Conductors and Cable Conductors:
 - a. AFC Cable Systems, Inc., a Division of Tyco.
 - b. AMP.
 - c. Burndy Corporation.
 - d. Hubbell Power Systems, Inc.
 - e. O-Z/Gedney Co.; EGS Electrical Group LLC.
 - f. 3M Company; Electrical Products Division.
 - g. Raychem Corporation.
 - h. Square D Company.
 - i. Thomas and Betts Corporation.
 - j. Tyco Electronics Corp.

2.2 WIRES AND CABLES

- A. General: Provide wire and cable suitable for the temperature, conditions and location where indicated.
- B. Conductor Material: Copper and Aluminum.
- C. Conductors: Provide solid conductors for power and lighting circuits sizes No. 12 AWG and smaller. Provide stranded conductors for sizes No. 10 AWG and larger.
- D. Insulation: Provide insulation type in accordance with Part 3 below.
- E. Color Coding:

<u>208/120Volts</u>		<u>480/277 Volts</u>	
<u>Phase</u>	<u>Color</u>	<u>Phase</u>	<u>Color</u>
A	Black	A	Brown
B	Red	B	Orange
C	Blue	C	Yellow

Neutral	White	Neutral	Gray
Ground	Green	Ground	Green
IsoGround strips	Green w/Yellow	IsoGround	Green

- F. Jackets: Factory-applied nylon or PVC external jacketed wires and cables for pulls in raceways over 100-feet in length, for pulls in raceways with more than three equivalent 90 deg. bends, for pulls in conduits underground or under slabs on grade, and where indicated.
- G. Multiconductor Cables: Provide the following type(s) of cables in NEC approved locations and applications where indicated. Provide cable UL listed for particular application:
 - 1. Metal-Clad Cable: Type MC:
 - a. Complete with ground conductor.
 - 2. Armored Cable: Types AC and ACL:
 - a. Complete with ground conductor.
 - 3. Mineral Insulated Cable: Type MI.

2.3 PREFABRICATED MC CABLE WIRING SYSTEM ASSEMBLY OPTION

- A. At contractors' option, but subject to other requirements of this Section and other Division 26 Sections, UL listed assemblies may be used which allow:
 - 1. Floor or wall bracket, with one to four gang openings for pre-installed outlet boxes, with far side support arm(s).
 - 2. Pre-installed box trim rings for flush device installation.
 - 3. Wiring device pigtail connector option.
 - 4. MC cable whip appropriate for application(s).
- B. Basis of assembly design shall be Legrand Cabofil FAS Power TM or Alcan Modex TM
- C. If used, submit custom shop drawing per assembly type for Engineer's approval.

2.4 PRE-WIRED MC CABLE MODULAR WIRING SYSTEM

- A. Subject to other requirements of this Section and other Division 26 Sections, provide UL listed assemblies for a complete preassembled branch circuit system.
 - 1. The system shall include plug-in connectors on the MC cables line

- side end and associated modular wiring receiving box tied to a rigid metallic homerun above ceiling raceway.
2. MC cable load side male and female plug-in connectors may be used with branch circuit loads on maximum 6-foot whips to lighting systems and 10-foot whips to first wiring device.
 3. The system may be used with the prefabricated MC cable system assembly option for maximum flexibility.
- B. Basis of system design shall be:
1. AFC-ASC/Uni-Fab series, a Division of Tyco.
 2. Wiremold-Walker flex series, a Division of Legrand.
- 2.5 CONNECTORS AND SPLICES**
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Burnley, Thomas & Betts.
 2. O-Z/Gedney, EGS Electrical Group LLC.
 3. 3M; Electrical Products Division
 4. Ilsco.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
1. Above Ground Circuits (No. 10 AWG and smaller):
 - a. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 90°C, with integral insulation, approved for copper conductors.
 - b. The integral insulator shall have a skirt to completely cover the stripped wires.
 - c. The number, size, and combination of conductors, as listed on the manufacturer's packaging, shall be strictly followed.
 2. Above Ground Circuits (No. 8 AWG and larger)
 - a. Cable termination connecting blocks shall be made of high conductivity and corrosion-resistant material, electro-tin plated, listed for use with copper conductors only, rated for 600 V. Lugs shall be color coded by size.
 - b. Cable termination lugs shall be indent type, long barrel with chamfered entry, 2-hole, compression type for 250 kcmil and

above, 1-hole for less than 250 kcmil.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUCTORS AND CABLES

- A. General: Install electrical cables, conductors and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation," and in accordance with recognized industry practices.
1. Install all conductors within raceways or approved cables.
 2. Install conductors and cables run under the building slab in raceways.
 3. Install minimum No. 12 AWG for circuits 100 volts and above.
 4. Increase conductor size as required due to NEC derating requirements and availability. Minimum feeder conductor sizes, based upon NEC Table 310.16 and maximum 40% conduit raceway fill, are shown on Drawings. If conductor size increased, be responsible for associated feeder conduit size, based upon NEC Table 310.16 and maximum 40% conduit raceway fill, and increased ground conductor size per NEC. If raceway type altered, also be responsible for associated feeder conduit raceway size per NEC to meet 40% maximum fill.
 5. Keep conductor splices to a minimum.
 6. Do not bend conductors and cables, either permanently or temporarily during installation to radii less than that recommended by the manufacturer.
 7. Provide slack wire for all future connections with ends of wires taped and blank box covers installed.
 8. Provide conductors of the same size from the protective device to the last load.
 9. Make conductor length identical for parallel feeders.
 10. Ground and continuously polarize systems properly throughout following the color coding specified.
 11. Support conductors in vertical raceways. One cable support shall be provided at the top or as close to the top as practical, plus a support for each additional interval of spacing per NEC.
 12. Install exposed cable parallel and perpendicular to surfaces, or exposed structural members, and following surface contours, where possible.
 13. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."

- B. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. When conductors larger than No. 12 AWG are installed on 15 – 20-A circuits, splice No. 12 AWG pigtails for device connections.
 5. Existing Conductors:
 - a. Cut back and pigtail or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.
- C. Coordinate conductor/cable installation work including electrical raceway and equipment installation work, as necessary to properly interface installation of wires/cables with other work.
1. Pull conductors simultaneously where more than one is being installed in same raceway.
 2. Use of pull compound or lubricant is to be avoided unless absolutely necessary; compound used must not deteriorate conductor or insulation, and be one of the following:
 - a. Ideal-Aqua-Gel.
 - b. Polywater.
 - c. Yellow 77.
 3. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceway.
- D. Use conductors with 90 degree C insulation and appropriate NEC derating factors when wiring is within seven feet of passing over or attached to the following:
1. Boilers and other heat producing equipment.
 2. Hot water heaters.
 3. Rooftop and exposed exterior locations.

3.2 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: As shown on drawings.
- B. Branch Circuits: Copper.
- C. Ground conductor material shall match feeder type.

3.3 CONDUCTOR APPLICATIONS

- A. Install UL Type SE cable for above ground service entrance.
- B. Install UL Type UF cable with nonmetallic outer jacketing, for direct buried underground feeders not encased in conduit.
- C. Install UL Type THHN or THWN wiring in conduit, for branch circuits #10 and smaller.
 - 1. Include wet location label when installed in underground or above grade exterior raceways.
- D. Install UL Type XHHW or THHN wiring in conduit, for feeders and branch circuits #8 and larger.
 - 1. Include wet location label when installed in underground or above grade exterior raceways.
- E. Install UL Type XHHW or THWN wiring in conduit, for feeders and branch circuits installed outside of the building envelope, in raceway in contact with soil, or whenever raceway may be subject to moisture and/or condensation.
- F. Install UL Type XHHW wiring in conduit for isolated power branch circuits.
- G. Install SO hard service cord with stainless steel, wire mesh, strain relief at terminations to suit application.

3.4 TRENCH HEADER WIRING

- A. Bundle branch circuit wiring in trench headers together into individual circuits. Each bundled circuit shall consist of 1, 2, or 3-phase conductors and associated neutral conductor. Branch circuit wiring in the trench headers shall be installed in the power compartment, with bundled circuits identified by circuit numbers on five-foot intervals. Bundling of individual branch circuits shall be done with nylon straps made of self-extinguishing nylon with a locking hub or

head on one end and a taper on the other end. Nylon straps shall be Thomas and Betts "TY-RAP" or approved equal.

3.5 EQUIPMENT CONNECTIONS

- A. Follow circuit numbers shown on Drawings in connecting circuits to panelboards. In the event that field observation shows that the indicated circuit numbers are not connected to the corresponding panel overcurrent device, make all corrections necessary. Each branch circuit homerun containing two or more circuits with a common neutral shall be connected to the circuit breaker or switch in a three- or four-wire branch circuit panelboard so that no two of the circuits will be fed from the same phase.
- B. Provide all wiring to and between motors, controllers, line voltage (120-600 volt) control devices, disconnect switches and other related electrical equipment, except where such items are factory wired.
- C. Terminate power wiring for elevator systems at the respective controller and be in compliance with the manufacturer's approved shop drawings.
- D. Provide power and all wiring connections to the control devices for electrically operated overhead doors, door operators and control devices which will be provided under another division.
- E. Connectors for Splices, Taps, and Terminations:
 1. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torqueing requirements are not indicated, tighten connector and terminals to comply with tightening torques specified in UL Std. 486A and B.
 2. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - a. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
 3. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.
 4. Make splices and taps in wiring No. 10 AWG and smaller mechanically and electrically secure with mechanical pressure type splicing devices.

5. Make splices and taps of conductors No. 8 AWG or larger and all splices in motor terminal boxes using compression connectors requiring the use of compression tools for securing the conductors in the connectors. Termination of conductors at all distribution equipment, except transformers, shall be made using mechanical lugs. Connectors shall be of high conductivity, corrosion-resistant material and have actual contact area that shall provide at least the current carrying capacity of the wire or cable. For conductors No. 1/0 and larger, connector lugs shall be of the two-hole type. Connector lugs shall be bolted to bussing using Belleville washers in combination with flat washers and nuts. Compression connectors shall be as manufactured by Thomas & Betts, Burndy, or approved equal.
6. Each conductor lug or bus connection shall be individually made with separate lug and/or bolt as required for the termination.
7. Provide insulated connectors for splices and taps with a self-fusing rubber insulating tape that is non-corrosive to the connector and the conductor. Insulation tape shall have a minimum of 350 volts per mil dielectric strength. Friction or vinyl tape shall be applied directly over rubber insulating tape equal to 3M Scotch 88 type.

3.6 ARMORED CABLE (TYPE AC CABLE)

- A. May be used only when approved by the local authority having jurisdiction and only for concealed branch circuit wiring in spaces above accessible ceilings and in hollow studded interior partitions starting ten feet maximum from first wiring device off of a rigid metallic homerun raceway.
- B. In general, may be used only for lighting and convenience outlet wiring, and only for those branches and areas which are not identified herein as exceptions.
- C. The exception branches and areas where AC Cable is not acceptable for lighting and convenience outlet wiring are as follows:
 1. Emergency branch circuits.
 2. Exposed locations.
 3. Exterior canopy branch circuits.
 4. Hazardous locations.
 5. HVAC ducts and plenums.
 6. Isolated power systems feeder and branch circuits.

7. Kitchen equipment feeder and branch circuits.
 8. Life safety branch circuits.
 9. Mechanical, electrical, generator, battery and boiler rooms.
 10. Sitework.
 11. Through fire and smoke barriers.
 12. Wet and damp locations.
- D. AC cable shall be secured at intervals not exceeding 4-1/2 feet and within 12 inches of every outlet box or fitting. Luminaire whips may be 6 feet maximum without support.
- E. At all terminations, a fitting shall be provided to protect the conductors from abrasion. Approved insulating bushings shall be provided between the conductors and the armor. The connector or clamp by which the cable is fastened to boxes or cabinets shall be metal, of double lock-nut constructions, UL approved for use with AC cable, and of such design that the insulating bushing will be visible for inspection. Internal box cable clamps are not acceptable.

3.7 METAL-CLAD CABLE (TYPE MC CABLE)

- A. May be used only when approved by the local authority having jurisdiction and only for concealed branch circuit wiring in spaces above ceilings and in hollow studded interior partitions starting ten feet maximum from first wiring device off of a rigid metallic homerun raceway.
- B. In general, may be used only for lighting and convenience outlet wiring, and only for those branches and areas which are not identified herein as exceptions.
- C. Armor: Interlocked galvanized steel.
- D. The exception branches and areas where MC Cable is not acceptable for lighting and convenience outlet wiring are as follows:
 1. Computer rooms.
 2. Emergency branch circuit.
 3. Exposed locations.
 4. Exterior canopy branch circuits.
 5. Hazardous locations.
 6. Isolated grounding device branch circuits.
 7. Kitchen equipment feeder and branch circuits.

8. Life safety branch circuits.
 9. Mechanical, electrical, generator, battery, and boiler rooms.
 10. Sitework.
 11. Through fire and smoke barriers.
 12. Wet and damp locations.
- E. MC cable shall be secured at intervals not exceeding 6 feet and within 12 inches of every outlet box or fitting. Luminaire whips may be 6 feet maximum without support.
- F. At all terminations, a fitting shall be provided to protect the conductors from abrasion. Approved insulating bushings shall be provided between the conductors and the armor. The connector or clamp by which the cable is fastened to boxes or cabinets shall be metal, of double lock-nut construction, UL approved for use with MC cable, and of such design that the insulating bushing will be visible for inspection. Internal box cable clamps are not acceptable.

3.8 PRE-WIRED MC CABLE MODULAR WIRING SYSTEM

- A. Install system per manufacturer's instructions except in HVAC plenum areas where the system is prohibited.
- B. The modular wiring receiving box shall be installed with a single point connection to an adjacent homerun raceway box to allow overall system removal.
- C. Identify modular wiring receiving boxes at associated plug-in MC cables per Division 26 Section "Electrical Identification." Provide self-adhesive write-on tags identical to box identification requirements at each plug-in connection.

3.9 MAXIMUM BRANCH CIRCUIT LENGTHS

- A. Per NEC and as shown on Drawings.

3.10 SPECIAL BRANCH CIRCUIT (NEUTRAL) PROTECTION

- A. Pull separate neutral conductors as shown on Drawings and to branch circuits serving or having:
 1. Dimmers.
 2. Ground fault protected devices.

3. Isolated grounds.
4. Arc fault protected devices.
5. Computer receptacles.
6. Surge suppression devices.
7. Other non-sinusoidal loads.

3.11 CONDUCTOR AND CABLE IDENTIFICATION

- A. Color code cable at splices and terminations per Division 26 Section "Electrical Identification."

3.12 WIRING METHODS

- A. The following wiring methods shall not be used:
 1. Non-metallic sheathed cable.
 2. AC cable.
 3. AC cable with aluminum sheath (sometimes call "AC light" or "AC HCF light").
 4. MC cable.
 5. Aluminum wire and cable.

3.13 ROUTING OF CONDUCTORS AND FEEDERS

- A. Separate normal power and generator powered conductors, branch circuits and feeders in separate enclosures and rooms.
- B. Do not extend generator powered conductors and feeders through normal power electrical room except where shown on Drawings or approved by the Electrical Engineer.

3.14 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling".

3.15 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping".

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes solid grounding of building structures and electrical and communications systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications. Types of grounding systems include the following:
 1. Electrical Service and Transformer Grounding.
 2. Building Grounding.
 3. Equipment Room Ground Terminal Bar.
 4. Electrical Equipment Grounding.
 5. Surge Protective Device (SPD) Grounding.
 6. Telecommunications Grounding.
 7. Underground Distribution Grounding.
 8. Common Ground Bonding with Lightning Protection System.
- B. Requirements of the following Division 26 Sections apply to this Section:
 1. Section "Basic Division 26 Requirements."
 2. Section "Low Voltage Electrical Power Conductors and Cables."
 3. Section "Raceways."
 4. Section "Underground Ducts and Manholes."
 5. Section "Electrical Identification."

1.2 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract, Division 01 Specification Sections, and Division 26 Section "Basic Division 26 Requirements".

1.3 ACTION SUBMITTALS

- A. Product data for each type of product indicated.
- B. Submittals: Submit six (6) complete sets of submittals including:
 1. Schedules and Lists: Product or equipment schedules and lists.

2. Wiring Diagrams: Detailed wiring for grounding and bonding. Differentiate clearly intersystem bonding between communications.
3. Coordination drawings.

C. Samples:

1. For verification: For each type of lug indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
 1. Ground rods.
 2. Ground rings.
 3. Grounding arrangements and connections for separately derived systems.
 4. Grounding for sensitive electronic equipment.
- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data", include the following:
 1. Instructions for periodic testing and inspection of grounding features at ground rings based on NETA MTS and NFPA 70B.
 - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
 - b. Include recommended testing intervals.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a

member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with UL 467 for grounding and bonding materials and equipment.
- D. Comply with ANSI/TIA/EIA-607A – Commercial Building Grounding, Earthing and Bonding Requirements for Telecommunications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following listed manufacturers:
 1. Ground Rods:
 - a. Burndy.
 - b. Erico Products.
 - c. Knight Metalcraft.
 - d. Nehring.
 2. Molded Fusion Welding Material:
 - a. Cadweld.
 - b. ThermOweld.
 3. Ground Clamps/Connectors:
 - a. Adalet – PLM Division; a Division of Scott Felzer.
 - b. Anderson Corp.
 - c. Anixter Bros., Inc.
 - d. Burndy.
 - e. Chance – A.B. chance Co.
 - f. Crouse-Hinds, a Division of Cooper Industries.
 - g. Erico Products.
 - h. Ideal Industries, Inc.
 - i. Joslyn Corporation.
 - j. O-Z/Gedney Co.
 - k. Raco, Inc.
 - l. Thomas & Betts Corp.

4. Enclosure Equipment Grounding Kits:
 - a. Same manufacturer as box/cabinet or per 2.1 A.3.
5. Potential Equalizing Grid
 - a. Burndy.
 - b. Erico Products.

2.2 GROUNDING AND BONDING PRODUCTS

- A. Products: Of types indicated and of sizes and ratings to comply with NEC and Electric Utility requirements. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.3 WIRE AND CABLE CONDUCTORS

- A. General: Comply with Division 26 Section "Low Voltage Electrical Power Conductors and Cables."
- B. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- C. Equipment Grounding Conductor: Green insulated. Conductors No. 8 and larger may use green taped conductor ends.
- D. Grounding Electrode Conductor: Bare stranded, soft drawn or soft annealed, copper wire.
- E. Underground Grounding Conductors: Install bare copper conductor, NEC sized AWG minimum.
 1. Bury at least 24 inches (600 mm) below grade.
 2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

2.4 EQUIPMENT ROOM GROUND TERMINAL BAR

- A. Copper $\frac{1}{4}$ -inch thick by 2-1/2 inch wide by length shown on Drawings, unless otherwise indicated, with two (2) rows of holes on 1-1/2-inch centers for $\frac{1}{2}$ -inch bolt, to receive cables from two (2) directions.

2.5 TELECOMMUNICATIONS GROUNDING EQUIPMENT

- A. Grounding Busbars:
 - 1. Telecommunications Main Grounding Bus Bar (TMGB) - 24"W x 4"H x 1/4"D copper bus, with two (2) rows of holes on 1 inch centers for 1/4 inch bolts, to receive cables from two directions.
 - 2. Telecommunications Grounding Bus Bar (TGB) - 12"W x 4"H x 1/4"D copper bus, with two (2) rows of holes on 1 inch centers for 1/4 inch bolts, to receive cables from two directions.
 - 3. Acceptable Manufacturer/Series – Erico; Eritechn #TMGB/#TGB Series or equal by Newton or Harger.
- B. Telecommunications Bonding Backbone (TBB):
 - 1. Size TBB based on the following chart which is approximately 2kc mils per linear foot.
 - a. Minimum of No. 6 AWG conductor TBB between TGB/TMGB and equipment, equipment racks, etc.
 - b. Minimum of No. 2 AWG conductor TBB between TGB/TMGB and equipment, equipment racks, etc.

2.6 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
 - 2. Split-bolt connectors shall not be used for any application.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.7 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core.
 - 1. Size: 3/4-inch diameter by 10 feet.
- B. Plate Electrodes: Copper plates, minimum 0.10 inch thick, size as indicated.

PART 3 - EXECUTION

3.1 GENERAL

- A. Ground all equipment, furnished by this Division or by others.
 - 1. Split-Bolt connection methods shall not be used.
- B. Provide building grounding as shown on drawings.
- C. Provide ground connection for electric service as shown on drawings.
- D. Provide ground connection for communication/special systems services including underground, aerial, and antenna delivery systems.
- E. All transformer enclosures and secondary neutrals shall be separately grounded. Do not ground directly to building steel. Refer to "single line diagram" and details on Drawings.
- F. Make fusion welds in strict accordance with supplier's instructions. Clamp cables securely in place, independent of mold. Clean and inspect all welds.
- G. At least one connection shall be made between the building ground, the electrical service ground for the building, and a metallic cold water pipe ground larger than one-inch trade diameter.
- H. Provide a 3/0 AWG copper ground wire connected on building side of the water meter to the metallic water pipe using suitable pipe clamps. Also provide a similar bonding jumper around the water meter that will remain in place whether the water meter is in place or not.
- I. Grounding cable shall not be buried directly in concrete, but a conduit sleeve shall be provided where cable passes through concrete.
- J. Where ground conductors are shown on Drawings and for all feeders, the use of the metallic raceway in place of the ground conductor shall not be permitted. Provide grounding bushings at each end of all low voltage feeder raceways. Where non-metallic conduit is used, be responsible for installing a code sized ground conductor, whether indicated or not.
- K. All grounding conductors run inside the building shall be run within NEC sized metallic raceways with raceway grounding bushings at each end

and bonding jumper to the enclosure or ground bus. Extend raceway to associated equipment enclosures and to within 6 inches of exposed ground terminal bar installations. Raceway installations shall be in accordance with Division 26 Section "Raceways."

1. Each ground conductor bus connection shall be terminated with individual compression lug and associated individual lug bolt.
 2. Split-bolt connection methods shall not be used for any application.
- L. Welded connections may have multiple ground conductors to suit mold and may be considered "continuous."

3.2 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 3. Use exothermic-welded connectors for outdoor locations. Only when a disconnect-type connection is indicated, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector

- to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.3 BUILDING GROUNDING INSTALLATIONS

- A. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.
- B. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
 1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
 2. Bury ground ring not less than 24 inches (600 mm) from building foundation.

3.4 UNDERGROUND INSTALLATIONS

- A. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
- B. Drive the ground rods to a minimum depth of ten feet, or more if necessary to reach permanent moisture. Ground rods shall be driven at least two feet away from the footing.
- C. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

- D. For service grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- E. All connections below grade shall be made with exothermic welds. Provide corrosion protection in acid soils.

3.5 ELECTRIC SERVICE AND TRANSFORMER GROUNDING INSTALLATIONS

- A. Make grounding connections electrically ahead of any overcurrent or disconnect device or tap connection such that disconnection of neutral load conductors does not interfere with or remove the system ground connection. Use separate lugs on the transformer neutral terminal for neutral and main grounding jumper when cable is used for transformer connections.
- B. Connect low voltage transformer grounds to common grounding electrode conductor(s) and not to building steel.
- C. Make all connections to the grounding electrode system accessible.

3.6 EQUIPMENT ROOM GROUND TERMINAL BAR INSTALLATION

- A. Install a complete grounding electrode system with interconnecting cables and terminations at electrical and communications equipment rooms.
- B. Install ground terminal bar in equipment rooms where shown on drawings. Mount bar by anchors and bolts using 1-1/2 inch long insulated spacer between bar and wall. Use a minimum of two supports 18 inch on center. Connect all grounding electrode system conductors, system enclosure ground bus, and other indicated electrode systems to the terminal bar.
 1. Where indicated on both sides of doorways, route bus up to top of doorframe, across top of doorway, down to specified height above floor, and connect to horizontal bus.

3.7 TELECOMMUNICATIONS SIGNAL GROUNDING SYSTEM INSTALLATION

- A. Install a complete telecommunications grounding electrode system with room grounding buses, grounding electrodes, and interconnecting cables per ANSI/EIA/TIA-607A.

- B. Install main and room ground bus bars at 18 inches AFF where indicated. Mount bus bar by anchors and bolts using 1-1/2 inch long insulated spacer between bar and plywood. Use a minimum of two supports for each bus bar.
 - 1. Provide signal ground (TBB) homeruns from TMGB to each TGB with insulated grounding conductor in conduit per Division 26 Section "Grounding and Bonding for Electrical Systems."
 - a. TBB shall be routed to highest TGB in a vertical of stack telecommunications rooms. TBB sized per length to furthest TGB from TMGB. Each TGB shall be connected to TBB in each TR with a maximum 8" grounding whip with irreversible connection.
 - 2. Lug main grounding bus to grounding electrodes with No. 1/0 grounding electrode conductor per Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Provide a Bonding Conductor (BC) terminated at the TMGB and the electrical service ground bar. Size similar to a TBB.
- D. Provide a grounding equalizer (GE) extending from TGB to TGB every three (3) floors in the building (and at top floor). Size similar to TBB.
- E. Provide an exterior service entrance grounding electrode system specific to telecommunications system.
 - 1. Install three (3) ground rods equidistant from each other (minimum of 6 feet).
 - 2. Extend BC to TMGB from one ground rod.
- F. Install room terminal ground bus directly adjacent to main and room ground buses at 18-inch AFF. Tie to room ground bus with bare No. 1/0 AWG.
- G. Terminate metallic telecommunications pathways (conduit, sleeves, cable trays, etc.) to building steel or ground and not to telecommunication grounding bus systems on both ends.
- H. All exterior/underground terminations shall be made with exothermic welds.
- I. Measure impedance of grounding conductors upon completion and record on as-built documents.

J. Size all TBB and Equipment Grounding Conductors for the following schedule:

INSULATED GROUNDING CONDUCTOR SIZING SCHEDULE

CONDUCTOR LENGTH (FEET)	INSULATED CONDUCTOR SIZE (AWG)	MAXIMUM AREA (CIRCULAR MILS)
13	6	26,240
21	4	41,740
26	3	52,620
33	2	66,360
42	1	83,690
53	1/0	105,600
67	2/0	133,100
84	3/0	167,800
106	4/0	211,600
125	250	250,000
150	300	300,000
175	350	350,000
200	400	400,000
250	500	500,000
300	600	600,000
350	700	700,000
375	750	750,000
400	800	800,000
450	900	900,000

CONDUCTOR LENGTH (FEET)	INSULATED CONDUCTOR SIZE (AWG)	MAXIMUM AREA (CIRCULAR MILS)
500	1000	1,000,000
625	1250	1,250,000
750	1500	1,500,000
875	1750	1,750,000
1000	2000	2,000,000

1. DESIGN GUIDE BASIS:
 - A. MAXIMUM VALUE OF 0.1 OHM AT
 - B. EACH POINT 2K CIRCULAR MILS
 - C. NEEDED FOR EVERY FOOT NEC TABLE 8

2. MINIMUM REQUIREMENTS:
 - A. EQUIPMENT GROUND CONDUCTOR: 6
 - B. AWG (MIN.) TELECOMMUNICATIONS BUILDING BACKBONE (TBB: 2 AWG (MIN.))

3.8 ELECTRICAL EQUIPMENT GROUND CONDUCTOR INSTALLATIONS

- A. Unless indicated otherwise, form one equipment ground circuit with rigid metallic raceways (e.g. EMT, rigid steel conduit) where used. Install a bonding jumper for continuity around all fittings and terminations where the conductive raceway is made non-continuous (i.e. underground feeder non-metallic raceways).
 1. Bond all grounding conductors to boxes or enclosures at each access point utilizing approved grounding kits. Do not use building steel as equipment grounding path.
 2. Bond all conductive metallic piping system in each mechanical equipment room as required by NEC 250-104B utilizing approved clamps. Minimum size of conductors as required by NEC. Locate all connections where access is unrestricted for inspection. Looping of conductor from one system to another is acceptable provided the conductor is without splice and has each end of loop bonded.
 3. If non-metallic raceways are used for power distribution feeders (i.e., panels, transformers, HVAC equipment), where the feeder is a single feeder and not a parallel feeder, a second insulated grounding conductors shall be provided inside the conduit (conduit

size shall be adjusted accordingly), or a bare grounding conductor shall be provided strapped to the outside of the conduit. The grounding conductor shall be the same size as the grounding conductor provided inside the conduit. Terminate at grounding bushings or bus on each end. Where the feeder is a parallel feeder, a second grounding conductor shall not be required.

4. Where non-metallic raceways are used for branch circuit wiring (such as lighting, receptacles and miscellaneous equipment circuits), a second insulated grounding conductor shall be provided inside the conduit (conduit size shall be adjusted accordingly), or, a bare grounding conductor shall be provided strapped to the outside of the conduit. The grounding conductor shall be the same size as the grounding conductor provided inside the conduit.
- B. Provide, in the same raceway with the associated phase and/or neutral conductors, a green colored equipment ground conductor having the same type insulation and connected as described below to provide equipment ground redundancy.
 1. Install a ground conductor in each raceway to augment the circuit formed by the metallic raceway system. Bond the conductor to each box or enclosure in which access is possible utilizing enclosure equipment ground kits, through metallic conduit insulated ground bushings or wedges and/or enclosure threaded grounding studs. Size conductor as specified, shown or required by Code, whichever is larger. Install a raceway grounding bushing and bonding jumper to the enclosure or contained ground bus for the following: each termination of conduits 1 inch trade size and larger at a switchboard, panelboard, or other enclosure, each location where multiple ring knockouts are damaged during conduit installation, each location where conduits are stubbed up into floor mounted enclosures; each conduit termination at a painted enclosure where paint is not removed before installation of raceway and each feeder.
 - a. All branch circuits shall be provided with an equipment grounding conductor sized per NEC Table 250-122. This includes all lighting and power branch circuits.
 - b. Provide a ground conductor to all light switches, receptacles, motors, light fixtures and all other branch circuit loads.
 - c. Install a ground conductor inside all flexible raceways (e.g., flexible steel, liquid tight). Bond the conductor to the enclosure or ground bus in the nearest box or access on either side of the flexible section. Size conductor as specified, indicated, or required by Code, whichever is larger.

- d. Install a ground conductor in all sectional raceways with removable covers for access (e.g. plug-in strips, surface raceway systems, and wireways) unless specified otherwise. Size conductor in accordance with the NEC for the largest phase conductor size installed in raceway, or as indicated. Bond all sections of the raceway to the ground conductors. Connect all receptacle ground terminals in the raceway to the ground conductor, and make other ground connections shown on Drawings.
 - C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
 - D. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
 - E. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
 - F. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
- 3.9 SURGE PROTECTION DEVICE PROTECTION DEVICE (SPD) GROUND CONDUCTOR INSTALLATIONS

- A. Extent transient voltage surge suppressor dissipation ground conductors to local equipment ground bus and to common grounding electrode conductors. Size conductors per (SPD) manufacturer recommendations and National Electrical Code. Refer to details on Drawings.

3.10 LABELING

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
 - 1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

- a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- E. Grounding system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 26 05 26

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Provide bases, inertia pads, steel supports, anchor bolts, inserts, etc., for all equipment and apparatus shown on Drawings.
- C. Floor-mounted electrical equipment shall be installed on 4-inch-high floor doweled concrete housekeeping pads with 4-inch equipment inset all sides. Concrete shall be in accordance with referenced concrete specification section.
- D. Provide formed steel support channels extending from the solidly anchored to floor and ceiling slabs and mount the designated equipment thereto.
- E. Provide Steel Support Channels For:
 - 1. Cable Trays.
 - 2. Disconnect Switches.
 - 3. Individual Motor Controllers.
 - 4. Individual Circuit Breakers.
 - 5. Raceways.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract, Division 01 Specification Sections, and Division 26 Section "Basic Division 26 Requirements".

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Steel slotted support systems.
 2. Nonmetallic slotted support systems.
- B. Shop Drawings:
1. Signed and sealed by a qualified professional engineer.
 2. Show fabrication and installation details and include calculations for the following:
 - a. Trapeze hangers. Include Product Data for components.
 - b. Steel slotted channel systems. Include Product Data for components.
 - c. Nonmetallic slotted channel systems include Product Data for components.
 - d. Equipment supports.

1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit, a Division of Tyco.
 - b. Line Systems.
 - c. Cooper B-Line, Inc.; a Division of Cooper Industries.
 - d. ERICO International Corporation.
 - e. GS Metals Corporation.
 - f. Thomas & Betts Corporation.
 - g. Unistrut; Tyco International, Ltd.
 - h. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 5. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a Division of Cooper Industries.
 - c. Fabco Plastics Wholesale Limited.
 - d. Seasafe, Inc.
 - 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 - 3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
 - 4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Power-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti, Inc.
 - 2) ITW Ramset/Red Head; a Division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; MasterSet Fastening Systems Unit.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a Division of Cooper Industries.

- 2) Empire Tool and Manufacturing Co., Inc.
- 3) Hilti, Inc.
- 4) ITW Ramset/Red Head; a Division of Illinois Tool Works, Inc.
- 5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with NEC, NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Take care not to weaken concrete or penetrate waterproofing where equipment supports are on concrete construction.
- C. Obtain prior approval for installation method of structural steel required to frame into building structural members for the support of equipment, conduit, etc. Welding shall be permitted only when approved by Engineer's field representative.
- D. Coordinate with the building structural system and with other electrical installation.
 1. Metal Decking: Nothing is to be suspended from metal roof decks (no concrete).

- E. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel or angle iron racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.
- F. In overhead spaces, boxes shall be supported independently of raceways and raceways independent of the boxes. Support boxes directly from the building structure or by bar hangers.
 - 1. Where bar hangers are used for boxes, attach the bar to raceways on opposite sides of the box and support the raceway with an independent approved type of fastener not more than 24 inches from the box. To clarify, box or raceway removal should not require re-supporting of the other.
- G. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where it's Table 1 lists maximum spacing less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- H. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with single-bolt conduit clamps single-bolt conduit clamps using spring friction action for retention in support channel.
- I. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1- 1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NEC, NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 6. To Light Steel: Sheet metal screws.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Coordinate dimensions of concrete housekeeping pads with requirement for equipment supplied.

- B. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- C. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section Cast-in-Place Concrete.
- D. Anchor equipment to concrete base:
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 34

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL**1.1 SECTION INCLUDES**

- A. Metal Conduit.
- B. Surface Mounted Raceway.
- C. Fittings and Conduit Bodies.
- D. Pull and Junction Boxes.

1.2 RELATED SECTIONS

- A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions and Supplementary Conditions within Section 10 – Standard General Provisions.
- B. Section 26 00 10 - Division 26 – Basic Division 26 Requirements
- C. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
- D. Section 26 05 29 – Hangers and Supports for Electrical Systems.
- E. Section 26 05 33 – Hazardous Location Conduit Outlet Bodies and Fittings
- F. Section 26 05 34 – Raceway and Boxes for Electrical Systems
- G. Section 26 05 35 – Boxes and Cabinets
- H. Section 26 05 53 – Electrical Identification
- I. Section 26 05 75 – Conduit Rough-In Systems.
- J. Section 26 27 26 – Wiring Devices.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
 - 2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
 - 3. ANSI C80.5 - Rigid Aluminum Conduit.
- B. American Society for Testing and Materials (ASTM):

1. ASTM A 123 – Specification for Zinc Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip.
- C. National Electrical Manufacturers Association (NEMA):
1. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 2. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 3. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
 4. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
 5. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
 6. NEMA TC 7 - Smooth-Wall Coilable Polyethylene Electrical Plastic Conduit.
 7. UL651B – Continuous Length HDPE Conduit.
 8. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code.
- E. Telecommunications Industry Association (TIA) and Electronics Industries Association (EIA):
1. ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard.
- F. Building Industry Consulting Service International (BICSI):
1. BICSI Telecommunication Design Methods Manual.
- G. International Building Code (IBC):
1. IBC chapters 16 and 17 seismic requirements.

1.4 RACEWAY AND BOX INSTALLATION SCHEDULE

- A. Raceway Minimum Size:
1. Below Grade: Provide 1 inch minimum, unless otherwise noted.
 2. Above Grade or Slab on Grade: Provide 3 / 4inch minimum, unless otherwise noted.
- B. In or through CMU walls:
1. Raceway: Provide rigid steel conduit or intermediate metal conduit. EMT conduit may penetrate through CMU walls where the EMT is installed in a sleeve and does not come in direct contact with the CMU. All conduit in contact with concrete or block shall be rigid steel conduit half lapped wrapped with pipe wrap or be plastic-coated conduit.
 2. Boxes and Enclosures: Provide concrete tight cast and sheet metal steel metal boxes.
- C. Damp or Wet Interior/Exterior Locations:
1. Raceway: Provide rigid steel conduit or intermediate metal conduit.
 2. Boxes and Enclosures: Provide weatherproof malleable iron for branch circuit junction and outlet boxes. Provide weatherproof NEMA 3R sheet metal enclosures for safety and disconnect switches.

3. Fittings: Provide galvanized malleable iron with gaskets. Provide Myers threaded hubs for all conduit entries into top and side of sheet metal enclosures.
- D. Concealed Dry Locations:
1. Raceway: Provide rigid steel conduit, intermediate metal conduit, or electrical metallic tubing.
 2. Boxes and Enclosures: Provide sheet-metal boxes.
 3. Fittings: Provide galvanized malleable iron and steel.
- E. Exposed Dry Locations:
1. Raceway: Provide rigid steel conduit or intermediate metal conduit. EMT conduit may be used where it is not subject to physical damage or where installed on the ceiling or a minimum of ten feet above the floor.
 2. Boxes and Enclosures: Provide sheet-metal boxes with raised steel covers.
 3. Fittings: Provide galvanized malleable iron and steel.
 4. Surface Raceway and Boxes. Where specifically noted on the Drawings, provide surface raceway and boxes.
- F. Hazardous Locations:
1. Raceway: Provide rigid steel conduit or intermediate metal conduit UL listed for Class 1 Division 1 or Class 1 Division 2 areas.
 2. Boxes and Enclosures: Provide Class 1 Division 1 or Class 1 Division 2 devices as needed.
 3. Fittings: Provide fitting per section 26-0533. Threads shall engage minimum of 5 threads per connection.
 4. Surface Raceway and Boxes. Where specifically noted on the Drawings, provide surface raceway and boxes.

1.5 DESIGN REQUIREMENTS

- A. Raceway Minimum Size:
1. Line Voltage Circuits: Raceway is sized on the drawings for copper conductors with 600-Volt type insulation, unless otherwise noted. Where a raceway size is not shown on the drawings, it shall be calculated to not exceed the percentage fill specified in the NEC Table 1, Chapter 9 using the conduit dimensions of the NEC Table 4, Chapter 9 and conductor properties of the NEC Table 5, Chapter 9.
- B. Box Minimum Size: Provide all boxes sized and configured per NEC Article 370 and as specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

PART 2 - PRODUCTS

2.1 RIGID METAL CONDUIT (RMC)

- A. Rigid Steel Conduit: ANSI C80.1, UL 6.
- B. Fittings and Conduit Bodies: NEMA FB 1, UL 514B; Galvanized malleable iron with threaded hubs for all conduit entries. Provide threaded connections and couplings only. Set Screw and running thread fittings are not permitted.
- C. Provide insulated throat bushings at all conduit terminations.

2.2 INTERMEDIATE METAL CONDUIT (IMC)

- A. Product Description: ANSI C80.6, UL 1242; Galvanized Steel Conduit.
- B. Fittings and Conduit Bodies: NEMA FB 1, UL 514B; use fittings and conduit bodies specified above for rigid steel conduit.
- C. Provide insulated throat bushings at all conduit terminations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Ground and bond raceway and boxes in accordance with Section 26 05 35.
- B. Identify raceway and boxes with origin and destination in accordance with Section 26 05 34.
- C. Unless otherwise noted, do not inter-mix conductors from separate panelboards or any other system in the same raceway system or junction boxes.

3.2 INSTALLATION - GENERAL RACEWAY

- A. Install raceway for all systems, unless otherwise noted.
- B. Install an equipment grounding conductor inside of all raceways containing line voltage conductors.
- C. Provide raceways concealed in construction unless specifically noted otherwise, or where installed at surface cabinets, motor and equipment connections and in Mechanical and Electrical Equipment rooms. Do not route conduits on roofs, outside of exterior walls, or along the surface of interior finished walls unless specifically noted on the plans.
- D. Raceway routing and boxes are shown in approximate locations unless dimensioned. Where raceway routing is not denoted, field-coordinate to provide complete wiring system.

- E. Do not route raceways on floor. Arrange raceway and boxes to maintain a minimum of 6 feet 6 inches of headroom and present a neat appearance. Install raceways level and square to a tolerance of 1/8" per 10 feet. Route exposed raceways and raceways above accessible ceilings parallel and perpendicular to walls, ceiling, and adjacent piping.
- F. Maintain minimum 6-inch clearance between raceway and mechanical and piping and ductwork. Maintain 12-inch clearance between raceway and heat sources such as flues, steam pipes, heating pipes, heating appliances, and other surfaces with temperatures exceeding 104 degrees F.
- G. Do not install raceway imbedded in spray applied fire proofing. Seal raceway penetrations of fire-rated walls, ceilings, floors in accordance with the requirements of Section 26 05 00 and Division 07.
- H. Where raceway penetrates fire-rated walls and floors, seal opening around conduit with UL listed firestop sealant or intumescent firestop, preserving the fire time rating of the construction. Install in accordance with manufacturer's instructions.
- I. Raceways and boxes penetrating vapor barriers or penetrating areas from cold to warm shall be taped and sealed with a non-hardening duct sealing compound to prevent the accumulation of moisture and shall include a vapor barrier on the outside.
- J. Arrange raceway supports to prevent misalignment during wiring installation. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- K. Do not attach raceway to ceiling support wires or other piping systems and do not fasten raceway with wire or perforated pipe straps. Remove all wire used for temporary raceway support during construction before conductors are pulled. Raceway shall be installed to permit ready removal of equipment, piping, ductwork, or ceiling tiles.
- L. Group raceway in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps, as specified in Section 26 05 29. Provide space on each rack for 25 percent additional raceway.
- M. Cut conduit square; de-burr cut ends. Bring conduit to the shoulder of fittings and couplings and fasten securely. Where locknuts are used, install with one inside box and one outside with dished part against box.
- N. Use threaded rain tight conduit hubs for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations. Sealing locknuts are not acceptable.

- O. Install no more than the equivalent of three 90-degree bends between boxes.
- P. Install conduit bodies to make sharp changes in direction, such as around beams. "Goosenecks" in conduits are not acceptable.
- Q. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2-inch size.
- R. Provide protective plastic bushings or insulated throat bushings at each raceway termination not installed to an enclosure. Bushings shall be threaded to the raceway end or connector.
- S. Avoid moisture traps; install junction box with drain fitting at low points in raceway system.
- T. Install fittings and flexible metal conduit to accommodate 3-axis movements where raceway crosses seismic joints.
- U. Install fittings designed and listed to accommodate expansion and contraction where raceway crosses control and expansion joints.
- V. Use cable sealing fittings forming a watertight non-slip connection to pass cords and cables into conduit. Size cable sealing fitting for the conductor outside diameter. Use Appleton CG series or equal cable sealing fittings.
- W. Use suitable caps to protect installed raceway against entrance of dirt and moisture.
- X. Provide nylon "jet-line" or approved equal pull string in empty raceway, except sleeves and nipples.
- Y. Paint all exposed conduit to match surface to which it is attached or crosses, where required by the Owner. Clean greasy or dirty conduit prior to painting in accordance with paint manufacturer's instructions. Where raceway penetrates non-rated ceilings, floors or walls, provide patching, paint and trim to retain architectural aesthetics similar to surroundings.

3.3 INSTALLATION – GENERAL BOXES

- A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance. All electrical box locations shown on Drawings are approximate unless dimensioned.
- B. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only. Where installation is inaccessible, install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaries.

- C. Coordinate layout and installation of boxes to provide adequate headroom and working clearance. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- D. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- E. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems and where normal and emergency power circuits occur in the same box.
- F. Adjust box location up to 6 feet prior to rough-in to accommodate intended purpose.
- G. Locate and install boxes to maintain headroom and to present a neat appearance.
- H. Locate flush-mounted box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- I. Provide knockout closures for unused openings.
- J. Install boxes in walls without damaging wall insulation or reducing its effectiveness.
- K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. For outlet boxes in walls with combustible finished surfaces such as wood paneling or fabric wall coverings, position box to be flush with finished surface per NEC requirements.
- L. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes. Accurately position bridges to allow for surface finish thickness.
- M. Do not install flush mounted boxes back-to-back in walls; install with minimum 6 inches separation.
- N. Install with minimum 24 inches separation in fire rated walls. Limit penetrations in fire rated walls to 16 square inches each and a maximum total combined penetration area of 100 square inches in any given 100 square feet of wall. Where penetrations are in excess of these requirements provided UL listed fire stop wrap acceptable to Authority having Jurisdiction.
- O. Do not fasten boxes to ceiling support wires or other piping systems.
- P. Support boxes independently of conduit.
- Q. Clean interior of boxes to remove dust, debris, and other material and clean exposed surfaces and restore finish.
- R. Provide blank covers or plates for all boxes that do not contain devices.

END OF SECTION 26 05 34

SECTION 26 05 35

BOXES AND CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes cabinets, boxes and fittings for electrical installation and certain types of electrical fittings not covered in other sections. Types of products specified in this Section include:
1. Steel Device Boxes.
 2. Cast Device Boxes.
 3. Pull and Junction Boxes.

1.2 RELATED DOCUMENTS

- A. Requirements of Division 07 Section "Firestopping Penetrations" apply to this Section.
- B. Conduit-body type electrical enclosures and raceway fittings are specified in Section "Raceways."
- C. Requirements of the following Division 26 Sections apply to this Section:
1. Section "Basic Division 26 Requirements."
 2. Section "Raceways."
 3. Section "Hangers and Supports for Electrical Systems."
 4. Section "Electrical Identification."
 5. Section "Grounding and Bonding for Electrical Systems."

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract, Division 01 Specification Sections, and Division 26 Section "Basic Divisions 26 Requirements".

1.4 ACTION SUBMITTALS

- A. Shop drawings:
1. For the following raceway components, include plans, elevations, sections, details and attachments to other work:
 - a. Conduit fittings.

1.5 COORDINATION

- A. Coordinate wall and floor box and cabinet in rated walls with Division 07 firestopping installer to ensure rating is maintained.

1.6 QUALITY ASSURANCE

- A. UL Listing and Labeling: Items provided under this section shall be listed and labeled by UL.
- B. National Electrical Code Compliance: Components and installation shall comply with NFPA 70 "National Electrical Code."
- C. NEMA Compliance: Comply with NEMA Standard 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
- B. Steel Device Boxes:
 - 1. EGS/Appleton Electric Co.
 - 2. Midland Ross Corp. (Steel City).
 - 3. Raco; a Hubbell Co.
 - 4. Thomas & Betts Corporation
- C. Cast Device Boxes:
 - 1. EGS/Appleton Electric Co.
 - 2. Crouse Hinds Electrical Construction Material; Div. Of Cooper Industries, Inc.
 - 3. Killark Electric Manufacturing Co.
 - 4. O-Z/Gedney, a General Signal Co.
- D. Pull and Junction Boxes:
 - 1. O-Z/Gedney, a General Signal Co.
 - 2. Crouse Hinds; Div. of Cooper Industries, Inc.
 - 3. Appleton Electric Co.
 - 4. Hoffman Engineering Co.
 - 5. Lee Products.
 - 6. Hammond Manufacturing.
 - 7. Electromate Corporation.
- E. Cabinets:
 - 1. Galvanized Sheet Steel:
 - a. Square-D.
 - b. Chicago Switchboard.
 - c. Cutler Hammer/Westinghouse.
 - d. General Electric.
 - e. Hoffman Engineering Co.

- f. Illinois Switchboard.
- g. Lee Products.
- h. Crenlo, Inc.
- i. Hammond Manufacturing.
- j. Electromate Corporation.
- k. Sheet Aluminum.
- l. Siemens
- m. Hennessy Products, Inc.
- n. Wiegman, a Division of Hubbell Inc.

2.2 CABINETS AND BOXES - GENERAL

- A. Electrical Cabinets and Boxes: Of indicated types, sizes and NEMA enclosure classes. Where not indicated, provide units of types, sizes and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations. Box depth shall exceed depth of installed device by 1/4 inch.

2.3 MATERIALS AND FINISHES

- A. Sheet Steel: Flat-rolled, code-gage, galvanized steel.
- B. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.
- C. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.
- D. Cast Metal for Boxes, Enclosures and Covers: Copper-free aluminum except as otherwise specified.
- E. Exterior Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.
- F. Painted Interior Finish: Where indicated, white baked enamel.
- G. Fittings for Boxes, Cabinets and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, with ground terminal bushings and box connectors.

2.4 STEEL DEVICE BOXES

- A. General:
 1. Fabricate from galvanized or cadmium plated pressed sheet steel, with covers, extension, etc., as required by the installation.
 2. Box depth shall exceed depth of installed device by 1/4 inch.

B. Outlet, Receptacle, Device, and Junction Boxes:

1. 4-inch square by 1-1/2-inch depth minimum, without clamps for either conduit or tubing.
2. 4-11/16-inch square by 1-1/2-inch depth minimum, without clamps for either conduit or tubing.

2.5 CAST DEVICE BOXES

A. General:

1. Copper-free aluminum or malleable iron with matching cast cover.

B. Switch Boxes:

1. FS or FD series, single, two, multi-gang as required for wiring device arrangement.

C. Outlet, Receptacle, Device, and Junction Boxes:

1. FD series, single, two, multi-gang as required for wiring device arrangement.

2.6 PULL AND JUNCTION BOXES

A. General:

1. NEMA type and size as required by area or as shown, complete with matching cover. Where necessary, gaskets shall be used to prevent entrance of moisture.

B. Galvanized Sheet Steel:

1. Minimum 14-gauge, solder or braze all seams, roll edges at openings and bolt on covers.

C. Cast Iron:

1. Corrosion resistant, hot dip galvanized and bolt on cast cover utilizing stainless steel screws.

D. Cast Aluminum:

1. Non-rusting, non-sparking, non-magnetic and bolt on cast cover utilizing stainless steel screws.

E. Cast Bronze:

1. Non-rusting, non-sparking, non-magnetic and bolt on cast cover utilizing brass screws.

2.7 CABINETS

A. Comply with UL 50, "Electrical Cabinets and Boxes."

B. General: NEMA type and size as required by area, application, or as shown. Cabinet shall consist of a box and a front consisting of a one-piece frame and

hinged door. Hinged side shall be dependent upon physical application. Arrange door to close against a rabbet placed around the inside edge of the frame, with a uniformly close fit between door and frame. Provide concealed fasteners, not over 24 inches apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24 inches apart and not over 6 inches from top and bottom of door. Louvers for cabinet ventilation shall be provided as required by application. For flush cabinets, make the front approximately 3/4 inch larger than the box all around. For surface mounted cabinets make front same height and width as box.

- C. Doors: Double doors for cabinets wider than 24 inches. Cabinets wider than 48 inches may have sliding or removable doors.
- D. Locks: Combination spring catch and key lock, with all locks for cabinets of the same system keyed alike. Locks may be omitted on signal, power and lighting cabinets located within wire closets and mechanical-electrical rooms. Locks shall be of a type to permit doors to latch closed without locking. Latch shall be padlocking type for exterior applications.
- E. Galvanized Sheet Steel: Minimum 14-gauge, solder or braze all seams, roll edges at openings and minimum 12-gauge doors to match panelboard enclosures.
- F. Sheet Aluminum: Minimum .125 inch 5052-H32 sheet aluminum thickness, welded seams, gasketed weathertight door, weather-resistant hinge, and weather-resistant padlockable latching mechanism.

2.8 ACCESSORIES

- A. Provide grounding kits and/or stabs for each box and cabinet.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install items where indicated and where required to suit code requirements and installation conditions.
- B. Maintain the environmental rating of the enclosures. Install in the openings only listed or recognized conduit hubs or control devices with the same integrity as the enclosure, in compliance with the installation instructions of the device.
 1. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
 2. Use listed enclosure conduit connectors to maintain raceway to enclosure ground integrity. Cut through paint as applicable. Cutting slots shall not be acceptable for conduit entries into enclosures.

- C. Support and fasten items securely in accordance with Division 26 Section "Hangers and Supports for Electrical Systems."
 - 1. Fasten boxes to or support from building structure. Do not support boxes by raceways.
- D. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.
- E. Remove sharp edges where they may come in contact with wiring or personnel.
- F. Refinish and paint enclosures in field due to any field modifications.

3.2 APPLICATIONS

- A. Furnish electrical identification as indicated in Division 26 Section "Electrical Identification."
- B. Cabinets: Flush mounted, NEMA enclosure type 1 except as otherwise indicated.
- C. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements.
 - 1. Interior Dry Locations: NEMA type 1, sheet steel or nonmetallic as permitted by local code.
 - 2. Interior Dry Locations: Sheet steel, NEMA type 1.
 - 3. Interior Dry Locations: Nonmetallic, NEMA type 1.
 - 4. Interior Exposed to Weather or Dampness: Cast metal, NEMA type 3.
 - 5. Locations Exposed to Weather or Dampness: Cast metal, NEMA type 3R.
 - 6. Locations Exposed to Weather or Dampness: Molded PVC or glass fiber reinforced plastic, NEMA type 3.
 - 7. Locations Exposed to Weather or Dampness: Molded PVC or glass fiber reinforced plastic, NEMA type 3R.
 - 8. Wet Locations: NEMA type 4 enclosures.
 - 9. Corrosive Locations: NEMA type 4X enclosures.
 - 10. Hazardous (Classified) Locations: NEMA type listed and labeled for the location and class of hazard indicated.
- D. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location except as otherwise indicated.
- E. Floor Boxes: In slabs on grade and wet locations, use cast iron (or non-metallic) boxes. At other locations in slabs, use concrete-tight stamped steel boxes.
 - 1. When non-metallic is used, assure ground continuity to wiring devices and for through box branch circuits.
 - 2. Coordinate plate assemblies for applicable floor construction.

3.3 INSTALLATION OF BOXES

- A. Size all boxes as required by the National Electrical Code with oversize boxes as shown on Drawings. Obtain special backboxes with associated equipment when available.
- B. Provide where required for outlet facility and rough-in requirements. Securely support from building construction with rods or bar hangers independent of raceways. Provide backing extension for all steel device boxes in stud walls or support box on two opposite sides such that cover plate and drywall is not stressed to hold box in position.
- C. Give priority in available space to large steam mains, steam lines that pitch, waste lines, drain lines, large air duct, and all structural steel, unless shown otherwise.
 - 1. Minimum Spacing: 3 inches between boxes and cold water or waste piping and 6 inches between boxes and parallel steam pipes, condensate pipes, hot water pipes and air ducts.
 - 2. Do not support from ceiling supporting system, mechanical system supports or mechanical systems.
 - 3. Do not penetrate or anchor into mechanical ductwork.
- D. Install recessed except where shown or specified surface mounted.
- E. Maintain accessibility to all boxes. Z-spline ceilings are considered not accessible.
- F. Size and install so no part is visible and is completely covered by wall plate or fixture.
- G. Do not cut insulation in walls to install boxes.
- H. Do not use through-the-wall boxes.
- I. Recessed boxes shall not be installed back-to-back.
- J. Locate boxes so that cover or plate will not span different building finishes.
- K. In each instance where two or more device boxes are generally located in the same vicinity and at the same mounting height, mount those devices in a common multi-gang barriered box as appropriate for the device types.
 - 1. Maintain box and raceway separations per NEC. Pullbox barriers will not be acceptable except for special cases brought to the engineer's attention prior to installation.

- L. In each instance where two or more device boxes are generally located in the same vicinity and at different elevations, mount the boxes vertically on a common centerline.
- M. Install in center of glazed tile, brick, block or other masonry wall material with square cornered tile or masonry extension rings of proper depth.
- N. Install outlet boxes in sheet rock walls with square cornered tile or masonry rings of proper depth. Standard drywall rings will not be acceptable. Maintain NEC required tolerances.
- O. Close off all unused openings with proper fittings.
- P. Install outlet boxes for electric water coolers concealed inside cooler cabinet. Locate outlet boxes using rough-in template furnished with cooler.
- Q. Combination devices (i.e. switch and receptacle) installed in minimum 2 gang box under common wall plate.
- R. Provide box and cabinet barriers to segregate voltages 300 volts and greater and to segregate normal and emergency distribution system branches.
- S. Set floor boxes level at height to match trim with flooring type.

3.4 INSTALLATION OF PULL AND JUNCTION BOXES

- A. All boxes shall be concealed and accessible after completion of building.
- B. Installation in finished spaces requiring access panels is prohibited except where specifically shown or directed.

3.5 BOX IDENTIFICATION

- A. Per Division 26 Section "Electrical Identification."

3.6 BOX COVERS

- A. Provide appropriate screw cover for all boxes dependent upon type and application.
- B. Provide spannerhead screws for exposed covers in psychiatric and high security areas.

3.7 BOX APPLICATION

- A. Exterior walls shall not be considered interior dry locations for recessed exterior devices. Sheet steel boxes shall not be used.

- B. Galvanized steel boxes may be used in:
 - 1. Concealed interior locations above ceilings and in hollow studded partitions.
 - 2. Exposed interior location above seven feet.
 - 3. Direct contact with concrete except slab on grade.
 - 4. Stud walls of kitchens and laundries.
- C. Cast boxes shall be used in:
 - 1. Exterior locations.
 - 2. Hazardous locations.
 - 3. Within seven feet area around boilers, incinerators and other heat producing equipment.
 - 4. Exposed interior locations within seven feet of the floor.
 - 5. Direct contact with earth.
 - 6. Direct contact with concrete in slab on grade.
 - 7. Wet locations.
 - 8. Kitchens and laundries except in stud walls.
- D. Sectional Boxes:
 - 1. Shall not be used in any application.

3.8 INSTALLATION OF CABINETS

- A. Support securely independent from building construction and align with adjacent equipment. Top shall be 6 foot - 2 inches to top of trim.

3.9 GROUNDING

- A. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box, or enclosure.

3.10 CLEANING AND FINISH REPAIR

- A. Upon completion of installation, inspect components. Remove burrs, dirt and construction debris and repair damaged finish including chips, scratches, abrasions, and weld marks.
- B. Galvanized Finish: Repair damage using a zinc-rich paint recommended by the tray manufacturer.
- C. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating.

END OF SECTION 26 05 35

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Identification for raceway and cable.
 - 2. Identification for conductors and communication and control cable.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.
- B. Requirements of the following Division 09 Sections apply to this Section:
 - 1. Section "Interior Painting."
 - 2. Section "Exterior Painting."

1.2 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract, Division 01 Specification Sections, and Division 26 Section "Basic Division 26 Requirements".

1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated including labeling machines if used.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification specific products.
- C. Drawing: Depicting specific nomenclature for instruction signs including control-by-event or explanation of systems operations for:
 - 1. Switchboards.
 - 2. Remotely grounded equipment.
- D. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.

- B. Comply with NFPA 70 and NFPA 70E.
- C. Comply with 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 1. Brady USA, Inc. Industrial Products Division.
 2. BW Industries, Inc.
 3. Ideal Industries, Inc.
 4. Rhino/DYMO, a Newell Rubbermaid Company.
 5. Seton Name Plate Corporation.

2.2 FONT

- A. Arial uppercase.
- B. Text abbreviations other than equipment identifications permitted only as approved.

2.3 RACEWAY AND CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for System Identification and Printed Text:
 - 1. Per system or NEC branch color coding specified.
 - 2. Identification Label: Indicate system or service. Include branch and voltage text for NEC electrical distribution.
- C. Self-adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather and chemical-resistant coating, and matching wraparound adhesive tape for securing ends of legend label.

2.4 BOX WIRING IDENTIFICATION MATERIALS

- A. Self-adhesive Write-On Tags: Vinyl type with black pre-printed "System/Panelboard:", "Circuit No:" and "Load:" in three fill in lines on white field.
 - 1. Marker for Tags: Permanent, waterproof, blank ink marker recommended by tag manufacturer.
- B. Self-Adhesive Labels: Field machine printed by thermal transfer or equivalent process with System/Panelboard, Circuit No. and Load text.
- C. Metal Tags: Brass or aluminum, length as required for text by 2 by 0.05 inch (50 by 1.3 mm), with stamped text, punched or drilled for screw mounting.

2.5 CONDUCTOR AND COMMUNICATION AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Color Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Marker Tapes: Vinyl or vinyl cloth, self-adhesive wraparound type, with circuit identification text machine printed by thermal transfer or equivalent process.
- C. Aluminum Wraparound Marker Labels: Cut from 0.014 inch (0.35-mm- thick aluminum sheet, with stamped, embossed, or scribed text, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped text, punched for use with self-locking nylon tie fastener.
- E. Tie-On Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
- F. Self-adhesive Write-On Tags: Vinyl type with black pre-printed "System/Panelboard:", "Circuit No.:", and "Load:" in three fill in lines on white field.
 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.6 FLOOR MARKING TAPE

- A. 3-inch (75-mm) wide, 5 mil (0.12 -mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.7 UNDERGROUND LINE WARNING TAPE

- A. Description: Permanent, yellow colored, continuous-printed, polyethylene tape.
 1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
 2. Compounded for permanent direct-burial service.
 3. Embedded continuous metallic strip or core.
 4. Printed text shall indicate type of underground line.

2.8 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Baked Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4 mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Metal Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch (1 mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4 mm) grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).

2.9 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
 1. Engraved text with black letters on white face.

2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Electrical Assembly Single-Line:
1. Framed acrylic screw mounted full size record drawing.
 2. Printed operating instructions may be included as an option to separate signage.

2.10 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label: Machine printed, color coded by system, by thermal transfer or equivalent process. Minimum letter height shall be 1/2 inch (6.4 mm).
- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, color coded by system, by thermal transfer or equivalent process. Minimum letter height shall be 1/2 inch (6.4 mm). Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.
- C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, color coded by system. Minimum letter height shall be 1/2 inch (6.4 mm).
- D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting, color coded by system. Minimum letter height shall be 1/2 inch (6.4 mm).
- E. Stenciled Text: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.11 COMPONENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Minimum letter height shall be 1/4 inch.

2.12 ABOVE CEILING EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Dot Label: 1/2-inch vinyl dot color coded by system.

2.13 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws, or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION**3.1 GENERAL COLOR CODING OF SYSTEMS**

- A. Provide NEC electrical distribution branch color coding as follows:

1. Normal:
 - a. System ID or Black
 - b. Text: White
 - c. Conductors: Per associate
2. Generator:
 - a. System ID or Green
 - b. Text: White
 - c. Conductors: Per associated
3. Emergency:
 - a. System ID or Yellow
 - b. Text: Black
 - c. Conductors: Per associated

- B. Provide Division 23 systems color coding as follows:

1. Building Automation System:
 - a. System ID or Orange
 - b. Text: Yellow
 - c. Cable Jacket: Orange with Yellow

- C. Provide Division 26 systems color coding as follows:

1. Center Hung Cable Tray (tips):
 - a. System ID: Per associated Section
2. Wiring Devices and Wall Plates:
 - a. System ID: Per associated Section
3. Lighting Control Systems:
 - a. System ID or Gray
 - b. Text: White
 - c. Cable Jacket: Gray with White
4. Miscellaneous Control:
 - a. System ID or Gray
 - b. Text: Yellow
 - c. Cable Jacket: Gray with Yellow

- D. Provide Division 27 systems color coding as follows:

1. Structured Cabling:
 - a. System ID/Cable Jacket:
 - 1) OF Multimode Orang
 - 2) OF Multimode Aaua
 - 3) OF Singlemode Yellow
 - 4) Copper backbone Gray
 - 5) Horizontal cable Blue

- b. Nameplate/Text: Per EIA/TIA
 - c. Raceway: Yellow
 - 2. [Voice][Telephone]:
 - a. System ID/Cable Jacket:
 - 1) Copper Gray
 - 2) Horizontal cable Yello
 - b. Nameplate/Text: Per EIA/TIA
 - c. Raceway/Innerduct: Blue
 - 3. Public Address:
 - a. System ID/Cable Gray
 - b. Nameplate: Dark
 - c. Text: White
 - d. Raceway: White
 - 4. [Audio-Visual][Television][Video]:
 - a. System ID/Cable TP Purple or Coax
 - b. Nameplate: Dark Brown
 - c. Text: Yellow
 - d. Raceway: Black
 - 5. Intercom:
 - a. System ID/Cable Gray
 - b. Nameplate: Light
 - c. Text: Black
 - d. Raceway: White
- E. Provide Division 28 systems color coding as follows:
- 1. Security:
 - a. System ID/Cable Green
 - b. Nameplate: Dark
 - c. Text: White
 - d. Raceway: Yellow
 - 2. Door Monitoring and Access Control:
 - a. System ID/Cable Yellow
 - b. Nameplate: Dark
 - c. Text: Yellow
 - d. Raceway/ Inner-duct: Yellow
 - 3. Fire Alarm:
 - a. System ID/Cable Red
 - b. Nameplate: Red
 - c. Text: Whi
 - d. Raceway: Red

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products. Use Drawing nomenclature unless otherwise directed.

- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceway Systems and Cables: Each color band shall completely encircle cable or raceway. Place adjacent bands of two-color markings in contact, side by side.
- G. Box and Equipment Identification: Attach to box or enclosure cover in location with high visibility.
- H. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed in Division 26 Section "Low Voltage Electrical Power Conductors and Cables (100-600 Volts)" for ungrounded service, feeder conductors.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- I. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- J. Underground Line Warning Tape: During backfilling of trenches, install continuous underground- line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
- K. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

3.3 APPLICATION

- A. Raceway Systems and Cables Identification:
 - 1. Accessible Raceways, AC and MC Cables, 600 V or Less, for Service,

Feeder, and Branch Circuits More Than 30 amperes: Identify with self-adhesive vinyl label per NEC electrical distribution branch color coding including identification label. Install at box and conduit fittings within 12 inches, each side of joints, and at bushed conduits.

2. Accessible Raceways and Cables of Division 23 through 28 Systems: Identify the systems with preprinted identification label, self-adhesive vinyl tape applied in bands per color coding. Install at box and conduit fittings within 12 inches, each side of joints, and at bushed conduits.
 - a. Exception: No identification required for raceways and cable with readily identifiable terminations within the same room.

B. Box Identification:

1. Color-coded, field painting: Initial color-coded field painting of inside of system boxes and enclosures is allowable for Contractor identifications during wiring installation.
2. Wiring Identification: Identify Division 21-28 system or panelboard, circuit number, and load on outside of box cover with self-adhesive vinyl labels.
 - a. For finished areas or exterior areas, locate identification inside box cover.

C. Conductor Identification:

1. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number.
2. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source and circuit number.
3. Pull wires in Empty Raceways: Tag pull wires at each end and in each intermediate box, manhole, or other enclosure identifying other end location using metal tags.
4. Division 23 through 28 Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
 - a. Identify conductors, cables, and terminals within boxes, enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - b. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - c. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

D. Device Wall Plate Identification:

1. Device Wall Plate Identification: Engrave plates below with 1/8-inch-high black uppercase letters.
2. All Emergency Red NEMA 5-15R and 5-20R receptacles shall be labeled with self-adhesive typed label with the following branch

- circuit source information:
- a. "EMERGENCY."
 - b. Panelboard number.
 - c. Circuit number.
 - d. Example: "EMERGENCY/1LSL1-3."
3. Other than NEMA 5-15R and 5-20R receptacles shall be labeled with self-adhesive typed label with the following:
 - a. Voltage.
 - b. Number of phases.
 - c. Current rating.
 - d. Example: "208/3P/50A."
 4. Receptacles protected upstream on associated branch circuit by a ground fault circuit interrupter device shall be laser or mechanically/engraved "GFCI PROTECTED."
 5. Switch used as equipment or motor disconnect shall be laser or mechanically engraved "Disconnect/ (Device Designation)" (i.e., "Disconnect/Ice Machine", "Disconnect/D4-EF01", etc.).
 6. Special systems/communication systems devices (i.e., firephone receptacles) shall be laser or mechanically engraved designating device type per Owner representative requirements (i.e., FIREPHONE, DATA, EKG, TEL, TV, etc.).
 7. 4-gang and larger multiple switch installations shall be laser or mechanically engraved with designating lighting type and/or area (i.e., Night Light, North, etc.)
 8. Wiring device circuit identification for NEMA 5-15R and NEMA 5-20R receptacles and all switches other than emergency use [red] NEMA 5-15R and 5-20R receptacles: Use box wiring identification self-adhesive labels on back of wall plate.
- E. Warning Tapes, Labels, and Signs:
1. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground- line warning tape for both direct-buried cables and cables in raceway.
 2. Warning Labels for Identification for Branch Circuit Ungrounded Conductors: Install at all branch circuit panelboards, cabinets, and enclosures per NFPA 70. Provide black text on an orange background. Apply to exterior of door, cover, or other access generally. For flush mounted panelboards in finished spaces, install on inside of protective device door.
 - a. For 208/120-volt systems, lines and text shall be:
 - 1) "208/120 VOLT SYSTEM"
 - 2) "PHASE A – BLACK"
 - 3) "PHASE B – RED"
 - 4) "PHASE C – BLUE"
 - b. For 480/277-volt systems, lines and text shall be:
 - 1) "480/277 VOLT SYSTEM"

- 2) "PHASE A – BROWN"
 - 3) "PHASE B – ORANGE"
 - 4) "PHASE C – YELLOW"
3. Warning labels and signs shall include, but are not limited to, the following texts:
- a. Low Voltage Room Door Sign: "DANGER-ELECTRICAL HAZARD – AUTHORIZED PERSONNEL ONLY".
 - b. Service Disconnect Sign: "SERVICE DISCONNECT."
 - c. Generator Disconnect Sign: "GENERATOR XX DISCONNECT."
 - d. Fire Pump Disconnect Sign: "FIRE PUMP DISCONNECT."
 - e. Multiple Power Source Warning (locate at each service and generator disconnect equipment): "DANGER – ELECTRICAL SHOCK HAZARD – EQUIPMENT HAS MULTIPLE POWER SOURCES. STANDBY POWER SOURCE LOCATED IN SERVICE YARD OF BUILDING."
 - f. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black text on an orange background. Apply to exterior of door, cover, or other access.
 - 1) Equipment with Multiple Power or Control Sources: Apply to front of equipment including, but not limited to, the following:
 - a) Transfer switches.
 - b) Controls with external control power connections.
 - g. Fused and Non-Fused Motor Disconnect Switches: Install baked enamel warning sign with white legend on red background with minimum 3/8-inch-high lettering with the following designation – "DANGER, DO NOT USE TO START OR STOP MOTOR. USE FOR ISOLATION ONLY."
 - h. Back-Fed Switches and Circuit Breakers: Where switches and devices such as knife switches, circuit breakers, molded-case switches, and contacts are installed such that the load side of the switch device could energize with the switch open due to back feeding, provide a warning plate with the wording "WARNING –LOAD SIDE OF SWITCH MAY BE ENERGIZED BY BACKFEED", shall be installed on the switch.
 - i. Arc Flash Hazard Warning: Per NFPA 70 requirements.

F. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch (10-mm) high letters for emergency instructions at equipment used for power transfer.
3. Electrical Assembly Single-Line: Install at end of assembly or as otherwise located on Drawings.

G. Equipment Identification Labels:

1. Apply equipment identification labels of self-adhesive, engraved, laminated acrylic or melamine label on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes communication/signal/alarm systems unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text in field designating the equipment served. Utilize NEC electrical distribution branch color coded field and lettering for equipment connected. Text shall match terminology and numbering of the Contract Documents and shop drawings. Electrical equipment nameplates shall also designate line side source (i.e., FED FROM: "____" ROOM # "____") in smaller than 1/8-inch (3.2 mm) text. Smaller nameplate text may be used where adequate nameplate mounting space is not available, but in no case shall the text be smaller than 1/8-inch (3.2 mm). Apply labels mechanically with machine screws or pop rivets for each unit of the following categories of electrical equipment and those scheduled on Drawings for electrical equipment and panelboard designations. Transfer switches shall include similar emergency and normal fed from and load identification text.
 - a. Automatic transfer switch.
 - b. Battery chargers.
 - c. Boxes (Pull, Junction, or Branch Circuit) when given specific designation on drawings.
 - d. Communication/special systems cabinets and backboards.
 - e. Contactors.
 - f. Control devices.
 - g. Dimming racks and panels.
 - h. Disconnect switches.
 - i. Distribution panelboards protective devices.
 - j. Emergency generator set.
 - k. Emergency generator control system relays and protective devices.
 - l. Fire alarm system field processing units, terminal cabinets, peripheral monitor and control addressable relay modules, fire phone cabinets and remote duct detector test stations.
 - m. Generator tool kit cabinets.
 - n. Ground buses and terminal bars.
 - o. Metering equipment.
 - 1) Designate motor function (i.e., "CW Pump P-1"), not "P-1."
 - p. Motor controllers.
 - 1) Designate motor function (i.e., "CW Pump P-1"), not "P-1."
 - a) Manual transfer switch.
 - q. Other systems.
 - r. Panelboards.
 - s. Security panels.
 - t. Separately mounted motor controllers.
 - u. Single-pole switches and fractional horsepower manual starters used for motor disconnect switch.
 - v. Spare fuse cabinet.

- w. Surge protection devices.
 - x. Switchboards and associated protective devices.
 - y. Separately mounted circuit breakers.
 - z. Standard telecommunication system.
 - aa. Transfer switch.
 - bb. Transformers.
2. Refer to appropriate sections for other identification marking requirements and nomenclature.
 3. Attach identification after finish painting.

H. Component Identification Labels:

1. Apply component identification labels to distribution panelboard and switchboard:
 - a. Assembly Nameplate: Apply per equipment identification label requirements except 1-inch (80 mm) identification text.
 - b. Cubicle Label: Apply 1/2-inch (40 mm) black text on white plate identifying left-to-right number with 1/4-inch (20 mm) black text below identification section type(s):
 - 1) Pull.
 - 2) Main Circuit Breaker.
 - 3) Utility Metering.
 - 4) Customer Metering.
 - 5) Transformer # XX.
 - 6) Distribution #XX.
 - 7) Main Lugs.
 - 8) Transition.
 - 9) Transfer Switch.
 - 10) Battery.
 - 11) Panelboard.
 - 12) Circuit Breaker.
 - 13) Spare.
 - 14) Space.
 - 15) Motor Controller.
 - c. Protective Device Load Label: Apply 1/4-inch (20 mm) text on plate per system color coding identifying load served.
 - d. Miscellaneous Component Labels: Apply 1/4-inch (20 mm) black text on white plate identifying components and instruments mounted on front or within the assembly such as relays, fuses, switches, terminal blocks.

I. Above Ceiling Equipment Identification Labels:

1. Apply adhesive dot labels to nearest exposed ceiling grid or associated access panel latch for the following above ceiling equipment:
 - a. System type occupancy sensor control and relay units.
 - b. Fire alarm addressable relay.
 - c. Remote lighting ballast.
 - d. Power supply.

- e. Strategic termination box enclosure.
- f. Data location:
 - 1) Wireless access point.
 - 2) Camera (IP) location.
 - 3) Projection unit.
- g. Card access controller.

END OF SECTION 26 05 53

SECTION 26 05 75

CONDUIT ROUGH-IN SYSTEMS

PART 1 - GENERAL**1.1 SUMMARY**

- A. This Section includes Conduit Rough-In Systems and pathways for communication and signaling systems cabling and boxes including all work incidental thereto as shown on Drawings and specified.
- B. Requirements of the following Sections and Drawings apply to this Section:
 - 1. Division 06 for plywood equipment backboards.
 - 2. Division 07 Section "Penetration Firestopping" for general firestopping requirements.
 - 3. Division 07 Section "Joint Sealants" for general wall sealants.
 - 4. Architectural Drawings and Specifications for locations of the resistance rated barriers and smoke barriers.
 - 5. Division 20 Section "Common Work Results, Division 21 through 28" apply to this Section.
- C. Requirements of the following Division 26 Sections apply to this Section:
 - 1. Section "Basic Division 26 Requirements."
 - 2. Section "Basic Materials and Methods."
 - 3. Section "Raceways."
 - 4. Section "Sleeves and Fire-Rated Cable Assemblies."
 - 5. Section "Boxes and Cabinets."
 - 6. Section "Wiring Devices."
 - 7. Section "Electrical Identification."
 - 8. Section "Grounding and Bonding for Electrical Systems."
 - 9. Section "Panelboards."

1.2 QUALITY ASSURANCE

- A. Comply with the following Standards and Codes:
 - 1. ANSI/EIA/TIA – 568B: Commercial Building Telecommunications Cabling Standard
 - 2. ANSI/EIA/TIA – 569B: Commercial Building Standard for Telecommunications Pathways and Spaces
 - 3. ANSI/EIA/TIA – 606A: Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 - 4. ANSI-J-STD-607-A: Commercial Building Grounding, Earthing and Bonding Requirements for Telecommunications
 - 5. ANSI/NECA/BICSI 568-2001: Installing Commercial Building Telecommunications Cabling

6. NFPA 70: National Electrical Code
7. All addenda, technical service bulletins, etc., associated with the above reference standards.

1.3 DEFINITIONS

- A. Pathway: Routing of cabling from work area outlet box to telecommunications room. Pathways may consist of outlet boxes, cabinets, surface raceways, conduit, conduit stub, conduit sleeve(s), cable tray, J-Hooks, etc. where system cabling will be run.
- B. Rough-In: Preparation for system(s) cabling and equipment installations.
- C. System Cabling: Low voltage signal and control cabling. System cabling is designated by the manufacturer for a particular system in each specification section.

1.4 COORDINATION

- A. Coordinate all requirements of the Owner's and manufacturer's representatives for all room preparation, pathways, and specific rough-in installation requirements, including associated sizing, location and labeling, for the following systems:
 1. Division 23 Systems:
 - a. Instrumentation and Control for HVAC.
 2. Division 25 Systems:
 - a. Integrated Facility Control.
 3. Division 26 Systems:
 - a. Automatic Line Voltage Lighting Control Equipment.
 - b. Lighting Dimming.
 - c. Wallbox Preset Dimming.
 4. Division 27 Systems:
 - a. Structured Telecommunications Cabling.
 - b. Broadband Television Distribution
 - c. Audio Visual Cabling.
 5. Division 28 Systems:
 - a. Fire Alarm.
 - b. Access Control / Intrusion Detection.
 - c. Protective Services CCTV Distribution.
 - d. Video Surveillance.
- B. Coordinate equipment backboard installations including:
 1. Meet Owner's and manufacturer's representative layout requirements.
 2. Endures that installer:
 - a. Provides spacers between wall and backboard to support and

- b. Locates backboard 6 inches above finish floor level around room.
 - c. Paints backboard white on all sides with appropriate print.
 - d. Allows for flush rough-in of wiring devices.
 - e. Allows for cable management and slots behind backboards.
 - f. Allows for signal grounding installation per Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Coordinate sleeves and fire-rated cable assemblies for pathways and cable per Division 26 Section "Sleeves."

1.5 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract, Division 01 Specification Sections, and Division 26 Section "Basic Division 26 Requirements".

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Provide per "Basic Division 26 Requirements" Include:
 - 1. Details for all identified systems equipment rooms including, but not limited to those rooms labeled:
 - a. Cable Pull.
 - b. Communications.
 - c. Data.
 - d. Network.
 - e. MDF.
 - f. Server.
 - g. Tel/Data.
 - h. Telecommunications.
 - 2. Floor plans for each system local equipment room service area depicting:
 - a. Cabling pathways, color coding and field equipment, identification labels.
 - b. Specific equipment, outlet, and patching identification labels.
 - 3. Signoffs of Owner's and manufacturer's representatives for each document submitted.

1.7 CLOSEOUT SUBMITTALS

- A. Record Documents:
 - 1. Submit updated Coordination Drawings as Record Documents.

PART 2 - PRODUCTS**2.1 OUTLET BOXES**

- A. Flush wall mounted 4-11/16 inches square, 3-5/8" deep pressed galvanized steel minimum.
 - 1. Utilize 4-11/16" square, 2-1/8" deep backbox with 4-11/16" square, 1-1/2" deep extension ring to meet backbox depth requirement; if 3-1/2" deep box not available.
 - 2. Provide plastic bushings at grommet of outlet box where open cabling installation is allowed to directly enter outlet box (in ceiling spaces).
- B. Mullion Mounted Devices:
 - 1. Flush backbox or open ring as recommended by device manufacturer for installation in metal door frame/aluminum doorframe as shown on Drawings.
 - 2. Coordinate installation and conduit access with door frame and door hardware manufacturer's for cabling routing and connectivity.
- C. Cable Bushings:
 - 1. Bush cable opening for device boxes without conduit stubs.

2.2 PLASTER COVER

- A. Single gang, galvanized steel, for single gang device.
- B. Two gang, galvanized steel, for two-gang device.
 - 1. Provide steel barrier for devices requiring power and low voltage device to be mounted in same backbox.

2.3 COVER PLATES

- A. Same material, finish, and color as for wiring devices. Refer to Division 26 Section "Wiring Devices."
- B. Single gang for single device with appropriate opening, split plate, etc. for device to be installed.
- C. Two gang for combination NEMA 5 receptacle and communications/device with appropriate openings for receptacle and opening, split plate, etc. for device to be installed.
- D. Two gang as required for system outlets.
- E. Device opening shall be bushed one inch when used for wire pull.

- F. Blank as shown on drawings or when single device type not used.

2.4 RACEWAYS

- A. Refer to Division 26 Section "Raceways" for requirements. Provide with insulated throats and bushings on all conduit runs, stubs and sleeves.

2.5 SLEEVES

- A. Refer to Division 07 and Division 26 Section "Sleeves" for firestopping requirements.

2.6 CABLE J-HOOKS

- A. Metallic J-hook bracket (1-1/2" wide) with cable retainer or Velcro strap, ceiling or support rod mounted.

1. Provide system manufacturer recommended fasteners.

- B. Category 6 compliant.

- C. Acceptable Manufacturers/Series:

1. Caddy Cat. 32 Series.

2. B-Line BCH32 Series.

3. Or approved equivalent.

2.7 EQUIPMENT BACKBOARDS

- A. Refer to Division 06 for plywood equipment backboard requirements.

2.8 CABLE DISTRIBUTION SPOOLS FOR BACKBOARDS

- A. Fire-Retardant, high strength composite material.

- B. 1-1/2" length.

- C. Promotes compliance with T568B bend radius (4 x cable diameter)

2.9 CABINETS AND COMMUNICATION RACKS

- A. Refer to Division 26 Section "Boxes and Cabinets" for cabinet requirements.

- B. Refer to Division 27 Section "Communications Cabinets and Racks" for communications type rack assemblies.

PART 3 - EXECUTION**3.1 CONDUIT AND PATHWAYS APPLICATIONS**

- A. Conduit Raceways (completely enclosed wiring):
 - 1. Shall be used for separate and independent horizontal system cabling routing for each of the following systems:
 - a. Division 26 Systems:
 - 1) Automatic Line Voltage Lighting Control Equipment.
 - 2) Lighting Dimming.
 - 3) Wallbox Preset Dimming.
 - b. Division 27 Systems:
 - 1) Broadband Television Distribution.
 - 2) Structured Telecommunications Cabling.
 - 3) Audio Visual Cabling.
 - c. Division 28 Systems:
 - 1) Fire Alarm.
 - 2) Access Control / Intrusion Detection.
 - 3) Video Surveillance.
 - 2. Shall be used for:
 - a. Systems backbone and trunk risers.
 - b. Systems outlet boxes to accessible ceiling.
 - c. Systems outlet boxes to accessible corridor ceiling.
 - d. Systems outlet boxes to cable tray termination.
- B. J – Hooks:
 - 1. Shall be used for separate and independent cabling routing for each of the following systems:
 - a. Division 28 Systems:
 - 1) Fire Alarm.
 - 2) Access Control / Intrusion Detection.
 - 3) Protective Services CCTV Distribution.
 - 4) Video Surveillance.
 - 2. Shall be used for area horizontal ceiling space corridor cabling for the following systems:
 - a. Division 23 Systems:
 - 1) Instrumentation and Control for HVAC.
 - b. Division 25 Systems:
 - 1) Integrated Facility Control.
 - c. Division 26 Systems:
 - 1) Low Voltage Electrical Power Conductors and Cables.
 - 2) Automatic Line Voltage Lighting Control Equipment.
 - 3) Lighting Dimming.
 - 4) Wallbox Preset Dimming.
 - d. Division 27 Systems:
 - 1) Broadband Television Distribution.

- 2) Structured Telecommunications Cabling.
- 3) Audio Visual Cabling.
- e. Division 28 Systems:
 - 1) Fire Alarm.
 - 2) Access Control / Intrusion Detection.
 - 3) Protective Services CCTV Distribution.
 - 4) Video Surveillance.
3. Shall be used for:
 - a. Equipment room backboard cable management.
 - b. Accessible ceiling cabling not installed in other pathways.

3.2 INSTALLATION

A. General:

1. Install all pathways in accordance with EIA/TIA 569A Standards, associated addenda and technical service bulletins and per manufacturer's requirements.
 - a. Install all pathways in a safe, neat, professional, workmanlike manner.
 - b. Coordinate size of pathways such that EIA/TIA maximum fill requirements are not exceeded for that raceway size at 40% fill maximum.
2. Provide pathways to conceal all cabling in the facility except where specifically indicated otherwise.
3. Coordinate pathway installation such that it is independently supported.
4. Install all pathways parallel and perpendicular to building lines and tight to structure. Install pathways such that multiple cabling runs to the same geographic location will utilize similar pathway routing to destination point.
5. Route cabling pathways to the system equipment room from indicated zone or as shown on Drawings. In general, provide system outlet box pathways to the equipment room on the same floor to a system cabinet or identified equipment.
6. Install pathways to avoid elevator shafts, elevator equipment rooms or any areas that contain or store hazardous materials.
7. Install pathways to avoid sources of electromagnetic interference (EMI) for all pathways.
 - a. Maintain one foot minimum from fluorescent lighting (ballast).
 - b. Maintain four foot minimum from all transformers.
 - c. Maintain ten foot minimum from electrical power cabling or distribution panels exceeding 480 volts.
 - d. Maintain one foot minimum from electrical power cabling.
 - e. Maintain two inch minimum from electrical power cabling less than 220 volts.
 - f. Shorten distances if sufficient EMI isolation is provided and given prior approval by engineer.
8. Avoid routing pathways in areas subject to excessive environmental

conditions. Acceptable conditions are:

- a. Temperature range: 5°C – 50°C.
- b. Relative humidity range: 5% - 95%.
9. Install raceway and equipment identifications per Division 26 Section "Electrical Identification." Label all pathways and associated termination points.
 - a. Provide system identifying nameplate centered on main trunk riser boxes, equipment backboards, ground buses, and cabinets (i.e. DATACOM, CCTV, etc.).
 - b. Identify fiber optic labeling risers installed in ENT or Innerduct every 10 feet on center "Fiber Optic Cabling."

B. Outlet Boxes:

1. General:
 - a. Install systems outlets flush in new wall construction.
 - b. Do not install backboxes back-to-back.
 - 1) Maintain a minimum of 12" separation.
 - 2) Maintain a minimum of 24" separation in fire-rated walls.
 - c. Mount outlets alongside associated power receptacles where applicable.
 - d. Mount all outlet boxes vertically, unless otherwise noted.
 - e. Install raceway to avoid obstructions in the field such as molding, built-in cabinets, wiring devices, etc.
 - f. Install blank coverplates where device type is not installed. Coordinate such locations with the appropriate systems representatives, and the Owner.

C. Raceways:

1. Refer to Division 26 Section "Raceways" for basic routing and installation requirements.
2. Furnish and install trunk riser raceways, junction boxes, outlet box raceways and outlet boxes as specified and shown on Drawings.
3. Stub trunk riser and extend system outlet box raceways into accessible ceiling space.
4. Stub trunk riser and extend system outlet box raceways into accessible corridor ceiling space.
5. Stub trunk riser and extend system outlet box raceways into accessible corridor ceiling and terminate at cable tray system.
6. Provide cap for all conduit stubs and cover for outlet boxes to eliminate debris from entering boxes or conduits. Remove any debris found in conduits or outlet boxes upon cable installation.
7. Provide a dedicated conduit for cable installation for each Division 27 structured telecommunications cabling system outlet box. These outlet boxes shall not be connected together with conduit between boxes.

8. Provide minimum outlet box conduit size and conduit sleeve size at 1 inch.
 - a. Use chart below for minimum conduit size requirements based on maximum 40% fill for indicated quantity of cables.

Inside Diameter mm	Trade Size	Cable Outside Diameter mm (in)									
		3.3 (0.13)	4.6 (0.18)	5.6 (0.22)	6.1 (0.24)	7.4 (0.29)	7.9 (0.31)	9.4 (0.37)	13.5 (0.53)	15.8 (0.62)	17.8 (0.70)
21	3/4	6	5	4	3	2	2	1	0	0	0
27	1	8	8	7	6	3	3	2	1	0	0
35	1-1/4	16	14	12	10	6	4	3	1	1	1
41	1-1/2	20	18	16	15	7	6	4	2	1	1
53	2	30	26	22	20	14	12	7	4	3	2
63	2-1/2	45	40	36	30	17	14	12	6	3	3
78	3	70	60	50	40	20	20	17	7	6	6
91	3-1/2							22	12	7	6
103	4							30	14	12	7

9. Mark each conduit end for identification and destination of raceway.
10. Install all raceways such that the cabling manufacturer's minimum bend radius is not exceeded.
11. Furnish and install 200-pound test, braided nylon pullcords in all conduits and as shown on Drawings. Label all pullcords.
12. Provide complete conduit systems in areas with non-accessible ceilings for all cable systems.
13. Utilize surface raceway in finished areas where cabling cannot be concealed.
14. Feed multi-channel surface raceway, where shown on Drawings, with one (1) conduit for special outlets and one (1) conduit for power to feed multiple outlets. Refer to ANSI/EIA/TIA 569-A and NFPA 70 for conduit size requirements.
15. Special Fiber Optic Raceways:
 - a. Install backbone fiber optic cabling in plenum rated ENT (innerduct) raceway per Division 26 Section "Raceways." Install ENT in cable tray if available, using proper connectors and fittings.
16. Provide conduit segment length at no more than 100 feet with a maximum of two 90-degree bends. Additional junction/pull boxes shall be installed to allow more bends or length of conduit. Refer to EIA/TIA 569A. Coordinate location to nearby cable spool or cable management device.
17. Install telecommunications raceways to within six inches of equipment backboards, data racks and termination units.
 - a. Coordinate location and termination to cable management device.
18. Provide a minimum of 10-inch inside curve radius of conduits for each 1-

inch in diameter of installed conduit.

D. J-Hook Installation:

1. Provide independent J-hook pathways per system where cable tray is not shown, (minimum of 4 J-hooks mounted horizontally) in accessible ceiling space mounted a maximum of 4 and 5 feet on center. Mount pathway level, tight to structure and allow accessible installation of cabling.
2. Furnish and install single mounted J-hooks from individual conduits serving outlet boxes, mounted 4 feet on center maximum.
3. Ensure cabling is supported properly and cable does not sag or droop in excess of 8" from between supports.

E. Cable Distribution Spools:

1. Install distribution cable spools (mushrooms) on equipment backboards to allow cable support/routing. Mount spools along edge of boards, 6 inches from each corner and 1 foot on center, minimum.

3.3 RECORD DRAWINGS

- A. Post copy of appropriate systems record drawings in local equipment room as required by Owner representatives. Hang set on equipment backboard using proper anchoring techniques.

END OF SECTION 26 05 75

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes lighting and power panelboards and associated auxiliary equipment rated 600 volt or less.
- B. Requirements of the following Division 26 Sections apply to this Section:
 - 1. Section "Basic Division 26 Requirements."
 - 2. Section "Protective Device Coordination."
 - 3. Section "Hangers and Supports for Electrical Systems."
 - 4. Section "Electrical Identification."
 - 5. Section "Protective Devices."
 - 6. Section "Motor Controllers".

1.2 DEFINITIONS

- A. Lighting and Appliance Panelboard: A panelboard with thermal magnetic circuit breaker branches, bolt-in type only, designed for heavy commercial use, operating at 600 V and below, 3-phase versions, equipped as either surface or flush mounting. Panelboard shall have more than 10% of its overcurrent devices rated 30 amperes or less for which neutral connections are provided.
- B. Distribution Power Panelboard: A panelboard with thermal magnetic circuit breakers or fusible switches, bolt-in type, designed for heavy commercial use, operating at 600 V and below, 3- phase version, equipped as surface mounting with cabled connections between sections. Panelboard shall have less than 10% of its concurrent devices rated 30 amperes or less for which neutral connections are provided.
- C. Surge Protection Device (SPD): A method of reduction of effect of voltage spikes to sensitive electronic equipment by shunting these disturbances to earth ground.
- D. Overcurrent Protective Device (OCPD): A device operative on excessive current that causes and maintains the interruption of power in the circuit it protects.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract, Division 01 Specification Sections and Section "Basic 26 Division Requirements."

1.4 ACTION SUBMITTALS

A. Shop Drawings:

1. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
2. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices. Series rated protective devices are not acceptable.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - e. Wiring diagrams detailing control wiring and differentiating between manufacturer-installed and field-installed wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field quality control test reports including the following:
 1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 2. Include copy of typed directions depicting branch circuit loads.
- B. Record Documents.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Two spares for each type of panelboard cabinet lock.
 - 2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GEEP) Types: Two spares for each panelboard.
 - 3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Ambient Temperature: Not exceeding 104 deg. F (40 deg. C).
 - 2. Altitude: Not exceeding 6600 feet (2000 m).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.

2. Altitude not exceeding 6600 feet (2000 m).

1.10 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. General Panelboards:
 - a. Square D.
 - b. Eaton Corporation; Cutler-Hammer Products.
 - c. General Electric Co.; Electrical Distribution & Protection Div.
 - d. Siemens Energy & Automation, Inc.

2.2 PANELBOARDS, GENERAL REQUIREMENTS

- A. Overcurrent Protective Devices (OCPDs): Provide type, rating, and features as shown on Drawings. Comply with Division 26 Section "Protective Devices," with OCPDs adapted to panelboard installation. Tandem circuit breakers shall not be used. Multipole breakers shall have common trip.
- B. Supports and Bracing for Buses: Adequate strength of all panelboard components, including OCPD's, for short circuit current ratings as shown on Drawings. The minimum ratings shall be 10,000 AIC for 120/208-volt equipment and 14,000 AIC for 277/480 volt equipment. Series ratings of protective devices shall not be acceptable.
- C. Enclosures: Cabinets, flush or surface mounted as shown on Drawings. NEMA Type 1 enclosure, except where the following enclosure requirements are shown on Drawings. Backboxes shall be made from galvanized steel. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. Provide at least four interior mounting studs with adjustable nuts.
 1. NEMA 3R: Rain tight.
 2. NEMA 3S: Rain tight and dust tight.

3. NEMA 4X: Corrosion-resistant fiberglass enclosure, watertight, dust tight, and resistant to oil and coolant seepage.
 4. NEMA 12: Dust tight, drip proof, and resistant to oil and coolant seepage.
- D. Front: Secured to box with concealed trim clamps except as indicated. Front for surface-mounted panelboards shall be same dimensions as box. Fronts for flush panelboards shall overlap box except as otherwise specified.
- E. Hinged Front Cover: Entire front trim hinged to box with standard door within hinged trim cover. (Exception: Elevator Room fused switch panelboards).
- F. Directory Frame: Metal, mounted inside each panelboard door.
- G. Typed directory card completely filled out including "SPARE" and "SPACE" loads.
- H. Bus: Aluminum.
- I. Main and Neutral Lugs: Compression type.
- J. Main Circuit Breaker (when scheduled): Mounted physically separate from branch breaker lineups (not in same row) to allow for full branch circuit pole quantity.
- K. Branch Circuit Devices: Arranged for double row construction.
- L. Equipment Ground Bus: Adequate for feeder and branch circuit equipment ground conductors. Bond to box with bolted or welded connection.
- M. Gutter: Generally, conform to UL 61.
- N. Extra Gutter Space: Arrangement as shown on Drawings or as required for installation.
- O. Auxiliary Gutter: Conform to UL 870, "Wireways, Auxiliary Gutters, and Associated Fittings."
- P. Service Equipment Approval: Listed for use as service equipment for panelboards having main service disconnect.
- Q. Provision for Future Devices: Equip with mounting brackets, bus connections and extensions, and necessary appurtenances, for the OCPD ampere ratings shown on Drawing schedules for future installation of devices.
- R. Special Features: Provide the following features for panelboards as scheduled and or shown on Drawings or as required to meet NEC:
 1. Subfeed (Double Lugs): OCPD or lug provisions sized to accommodate feeders shown on Drawings. Provide subfeed lugs for all multi section

panelboards. Field install all required cross connection cables.

2.3 LIGHTING AND APPLIANCE PANELBOARDS

- A. General: Conform to above article "Panelboards, General Requirements" except as follows:
1. Circuit Breakers for Switching Lights at Panelboards: Indicated type SWD.
 2. Circuit Breakers for Equipment Marked HACR Type: Indicated HACR type.
 3. Interiors: Provide physical means to prevent installation of more OCPDs than the quantity for which the enclosure was listed.
 4. Main, Neutral, and Ground Lugs and Buses: Have mechanical connectors for conductors.
 5. Branch OCPDs: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
 6. Double-Width Panelboards: Where more than 42 poles are indicated or where otherwise indicated, provide two panelboards bussed together under single front or wired using serving feeder size between panelboards, at Division 26 discretion.
 7. Doors: In panel front, with concealed hinges. Secure with flush catch and cylindrical tumbler lock, all keyed alike. The flush lock shall not protrude beyond the front of the door.

2.4 POWER DISTRIBUTION PANELBOARDS

- A. Doors: In panel front, omit single panelboard door in cabinet front for fusible switch panelboards except as shown on Drawings. Secure with vault-type cylindrical tumbler lock, all keyed alike. The flush lock shall not protrude beyond the front of the door. Doors over 48 inches high hinged, and shall be provided with a vault type handle, built-in locks, and three-point latch (top, bottom, and center).
- B. Branch-Circuit Breakers: Where OCPDs are shown on Drawings to be circuit breakers, use bolt-on breakers except circuit breakers 225-ampere frame size and greater may be plug-in type where individual positive locking device requires mechanical release for removal.
- C. Motor Starter Disconnects: Include overcurrent protection as shown on Drawings. Mount integral with or, in same panelboard, adjacent to motor starter. Mechanically interlock starter door with disconnect device. Provide auxiliary contacts on disconnect to reenergize control connections to starter.

2.5 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items as required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: Arranged to permit testing of functions of solid-state trip

devices without removal from panelboard.

- C. Fungus Proofing: Permanent fungicidal treatment for panelboards interior including OCPDs and other components.

2.6 IDENTIFICATION

- A. General: Refer to Division 26 Section "Electrical Identification," for labeling materials and methods.
- B. Manufacturer's Nameplate Information:
 - 1. Voltage.
 - 2. Phase.
 - 3. Ampacity.
 - 4. Manufacturer.
 - 5. A.I.C. Symmetrical.
 - 6. UL Listing.
 - 7. Service Entrance Label (as applicable).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Install overcurrent protective devices and controllers.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- F. Install filler plates in unused spaces and plug any unused, open cabinet knockouts.
- G. Install breaker handle clips in on position at breakers servicing fire alarm equipment.
- H. Install handle ties on multi-wire branch circuit sharing a common neutral.
- I. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty

conduits into depressed floor space.

- J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

- K. Install feeders and cross-connect feeders between multi-section panelboards.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."
 - 1. Provide "Fire Alarm System" component identification label at breakers servicing fire alarm equipment.

- B. Create a typed directory to indicate installed circuit loads after balancing panelboard loads. Label circuit locations (not occupancy) and spares. Obtain typed approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
- C. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
- E. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 2. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.
- 3.5 CLEANING
- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 24 16

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following wiring devices, wiring device accessories, and wiring device assemblies:
 - 1. Switches.
 - 2. Receptacles.
 - 3. Dimmer Switches.
 - 4. Cover Plates.
 - 5. Special Purpose Devices.
- B. The terms wall plates and cover plates are considered synonymous.
- C. Requirements of the following Division 26 Sections apply to this section:
 - 1. Section "Basic Division 26 Requirements."
 - 2. Section "Boxes and Cabinets."
 - 3. Section "Electrical Identification."
 - 4. Section "Protective Devices."
 - 5. Section "Automatic Line Voltage Lighting Control Equipment."

1.2 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract, Division 01 Specification Sections, and Division 26 Section "Basic Division 26 Requirements."

1.3 ACTION SUBMITTALS

- A. Shop Drawings:
 - 1. Product data for each type of product specified.
 - 2. List of legends and description of materials and process used for premarking wall plates.
 - 3. Samples for each type of device and wall plate specified, in each color specified.
 - 4. Field quality-control test reports.
 - 5. Operation and Maintenance Data for wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.5 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

1.6 SEQUENCE AND SCHEDULING

- A. Protect wiring devices if installed prior to painting.
- B. Schedule installation of finish plates after the surface upon which they are installed has received final finish.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

- A. General: Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA standards. Verify color selections with Architect.
 - 1. Device colors for special application shall be as follows:
 - a. Emergency - Red.
- B. Receptacles: Comply with UL 498 and NEMA WD 1.
- C. Ground-Fault Circuit Interrupter (GFCI) Receptacles: Provide "feed-thru" type ground-fault circuit interrupter, with integral heavy-duty NEMA 5-20R duplex receptacles arranged to protect connected downstream receptacles on same circuit. Provide unit designed for installation in a 2-3/4-inch-deep outlet box without adapter, grounding type, Class A, Group 1, per UL Standard 943.
- D. Switches: Quiet type AC switches. Comply with UL 20 and NEMA WD1.

- E. Dimmer Switches: Solid state dimmer switches conforming to NEMA WD 1, mounted in boxes and in accordance with the following:
1. Fluorescent Lamp Dimmers: shall be 120 volt, manually operated for intensity control of fluorescent lamps, linear slide control, for single gang box mounting with heat sink fins concealed behind decorative cover plate.

2.2 WIRING DEVICE ACCESSORIES

- A. Wall plates: single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide wall plates with engraved legend conforming to requirements of Division 26 Section "Electrical Identification." Provide plates possessing the following additional construction features:
1. General Color: Provide wall plate color to match wiring devices except as otherwise indicated. Devices of different color under common wall plate shall have cover plate to match general normal power color.
 2. White plates in laboratories, lab support spaces, classrooms, conference rooms, offices, and back of house.
 3. Material and Finish: 0.04 inch thick, type 302 satin brushed stainless steel in public areas, lobby, lounge, restrooms, and corridors.
 4. Material and Finish: Steel Plate, Galvanized in equipment rooms.

2.3 WIRING DEVICE PIGTAIL CONNECTOR OPTION

- A. At contractor's option, but subject to other requirements of this Section, UL approved pigtail connectors may be used which allow:
1. Rough-in of pre-stripped six-inch leads to a connector.
 2. Connector plug-in to the wiring device.
 3. Basis of connector design to be PlugTail™ as supplied by Pass & Seymour, Snap Connect™ as supplied by Hubbell, or LEV-LOK™ as supplied by Leviton.

2.4 TESTER

- A. Provide two receptacle circuit testers and two ground fault interrupter testers. Present to owner upon completion.

2.5 MANUFACTURERS

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- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Switches, Specification
Grade: a. 20-amp
120-277 volt:
 - 1) Arrow Hart - 1991 series.
 - 2) Bryant - 4900 series.
 - 3) Eagle - 2221 series.
 - 4) Hubbell – HBL1221 series.
 - 5) Leviton - 1221 series.
 - 6) Pass and Seymour - 20 AC series.
 - a. 20-amp 120-277-volt, momentary contact, center off, SPDT:
 - 1) Arrow Hart - 1995 series.
 - 2) Bryant - 4921 series.
 - 3) Eagle - 2220 series.
 - 4) Hubbell – HBL 1557 series.
 - 5) Leviton - 1257 series.
 - 6) Pass and Seymour - 1251 series.
 - b. 20-amp 120-277 volt, maintained contact, three position, center off:
 - 1) Arrow Hart - 4360 series.
 - 2) Bryant - 4920 series.
 - 3) Eagle - 2225 series.
 - 4) Hubbell – HBL 2121 series.
 - 5) Hubbell - 1380 series.
 - 6) Leviton - 1285 series.
 - 7) Pass and Seymour - 1220 series.
 - c. 20-amp 120-277-volt, decorator style:
 - 1) Eagle - 6620 series.
 - 2) Hubbell – HBL 2121 series.
 - 3) Leviton - 5621 series.
 - 4) Pass and Seymour - 26252 series.
 - d. Lighting Switches - Despard type for use in door mullions.
 - e. 20-amp, 120-277-volt, specification grade:
 - 1) Single Pole:
 - a) Eagle 1121V.
 - b) General Electric - GE765-1.
 - c) Pass and Seymour - ACD201.
 - 2) Three Way:
 - a) Eagle - 1123V.
 - b) General Electric - GE7653-1.
 - c) Pass and Seymour - ACD203.
 - f. Vertical type mounting straps and plates.
 - 1) Single Device – Vertical:
 - a) Eagle - 911 with special cover.
 - b) General Electric - RA15 with RP121.
 - c) Pass and Seymour - 347 with SNK-4-1.
 - 2) Two Devices – Vertical:

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- a) Eagle - 913 with 935 and special cover.
 - b) General Electric - RA15 with RP122.
 - c) Pass and Seymour - 342 with STK-42-4.
2. Duplex Receptacles, Specification Grade:
 - a. 20-amp 125-volt, heavy duty, premium specification grade, grounding type with brass strap, straight blade, NEMA 5-20R, standard face:
 - 1) Arrow-Hart - 5362 Topbrass series.
 - 2) Hubbell - HBL5362 series.
 - 3) Leviton - 5362A series.
 - 4) Pass and Seymour - 5362A series.
 - b. 20-amp, 125-volt, specification grade, grounding type with steel strap, straight blade, NEMA 5-20R, standard face:
 - 1) Arrow-Hart - 5362 series.
 - 2) Bryant - 5362 series.
 - 3) Eagle - 5362 series.
 - 4) Hubbell - 5362 series.
 - 5) Leviton - 5362 series.
 - 6) Pass and Seymour - 5362 series.
 - c. Ground fault circuit interrupting, feed-thru type, 20-amp 125-volt, heavy duty, premium specification grade, grounding type, straight blade, NEMA 5-20R, standard face with LED function indicator:
 - 1) Arrow Hart - GF-5342.
 - 2) Bryant - GF53.
 - 3) Eagle - 647.
 - 4) Hubbell - GF20 series.
 - 5) Leviton 8898 series.
 - 6) Pass and Seymour - 2094 series.
 - d. 20-amp 125-volt, heavy duty, premium specification grade, grounding type, straight blade, NEMA 5-20R decorator style face:
 - 1) Eagle - 1277.
 - 2) Hubbell - HBL 2162 series.
 - 3) Leviton - 16352 series.
 - 4) Pass and Seymour - 26352 series.
 3. Special Purpose Devices:
 - a. Blank face GFCI feed-through receptacle, 20-amp, 125-volt, 3 wire grounding GCI type with LED protection assurance and no receptacles.
 - b. 20-amp, 125-volt ground fault module for downstream receptacles:
 - 1) Arrowhart (**TBD**) series.
 - 2) Eagle (**TBD**) series.
 - 3) Hubbell GFR 8300 series.
 - 4) Leviton (**TBD**) series.
 - 5) Pass and Seymour (**TBD**) series.
 - c. Emergency Power Off (EPO) Station:
 - 1) Heavy duty momentary contact red pushbutton with guard, flush stainless-steel plate. Provide four (4) sets of contacts

- (minimum) allowing four (4) independent shunt trip panelboards per lab, and special backbox (as required). Nameplate per Division 26 Section "Electrical Identification" requirements.
- 2) Allen Bradley, General Electric, Cutler Hammer - Westinghouse, Square D, or Siemens Allis.
 - d. Fifteen (15) Minute Wind-Up Timer:
 - 1) Paragon #SWP15M/SWPD15M.
 - 2) Mark-time #90005.
 - e. Wire Guards (Use designated by subscript "WG" as shown on Drawings):
 - 1) Requirement: Consistent application on project for physical protection of devices by heavy duty steel cage design. Cage shall not impede proper device operation and shall be screw mounted with appropriate hardware over device.
 - 2) General interior finish: black.
 - 3) General interior finish: chrome.
 - 4) General interior finish: white.
 - 5) Equipment room or exterior finish: corrosion resistant coating.
 - 6) Submittals shall include product information (and samples) for each device application.
 - 7) Manufacturers:
 - a) Safety Technology International, Inc. (STI)
 - b) S.E.C, Inc.
 - c) Space Age Electronics, Inc. (SAE)
 - d) Device manufacturers' standard wire guard product if compatible with other project wire guards.
 - 4. Illuminated locator handles, illuminated pilot handles, barrel key locking operators, corrosion resistant, key operators, and other special configurations shall be the same color, series, and manufacturer as the standard devices.
 - 5. Dimmer Switches:
 - a. Fluorescent (Use with electronic dimming ballasts specified in Division 26 Section "Interior Lighting":
 - 1) Single pole:
 - a) Lutron SF-10P series (120V) or SF-12P series (277V).
 - 2) Three way:
 - a) Lutron SF-103P series (120V) or SF-12P series (277V).
 - 6. Pilot Lights, Jewel Type Neon Pilot Mounted Under 1-Gang of a 2-Gang Cover:
 - a. Pass and Seymour - 2151-R or equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES AND ACCESSORIES

A. General:

1. Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

B. Coordination and Scheduling:

1. Coordinate with other Work, including painting, electrical boxes, and wiring installations, as necessary to interface installation of wiring devices with other Work.
2. Install wiring devices only in electrical boxes which are clean, free from building materials, dirt, and debris.
3. Install wiring devices after wiring work is completed.
4. Install wall plates after painting work is completed. Provide blank wall plate and/or wall plate sections at unused and/or barriered box locations unless otherwise directed by Owner.
5. Coordinate receptacles, shown within six feet of a sink or shown as exterior mounted, which shall be ground fault protected whether or not shown on Drawings.

C. Device Orientation and Mounting:

1. In each instance where two or more devices are generally located in the same vicinity and at the same mounting height, mount these devices in multi-gang, barriered boxes under a one-piece cover plate.
2. Combination receptacles and communications devices (i.e., telephone or television and receptacle) shall be installed in minimum 2gang boxes with barriers to segregate the systems and shall be installed under one common wall plate.
3. Coordination wiring device mounted with architectural elevations.
4. Unless otherwise noted, all wall mounted wiring devices shall be mounted vertically.
5. Lighting switches shall be installed so the upper position of switch handles shall be in the "ON" position.
6. Receptacles at cabinets shall be mounted 2 inches clear above counter backsplash or as otherwise shown on Drawings. Receptacles at water coolers shall be located behind the cooler as recommended by manufacturer of the cooler.
7. Unless otherwise noted, duplex receptacles shall be installed vertically with grounding pole up. Duplex receptacles mounted 3'-6" A.F.F. or above shall be installed vertically with grounding pole down.

D. Device Conductor Terminations:

1. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque

tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A. Use properly scaled torque indicating hand tool.

2. Remote maintained contact emergency stop and test pushbuttons shall be wired ahead of all other motor control devices and shall interrupt the motor control circuit in both the "Hand," and "Automatic" positions.

E. Wall Plates:

1. Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
2. Devices designated as high abuse (by suffix HA) shall be installed behind die-cast wall plates (Morlite Systems Inc. – CSWP series). Color shall be per Architect.
3. Exterior devices designated as weatherproof (by subscript below) shall be installed as follows:

<u>NEC Use</u>	<u>Box</u>	<u>Cover Mfg.</u>
Attended (WP when closed)	Heavy-Duty Aluminum Die Cast	P&S 4600 Series or equal – Keyed alike
Unattended (WP when closed or when plug inserted)	Heavy-Duty Aluminum Die Cast	Hubbell WP26M Series Thomas & Betts CKM Series

4. Devices designated as weatherproof spring cover (by subscript WPS) shall have standard outlet boxes with weatherproof spring cover.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Electrical Identification."

3.3 PROTECTION

- A. Protect installed components from damage. Replace damaged items prior to final acceptance.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 26 27 26

SPORTS LIGHTING

PART 1 – GENERAL

1.1 SUMMARY

- A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.
- B. The purpose of these specifications is to define the lighting system performance and design standards for Countryside Field #2 Soccer field. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications.
- C. The sports lighting will be for the following venues:
 - 1. 360 x 225 Soccer
- E. The primary goals of this sports lighting project are:
 - 1. Guaranteed I.E.S. class II Soccer Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore light levels are guaranteed to not drop below specified target values for a period of 10 years.
 - 2. Environmental Light Control: It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators and neighbors. The design should provide the same control as what is currently installed
 - 3. Control and Monitoring: To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system. Fields should be proactively monitored to detect luminaire outages over a 10-year life cycle. All communication and monitoring costs for 10-year period shall be included in the bid.
- F. Design and Permitting
 - 1. Contractor shall be responsible for securing necessary permits.

1.2 LIGHTING PERFORMANCE

- A. Illumination Levels and Design Factors: Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not drop below desired target values in accordance to IES RP-6-15, Page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period.

Area of Lighting	Minimum point Illumination Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Soccer	30fc	2.0:1	96	30' x 30'

- B. Hours of usage: Designs shall be based on the following hours of usage

Area of Lighting	Annual Usage Hours	10 year Usage Hours
All Venues	550	5,500

- C. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Higher mounting heights may be required based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal.

Field	Pole Designation	Pole Height
Soccer	S5, S6, P8	70'
Soccer	P3	90'
Soccer	P4	80'

1.3 ENVIRONMENTAL LIGHT CONTROL

- A. Light Control Luminaires: All luminaires shall utilize spill light and glare control devices including, but not limited to, internal shields, louvers and external shields. No symmetrical beam patterns are accepted.
- B. The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. Reports shall be certified by a qualified independent testing laboratory with a minimum of five years experience or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report.
- C. Upper Beam Definition

Fixtures shall not exceed the candlepower at the specified degrees above the center of the beam in the vertical plane as specified in the following table.

NEMA Classification of Vertical Beam	Candela	Degrees Above the Center of the Beam in the Vertical Plane
4	10,000	15.00 degrees

This mounting height increase will be calculated by referencing the fixture photometric report and determining the angle above vertical that the fixture achieves a candela reading less than or equal to 10,000 candela. Pole heights will be increased 3.33' for every one degree above 15.0 degrees needed to achieve a candela reading of 10,000. For example: If 10,000 candela is achieved at 19.5 degrees above vertical, a minimum mounting height of 85' (4.5 degrees x 3.33') would be required for the poles.

PART 2 – PRODUCT

2.1 SPORTS LIGHTING SYSTEM CONSTRUCTION

- A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, Ballast and other enclosures shall be factory assembled, aimed, wired and tested.
- B. Fixtures are to be labeled individually for ease of installation and identification for warranty purposes
- C. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel of 18-8 grade or better, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.
- D. System Description: Lighting system shall consist of the following:

1. Galvanized steel poles and cross-arm assembly. Alternate: Concrete pole with a minimum of 8,000 psi and installed with concrete backfill will be an acceptable alternative provided building code, wind speed and foundation designs per specifications are adhered to.
2. Non-approved pole technology:
 - a. Square static cast concrete poles will not be accepted.
 - b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long term performance concerns.
3. Pre-stressed concrete base embedded in concrete backfill allowed to cure for 12-24 hours before pole stress is applied. Alternate may be an anchor bolt foundation designed such that the steel pole and any exposed steel portion of the foundation is located a minimum of 18 inches above final grade. The concrete for anchor bolt foundations shall be allowed to cure for a minimum of 28 days before the pole stress is applied unless shorter cure time approved by structural engineer of record.
4. Manufacturer will remote all ballasts and supporting electrical equipment in aluminum enclosures mounted approximately 10 feet above grade. The enclosures shall be touch-safe and include ballasts and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure. Integral ballast fixtures will not be accepted.
5. Manufacturer shall provide surge protection at the pole equal to or greater than 40kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2_2002.
6. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
7. All luminaires, visors, and cross-arm assemblies shall withstand 150 mph winds and maintain luminaire aiming alignment.
8. Control cabinet to provide remote on-off control and monitoring of the lighting system. Cabinet shall be constructed of aluminum and be rated NEMA Type 4. Communication method shall be provided by manufacturer. Cabinet shall contain custom configured contactor modules for 30, 60, and 100 amps, labeled to match field diagrams and electrical design. Manual off-on-auto selector switches shall be provided.
9. Lightning Protection: Manufacturer shall provide integrated lightning grounding via concrete encased electrode grounding system as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.
10. Enhanced corrosion protection package: Due to the potentially corrosive environment for this project, manufacturers must provide documentation that their products meet the following enhanced requirements in addition to the standard durability protection specified above:
 - a) Exposed carbon steel horizontal surfaces on the crossarm assembly shall be galvanized to no less than a five (5) mil average thickness.
 - b) Exposed die cast aluminum components shall be Type II anodized per MIL-STD-8625 and coated with high performance polyester.
 - c) Exposed extruded aluminum components shall be Type II anodized per MIL-STD-8625 and coated with high performance polyester.

E. Safety: All system components shall be UL listed for the appropriate application.

2.2 ELECTRICAL

- A. Electric Power Requirements for the Sports Lighting Equipment:
 - 1. Electric power: 208 Volt, 3 Phase
 - 2. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed five (5) percent of the rated voltage.

2.3 **STRUCTURAL PARAMETERS**

- A. Wind Loads: Wind loads shall be based on the 2014 Florida Building Code. Wind loads to be calculated using ASCE 7-10, an ultimate design wind speed of 150 and exposure category C

2.1 **CONTROL**

- A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.
- B. Remote Lighting Control System: System shall allow owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.

The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute "early off" commands by phone. Scheduling tool shall be capable of setting curfew limits.

Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.
- C. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).
- D. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation and service. Mobile application will be provided suitable for IOS, Android and Blackberry devices.

Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the owner.

- 1. Cumulative hours: shall be tracked to show the total hours used by the facility
 - 2. Report hours saved by using early off and push buttons by users.
- E. Communication Costs: Manufacturer shall include communication costs for operating the controls and monitoring system for a period of 10 years.

PART 3 – EXECUTION

3.1 **DELIVERY TIMING**

Delivery Timing Equipment On-Site: The equipment must be on-site 7 Weeks from receipt of approved submittals and receipt of complete order information.

3.2 **FIELD QUALITY CONTROL**

- A. Laser aiming is required - This can be accomplished two ways
 - 1) If the fixtures are factory aimed, the crossarm assembly as one unit
 - 2) Fixtures that are not factory aimed must be individually laser aimed for quality control.

- B. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.
- C. Field Light Level Accountability
 - 1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warranty period of 10 Years.
 - 2. The contractor/manufacturer shall be responsible for an additional inspection one year from the date of commissioning of the lighting system and will utilize the owner's light meter in the presence of the owner.
 - 3. The contractor/manufacturer will be held responsible for any and all changes needed to bring these fields back to compliance for light levels and uniformities. Contractor/Manufacturer will be held responsible for any damage to the fields during these repairs.
- D. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including footcandles and uniformity ratios are not in conformance with the requirements of the performance specifications and submitted information, the Manufacturer shall be required to make adjustments to meet specifications and satisfy Owner.

3.4 WARRANTY AND GUARANTEE

- A. 10-Year Warranty: Each manufacturer shall supply a signed warranty covering the entire system for 10 years from the date of shipment. Warranty shall guarantee specified light levels. Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.
 - 1) Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term.
 - 2) Manufacturer must have employees/technicians to service the equipment located within a 60 mile radius. This is in addition to a network of contractors used to service the system.
 - 3) If the control system is not provided by the manufacturer of the lighting system, the manufacturer of the Control System must have employees/technicians to service the equipment located within a 60 mile radius. This is in addition to a network of contractors used to service the system.
- B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 10 years from the date of equipment shipment. Individual luminaire outages shall be repaired when the usage of any field is materially impacted. Owner agrees to check fuses in the event of a luminaire outage.

PART 4 – DESIGN APPROVAL

4.0 PRE-BID SUBMITTAL REQUIREMENTS (Non-Musco)

- A. Design Approval: The owner / engineer will review pre-bid submittals per section 4.0.B from all the manufacturers to ensure compliance to the specification 10 days prior to bid. If the design meets the design requirements of the specifications, a letter and/or addendum will be issued to the manufacturer indicating approval for the specific design submitted.
- B. Approved Product: Musco's LSG is the approved product. All substitutions must provide a complete submittal package for approval as outlined in Submittal Information at the end of this section at least 10 days prior to bid. Special manufacturing to meet the standards of this specification may be required. An addendum will be issued prior to bid listing any other approved lighting manufacturers and designs.
- C. All listed manufacturers not pre-approved shall submit the information at the end of this section at least 10 days prior to bid. An addendum will be issued prior to bid; listing approved lighting manufacturers and the design method to be used.

- D. Bidders are required to bid only products that have been approved by this specification or addendum by the owner or owner's representative. Bids received that do not utilize an approved system/design, will be rejected.



Control System Summary

Project Specific Notes:

Project #:	142739
Project Name:	City Of Clearwater Lighting Upgrade
Date:	12/11/20
Project Engineer:	Joel Stout
Sales Representative:	Bob DeCouto
Control System Type:	
Communication Type:	
Scan:	142739-prodSO
Document ID:	142739P5V1-1211091618
Distribution Panel Location or ID:	Countryside Soccer 1&2
Total # of Distribution Panel Locations for Project:	2
Design Voltage/Hertz/Phase:	208/60/3
Control Voltage:	120

Equipment Listing

DESCRIPTION	APPROXIMATE SIZE
1. Control and Monitoring Cabinet	
Total Contactors	QTY SIZE (AMPS)
Total Contactors	4 60 AMP
Total Off/On/Auto Switches:	2 100 AMP
	1

Materials Checklist

Contractor/Customer Supplied:

- A dedicated control circuit must be supplied per distribution panel location.
 - If the control voltage is NOT available, a control transformer is required.
- Electrical distribution panel to provide overcurrent protection for circuits
 - HID rated or D-curve circuit breaker sized per full load amps on Circuit Summary by Zone Chart
- Wiring:
 - See chart on page 2 for wiring requirements
 - Equipment grounding conductor and splices must be insulated. (per circuit)
 - Lightning ground protection (per pole), if not Musco supplied.
- Electrical conduit wireway system
 - Entrance hubs rated NEMA 4: must be die-cast zinc, PVC, or copper-free die-cast aluminum
- Mounting hardware for cabinets
- Breaker lock-on device to prevent unauthorized power interruption to control power
- Anti-corrosion compound to apply to ends of wire, if necessary

IMPORTANT NOTES

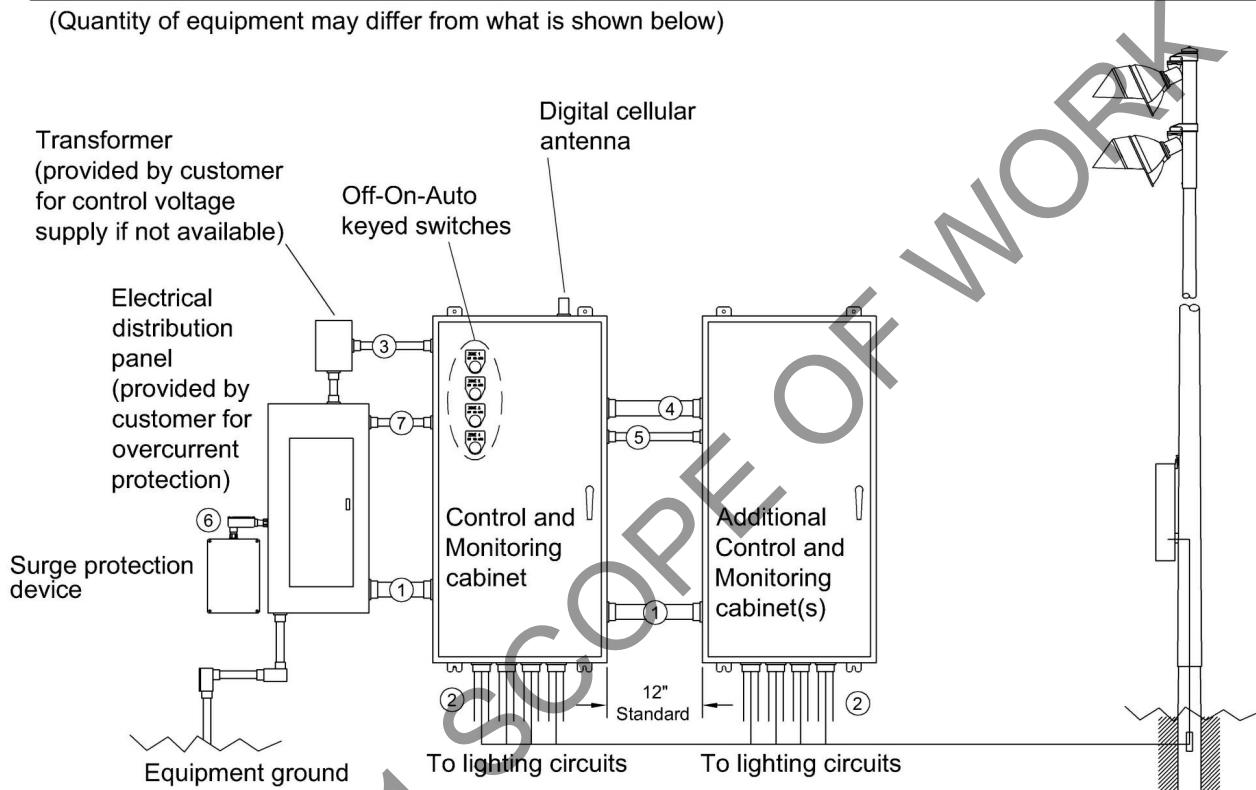
1. Please confirm that the design voltage listed above is accurate for this facility. Design voltage/phase is defined as the voltage/phase being connected and utilized at each lighting pole's electrical components enclosure disconnect. Inaccurate design voltage/phase can result in additional costs and delays. Contact your Musco sales representative to confirm this item.
2. In a 3 phase design, all 3 phases are to be run to each pole. When a 3 phase design is used Musco's single phase luminaires come pre-wired to utilize all 3 phases across the entire facility.
3. One contactor is required for each pole. When a pole has multiple circuits, one contactor is required for each circuit. All contactors are 100% rated for the published continuous load. All contactors are 3 pole.
4. If the lighting system will be fed from more than one distribution location, additional equipment may be required. Contact your Musco sales representative.
5. A single control circuit must be supplied per control system.
6. Size overcurrent devices using the full load amps column of the Circuit Summary By Zone chart- Minimum power factor is 0.9.

NOTE: Refer to Installation Instructions for more details on equipment information and the installation requirements.

Control-Link.

Control and Monitoring System - Digital Cellular

(Quantity of equipment may differ from what is shown below)



WIRE	DESCRIPTION	# OF WIRES	TYP. WIRE SIZE (AWG)	MAX. WIRE LENGTH (FT)	WIRE FROM MUSCO	NOTES
1	LINE POWER & GROUND TO CONTACTORS	NOTE A	NOTE B	27	NO	A-E
2	LOAD POWER TO LIGHTING CIRCUITS	NOTE A	NOTE B	N/A	NO	A-D
3	CONTROL POWER (DEDICATED, 20A)	3	12	N/A	NO	C, D
4	CONTROL HARNESSSES	--	--	8*	YES*	C, D
5	COMMUNICATION CABLE (RS-485)	1	--	8*	YES*	C, D
6	SURGE PROTECTION DEVICE TO DISTRIBUTION PANEL	--	--	N/A	YES	D
7	SURGE PROTECTION DEVICE MONITORING	2	14	N/A	NO	C, D

- Notes:
- A. Voltage and phasing per the notes on cover page
 - B. Calculate per load and voltage drop
 - C. Minimum conduit diameter
 - a. Wire 4 requires 2" (for connector ends to pass though)
 - b. Wire 5 requires 1" (for connector ends to pass though)
 - c. All other conduit diameters should be per code
 - D. Refer to Control and Monitoring System Installation Instructions for more details on equipment information and the installation requirements.
 - E. Contact Musco if maximum wire length from circuit breaker to contactor exceeds value in the chart.

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IMPORTANT: Communication wire (5) must be in separate conduit from any AC power wiring (1,2,3,4,6,7). Control (3,4) and monitoring (7) wire must be in separate conduit from line and load power wiring (1,2).

*Musco supplied wire harnesses are supplied in standard 8-foot lengths.



Control System Summary

City Of Clearwater Lighting Upgrade / 142739 -
Countryside Soccer 1&2 - Page 3 of 8

SWITCHING SCHEDULE

<u>Field/Zone Description</u>	<u>Zones</u>
Soccer 1-2	1

CONTROL POWER CONSUMPTION	
120V Single Phase	
VA loading of Musco Supplied Equipment	INRUSH: 1895.0
	SEALED: 171.0

BALLAST SPECIFICATIONS

.90 Minimum Power Factor

BALLAST OPERATING VOLTAGE

	200	208	220	230	240	277	347	380	480
1500 Watt Metal Halide Lamp Operating line amperage per fixture- maximum	9.1	8.6	8.3	0.0	7.5	6.5	5.1	4.7	3.7
1000 Watt Metal Halide Lamp Operating line amperage per fixture- maximum	7.0	6.5	6.4	0.0	5.8	4.9	4.0	3.6	2.9

VOLTAGE: 208v

THREE PHASE

CIRCUIT SUMMARY BY ZONE						
POLE	CIRCUIT DESCRIPTION	# OF FIXTURES	FULL LOAD AMPS	CONTACTOR SIZE (AMPS)	CONTACTOR ID	ZONE
S1	Soccer 1-2	7	43.0	60	C1	1
S2	Soccer 1-2	7	43.0	60	C2	1
S3	Soccer 1-2	13	77.4	100	C3	1
S4	Soccer 1-2	11	68.8	100	C4	1
S5	Soccer 1-2	7	43.0	60	C5	1
S6	Soccer 1-2	7	43.0	60	C6	1



Control System Summary

City Of Clearwater Lighting Upgrade / 142739 -
Countryside Soccer 1&2 - Page 4 of 8

PANEL SUMMARY						
CABINET #	CONTROL MODULE LOCATION	CONTACTOR ID	CIRCUIT DESCRIPTION	FULL LOAD AMPS	DISTRIBUTION PANEL ID (BY OTHERS)	CIRCUIT BREAKER POSITION (BY OTHERS)
1	1	C1	Pole S1	43.00		
1	1	C2	Pole S2	43.00		
1	1	C3	Pole S3	77.40		
1	1	C4	Pole S4	68.80		
1	1	C5	Pole S5	43.00		
1	1	C6	Pole S6	43.00		

ZONE SCHEDULE			CIRCUIT DESCRIPTION	
ZONE	SELECTOR SWITCH	ZONE DESCRIPTION	POLE ID	CONTACTOR ID
Zone 1	1	Soccer 1-2	S1 S2 S3 S4 S5 S6	C1 C2 C3 C4 C5 C6



Control System Summary

Project Specific Notes:

Project Information

Project #: 142739
Project Name: City Of Clearwater Lighting Upgrade
Date: 12/11/20
Project Engineer: Joel Stout
Sales Representative: Bob DeCouto
Control System Type:
Communication Type:
Scan: 142739-prodSO
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Distribution Panel Location or ID: Countryside Soccer 3&4
Total # of Distribution Panel Locations for Project: 2
Design Voltage/Hertz/Phase: 208/60/3
Control Voltage: 120

Equipment Listing

DESCRIPTION	APPROXIMATE SIZE
1. Control and Monitoring Cabinet	
Total Contactors	QTY 4 SIZE (AMPS) 60 AMP
Total Contactors	2 100 AMP
Total Off/On/Auto Switches:	1

Materials Checklist

Contractor/Customer Supplied:

- A dedicated control circuit must be supplied per distribution panel location.
 - If the control voltage is NOT available, a control transformer is required.
- Electrical distribution panel to provide overcurrent protection for circuits
 - HID rated or D-curve circuit breaker sized per full load amps on Circuit Summary by Zone Chart
- Wiring:
 - See chart on page 2 for wiring requirements
 - Equipment grounding conductor and splices must be insulated. (per circuit)
 - Lightning ground protection (per pole), if not Musco supplied.
- Electrical conduit wireway system
 - Entrance hubs rated NEMA 4: must be die-cast zinc, PVC, or copper-free die-cast aluminum
- Mounting hardware for cabinets
- Breaker lock-on device to prevent unauthorized power interruption to control power
- Anti-corrosion compound to apply to ends of wire, if necessary

IMPORTANT NOTES

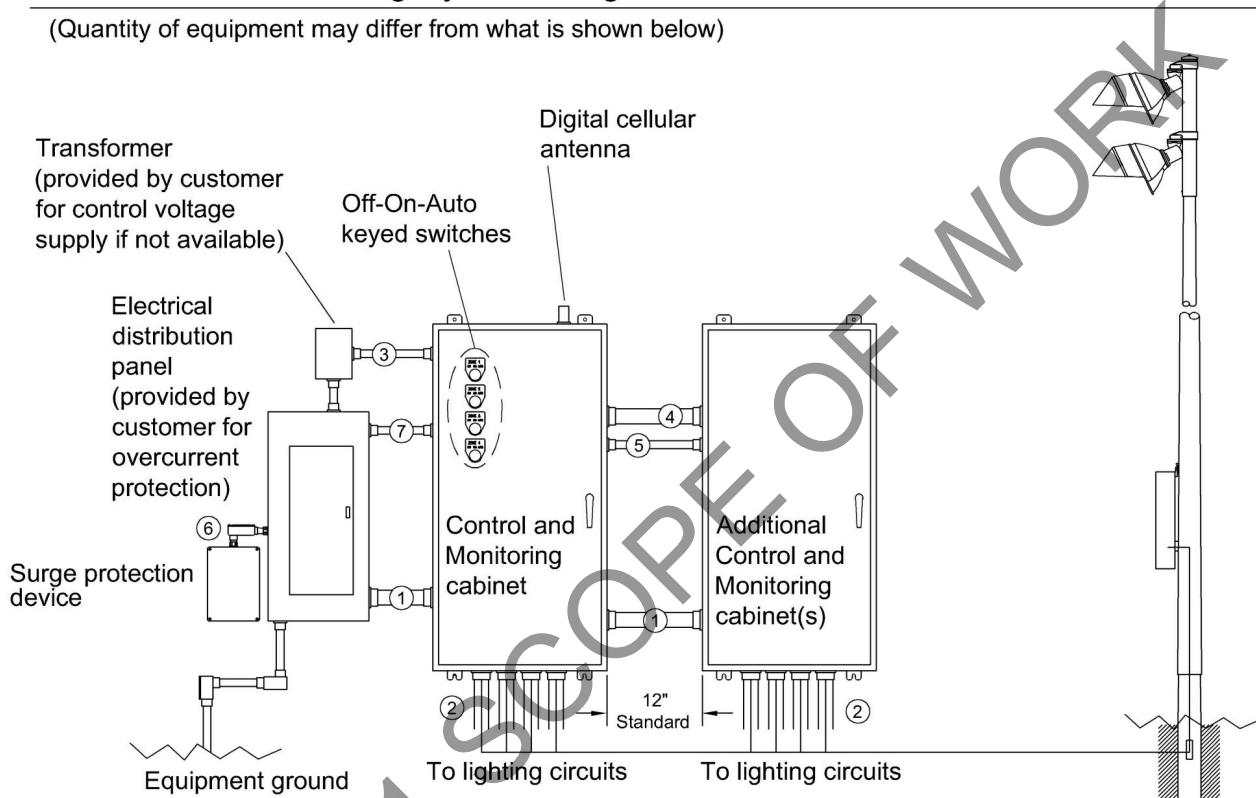
1. Please confirm that the design voltage listed above is accurate for this facility. Design voltage/phase is defined as the voltage/phase being connected and utilized at each lighting pole's electrical components enclosure disconnect. Inaccurate design voltage/phase can result in additional costs and delays. Contact your Musco sales representative to confirm this item.
2. In a 3 phase design, all 3 phases are to be run to each pole. When a 3 phase design is used Musco's single phase luminaires come pre-wired to utilize all 3 phases across the entire facility.
3. One contactor is required for each pole. When a pole has multiple circuits, one contactor is required for each circuit. All contactors are 100% rated for the published continuous load. All contactors are 3 pole.
4. If the lighting system will be fed from more than one distribution location, additional equipment may be required. Contact your Musco sales representative.
5. A single control circuit must be supplied per control system.
6. Size overcurrent devices using the full load amps column of the Circuit Summary By Zone chart- Minimum power factor is 0.9.

NOTE: Refer to Installation Instructions for more details on equipment information and the installation requirements.

Control-Link.

Control and Monitoring System - Digital Cellular

(Quantity of equipment may differ from what is shown below)



WIRE	DESCRIPTION	# OF WIRES	TYP. WIRE SIZE (AWG)	MAX. WIRE LENGTH (FT)	WIRE FROM MUSCO	NOTES
1	LINE POWER & GROUND TO CONTACTORS	NOTE A	NOTE B	27	NO	A-E
2	LOAD POWER TO LIGHTING CIRCUITS	NOTE A	NOTE B	N/A	NO	A-D
3	CONTROL POWER (DEDICATED, 20A)	3	12	N/A	NO	C, D
4	CONTROL HARNESSES	--	--	8*	YES*	C, D
5	COMMUNICATION CABLE (RS-485)	1	--	8*	YES*	C, D
6	SURGE PROTECTION DEVICE TO DISTRIBUTION PANEL	--	--	N/A	YES	D
7	SURGE PROTECTION DEVICE MONITORING	2	14	N/A	NO	C, D

Notes: A. Voltage and phasing per the notes on cover page

B. Calculate per load and voltage drop

C. Minimum conduit diameter

- a. Wire 4 requires 2" (for connector ends to pass though)
- b. Wire 5 requires 1" (for connector ends to pass though)
- c. All other conduit diameters should be per code

D. Refer to Control and Monitoring System Installation Instructions for more details on equipment information and the installation requirements.

E. Contact Musco if maximum wire length from circuit breaker to contactor exceeds value in the chart.

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IMPORTANT: Communication wire (5) must be in separate conduit from any AC power wiring (1,2,3,4,6,7). Control (3,4) and monitoring (7) wire must be in separate conduit from line and load power wiring (1,2).

*Musco supplied wire harnesses are supplied in standard 8-foot lengths.



Control System Summary

City Of Clearwater Lighting Upgrade / 142739 -
Countryside Soccer 3&4 - Page 7 of 8

SWITCHING SCHEDULE

<u>Field/Zone Description</u>	<u>Zones</u>
Soccer 3-4	1

CONTROL POWER CONSUMPTION	
120V Single Phase	
VA loading of Musco Supplied Equipment	INRUSH: 1895.0
	SEALED: 171.0

BALLAST SPECIFICATIONS

.90 Minimum Power Factor

BALLAST OPERATING VOLTAGE

	200	208	220	230	240	277	347	380	480
1500 Watt Metal Halide Lamp Operating line amperage per fixture- maximum	9.1	8.6	8.3	0.0	7.5	6.5	5.1	4.7	3.7
1000 Watt Metal Halide Lamp Operating line amperage per fixture- maximum	7.0	6.5	6.4	0.0	5.8	4.9	4.0	3.6	2.9

VOLTAGE: 208v

THREE PHASE

CIRCUIT SUMMARY BY ZONE						
POLE	CIRCUIT DESCRIPTION	# OF FIXTURES	FULL LOAD AMPS	CONTACTOR SIZE (AMPS)	CONTACTOR ID	ZONE
S10	Soccer 3-4	6	34.4	60	C1	1
S11	Soccer 3-4	6	34.4	60	C2	1
S4	Soccer 3-4	13	77.4	100	C3	1
S7	Soccer 3-4	7	43.0	60	C4	1
S8	Soccer 3-4	7	43.0	60	C5	1
S9	Soccer 3-4	13	77.4	100	C6	1



Control System Summary

City Of Clearwater Lighting Upgrade / 142739 -
Countryside Soccer 3&4 - Page 8 of 8

PANEL SUMMARY						
CABINET #	CONTROL MODULE LOCATION	CONTACTOR ID	CIRCUIT DESCRIPTION	FULL LOAD AMPS	DISTRIBUTION PANEL ID (BY OTHERS)	CIRCUIT BREAKER POSITION (BY OTHERS)
2	2	C1	Pole S10	34.40		
2	2	C2	Pole S11	34.40		
2	2	C3	Pole S4	77.40		
2	2	C4	Pole S7	43.00		
2	2	C5	Pole S8	43.00		
2	2	C6	Pole S9	77.40		

ZONE SCHEDULE			CIRCUIT DESCRIPTION	
ZONE	SELECTOR SWITCH	ZONE DESCRIPTION	POLE ID	CONTACTOR ID
Zone 1	1	Soccer 3-4	S10 S11 S4 S7 S8 S9	C1 C2 C3 C4 C5 C6



Control System Summary

Project Specific Notes:

Soccer 1-2 has (1) existing 72" control cabinet contactors C1-C6. We need to add a additional 72" secondary cabinet with contactors C7-C9.

Project Information

Project #:	208806
Project Name:	Countryside Athletic Complex Phase 3
Date:	12/11/20
Project Engineer:	Curt Lamberson
Sales Representative:	Bob DeCouto
Control System Type:	Control-Link™ Control and Monitoring System
Communication Type:	None
Scan:	208806B
Document ID:	208806P1V1-1211093807
Distribution Panel Location or ID:	Soccer 1-2
Total # of Distribution Panel Locations for Project:	1
Design Voltage/Hertz/Phase:	208/60/3
Control Voltage:	120

Equipment Listing

DESCRIPTION	APPROXIMATE SIZE
1. Control and Monitoring Cabinet	24 X 72
2. Control and Monitoring Cabinet	24 X 72
Total Contactors	4
Total Contactors	5
Total Off/On/Auto Switches:	1

Materials Checklist

Contractor/Customer Supplied:

- A dedicated control circuit must be supplied per distribution panel location
 - If the control voltage is NOT available, a control transformer is required
- Electrical distribution panel to provide overcurrent protection for circuits
 - HID rated or D-curve circuit breaker sized per full load amps on Circuit Summary by Zone Chart
- Wiring
 - See chart on page 2 for wiring requirements
 - Multi-Watt™ control power circuit from control cabinet to electrical components enclosures (if present)
 - Equipment grounding conductor and splices must be insulated (per circuit)
 - Lightning ground protection (per pole), if not Musco supplied.
- Electrical conduit wireway system
 - Entrance hubs rated NEMA 4, must be die-cast zinc, PVC, or copper-free die-cast aluminum
- Mounting hardware for cabinets
- Breaker lock-on device to prevent unauthorized power interruption to control power
- Anti-corrosion compound to apply to ends of wire, if necessary

Call Control-Link Central™ operations center at 877/347-3319 to schedule activation of the control system upon completion of the installation.

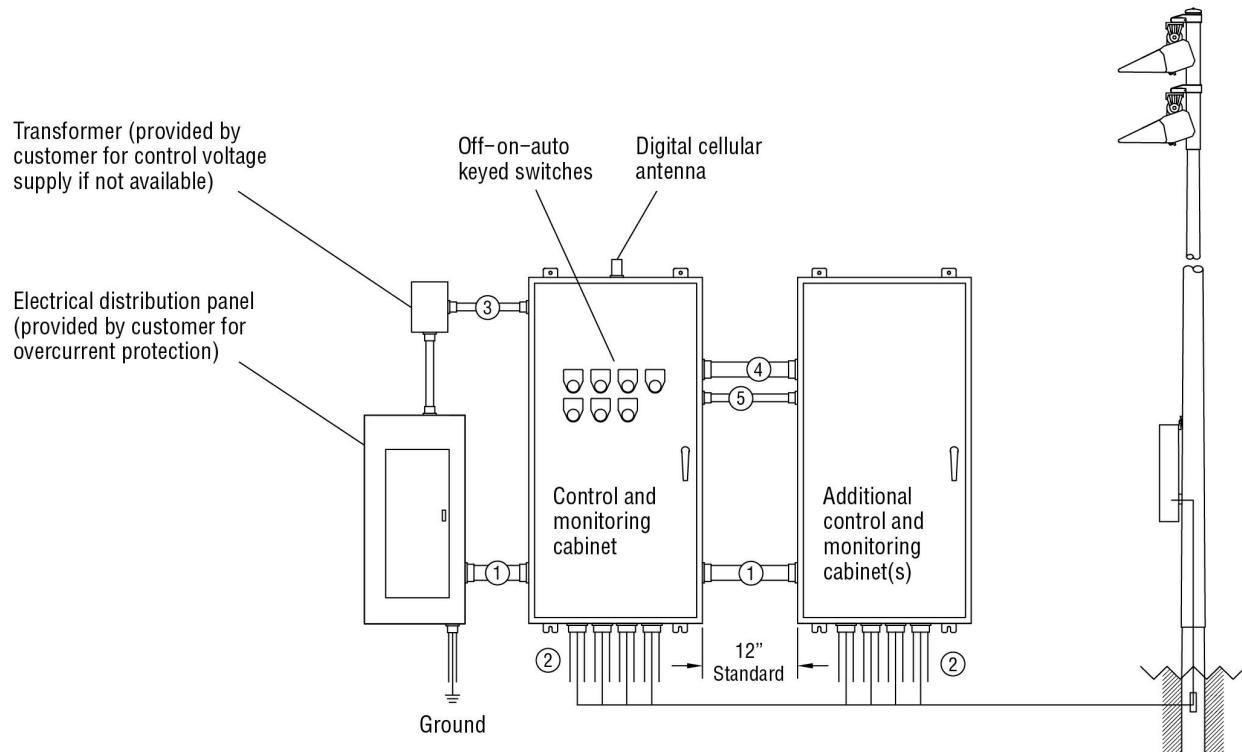
Note: Activation may take up to 1 1/2 hours.

IMPORTANT NOTES

1. Please confirm that the design voltage listed above is accurate for this facility. Design voltage/phase is defined as the voltage/phase being connected and utilized at each lighting pole's electrical components enclosure disconnect. Inaccurate design voltage/phase can result in additional costs and delays. Contact your Musco sales representative to confirm this item.
2. In a 3 phase design, all 3 phases are to be run to each pole. When a 3 phase design is used Musco's single phase luminaires come pre-wired to utilize all 3 phases across the entire facility.
3. One contactor is required for each pole. When a pole has multiple circuits, one contactor is required for each circuit. All contactors are 100% rated for the published continuous load. All contactors are 3 pole.
4. If the lighting system will be fed from more than one distribution location, additional equipment may be required. Contact your Musco sales representative.
5. A single control circuit must be supplied per control system.
6. Size overcurrent devices using the full load amps column of the Circuit Summary By Zone chart- Minimum power factor is 0.9.

NOTE: Refer to Installation Instructions for more details on equipment information and the installation requirements.

Control•Link® Control and Monitoring System



Wire	Description	# of Wires	Typ. Wire Size (AWG)	Max. Wire Length (FT)	Wire from Musco	Notes
1	Line power to contactors, and equipment grounding conductor	Note A	Note B	27	No	A – E
2	Load power to lighting circuits, and equipment grounding conductor	Note A	Note B	N/A	No	A – D
3	Control power (dedicated, 20A)	3	12	N/A	No	C, D
4	Control harnesses	Note F	--	8*	Yes*	C, D, F
5	Communication cable (RS – 485)	1	--	8*	Yes*	C, D

Notes:

- A. See voltage and phasing per the notes on cover page.
- B. Calculate per load and voltage drop.
- C. Minimum conduit diameter.
 - a. Wire 4 requires 2" (for connector ends to pass through).
 - b. Wire 5 requires 1" (for connector ends to pass through).
 - c. All other conduit diameters should be per code.
- D. Refer to control and monitoring system installation instructions for more details on equipment information and the installation requirements.
- E. Contact Musco if maximum wire length from circuit breaker to contactor exceeds value in chart.
- F. Number of wires = 6 power wires + 2 wires per zone (see circuit summary by zone chart for the number of zones).

R60-33-00_D

IMPORTANT: Communication wire (5) must be in separate conduit from any AC power wires (1, 2, 3, 4). Control wires (3, 4) must be in separate conduit from line and load power wires (1, 2).

*Musco supplied wire harnesses are provided in standard 8-foot lengths.



Control System Summary

Countryside Athletic Complex Phase 3 / 208806 - 208806B
Soccer 1-2 - Page 3 of 4

SWITCHING SCHEDULE

Field/Zone Description	Zones
Soccer 1-2	1

CONTROL POWER CONSUMPTION	
120V Single Phase	
VA loading of Musco Supplied Equipment	INRUSH: 3833.0
	SEALED: 339.8

BALLAST SPECIFICATIONS

.90 Minimum Power Factor

BALLAST OPERATING VOLTAGE

	200	208	220	230	240	277	347	380	480
--	-----	-----	-----	-----	-----	-----	-----	-----	-----

1500 Watt Metal Halide Lamp

Operating line amperage per fixture- maximum

1000 Watt Metal Halide Lamp

Operating line amperage per fixture- maximum

VOLTAGE: 208v

THREE PHASE

CIRCUIT SUMMARY BY ZONE						
POLE	CIRCUIT DESCRIPTION	# OF FIXTURES	FULL LOAD AMPS	CONTACTOR SIZE (AMPS)	CONTACTOR ID	ZONE
S1	Soccer 1-2	7	43.0	60	C1	1
S2	Soccer 1-2	7	43.0	60	C2	1
S3	Soccer 1-2	13	77.4	100	C3	1
S4	Soccer 1-2	11	68.8	100	C4	1
S5	Soccer 1-2	4	25.8	60	C5	1
S6	Soccer 1-2	4	25.8	60	C6	1
P3	Soccer 1-2	14	86.0	100	C7	1
P4	Soccer 1-2	13	77.4	100	C8	1
P8	Soccer 1-2	12	68.8	100	C9	1



Control System Summary

Countryside Athletic Complex Phase 3 / 208806 - 208806B
Soccer 1-2 - Page 4 of 4

PANEL SUMMARY						
CABINET #	CONTROL MODULE LOCATION	CONTACTOR ID	CIRCUIT DESCRIPTION	FULL LOAD AMPS	DISTRIBUTION PANEL ID (BY OTHERS)	CIRCUIT BREAKER POSITION (BY OTHERS)
1	1	C1	Pole S1	43.00		
1	1	C2	Pole S2	43.00		
1	1	C3	Pole S3	77.40		
1	1	C4	Pole S4	68.80		
1	1	C5	Pole S5	25.80		
1	1	C6	Pole S6	25.80		
2	1	C7	Pole P3	86.00		
2	1	C8	Pole P4	77.40		
2	1	C9	Pole P8	68.80		

ZONE SCHEDULE			CIRCUIT DESCRIPTION	
ZONE	SELECTOR SWITCH	ZONE DESCRIPTION	POLE ID	CONTACTOR ID
Zone 1	1	Soccer 1-2	S1 S2 S3 S4 S5 S6 P3 P4 P8	C1 C2 C3 C4 C5 C6 C7 C8 C9



Musco Constant 10™

10-Year Product Assurance & Warranty Program

Project name: Countryside Athletic Complex Redesign Project number: 189038

Owner: City of Clearwater City: Clearwater State: FL

Covered product(s): Light-Structure Green™ Lighting System

Date issued: July 31, 2020 Expiration: July 31, 2030

Musco Sports Lighting, LLC will provide all materials and labor to maintain operation of your lighting system to original design criteria for 10 years. Musco products and services are guaranteed to perform on your project as detailed in this document.

Light Performance

Specified illumination levels will be maintained and are marked as guaranteed in the Musco Illumination Summary.

Individual luminaire outages that occur during the warranty and maintenance period are repaired when the usage of any field is materially impacted.

Spill Light Control

If specified, spill light levels at identified locations are guaranteed to be controlled to the maximum values provided in the Musco Illumination Summary.

Energy Consumption

Total average kW consumption for your lighting system is guaranteed to be not more than the total load shown in the Musco Illumination Summary.

Monitoring, Maintenance, and Control Services

Musco shall monitor the performance of your lighting system, including on/off status, hours of usage, and luminaire outages. If outages that affect playability are detected, Musco will contact you and proactively dispatch technicians.

On-off control of your lighting system is provided via an easy-to-use web site scheduling system, smartphone app, phone, email, or fax. Our trained Control-Link Central™ service center staff is available toll-free 24/7. Regular usage reports are always available on Control-Link Central's web site.

Structural Integrity

Your project has been designed to FBC 2017, 150 mph, exposure C. Structural integrity of equipment manufactured by Musco is guaranteed.

Musco has a team to ensure fulfillment of our product and services warranty and maintains financial reserves dedicated to support our fulfillment of this warranty. Please keep this document as your signed contract guaranteeing comprehensive service for the 10 year period.



Musco Constant 10™

10-Year Product Assurance & Warranty Program

Terms and Conditions

Service under this Contract is provided by Musco Sports Lighting, LLC ("Musco") or an authorized servicer approved by Musco. Services performed under this Contract shall consist of furnishing labor and parts necessary to restore the operation of the Covered Product(s) to original design criteria provided such service is necessitated by failure of the Covered Product(s) during normal usage. This Contract covers Product(s) consisting of Musco's Total Light Control - TLC for LED® with Control-Link® and any additional Musco manufactured product as listed on page 1.

"We", "us," and "our" mean Musco. "You" and "your" mean the purchaser of the Covered Product(s). No one has the authority to change this Contract without the prior written approval of Musco. Musco shall not assume responsibility for their agents or assignees other than as described below. If there is a conflict between the terms of this Contract and information communicated either orally or in writing by one or more of our employees or agents, this Contract shall control.

Additional Provisions

- 1. Availability of Service:** Control-Link Central™ operators shall be available 24/7 via web site, phone, fax, or email. Maintenance service specialists shall be available 8AM to 5PM Central Time, and services shall be rendered during these same hours in your local time zone, Monday through Friday (with the exception of national holidays). Hours of operation are subject to change without notice to you. Musco will exercise all reasonable efforts to perform service under this Contract, but will not be responsible for delays or failure in performing such services caused by adverse weather conditions, acts of any government, failure of transportation, accidents, riots, war, labor actions or strikes or other causes beyond its control.
- 2. Determination of Repairs:** Musco will utilize the field monitoring system and any information provided by the customer to determine when the usage of the field is materially impacted. From this information, Musco will determine needed repair and/or replacement of Covered Product(s) and parts. Repair will be with Product(s) of like kind and quality.
- 3. Your Requirements Under this Contract:** You must meet all electrical and installation requirements as specified by the manufacturer. In addition, you promise and assure: full cooperation with Musco, Musco's technicians and authorized servicers during telephone diagnosis and repair of the Covered Product(s); reasonable accessibility of the Covered Product(s); a nonthreatening and safe environment for service.

You agree to check fuses and to replace fuses as needed. Musco provides spare fuses in the lowest alpha-numeric numbered enclosure. Musco will replenish spare fuses used.

You agree to keep your control system online. This means keeping the required control voltage to the control system at all times. Any deviation from this practice must be discussed with Musco's Warranty Department.

- 4. Service Limitations — This Contract does not cover:** Maintenance, repair, or replacement necessitated by loss or damage resulting from any external causes such as, but not limited to, theft, environmental conditions, negligence, misuse, abuse, improper electrical/power supply, unauthorized repairs by third parties, attachments, damage to cabinetry, equipment modifications, vandalism, animal or insect infestation, physical damage to Covered Product(s) parts or components, failure of existing structures, supporting electrical systems or any non-Musco equipment, or acts of nature (including, but not limited to: earthquake, flood, tornadoes, typhoons, hurricanes, or lightning).

5. Contract Limitations:

- a. **EXCLUSIONS FROM COVERAGE:** IN NO EVENT WILL MUSCO BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHICH INCLUDE, BUT ARE NOT LIMITED TO, ANY DELAY IN RENDERING SERVICE OR LOSS OF USE DURING THE REPAIR PERIOD OF THE COVERED PRODUCT(S) OR WHILE OTHERWISE AWAITING PARTS.
- b. **LIMITATION OF LIABILITY:** To the extent permitted by applicable law, the liability of Musco, if any, for any allegedly defective Covered Product(s) or components shall be limited to repair or replacement of the Covered Product(s) or components at Musco's option. THIS CONTRACT IS YOUR SOLE EXPRESS WARRANTY WITH RESPECT TO THE COVERED PRODUCT(S). ALL IMPLIED WARRANTIES WITH RESPECT TO THE COVERED PRODUCT(S) INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY EXPRESSLY EXCLUDED.
- c. For the purposes of and by your acceptance of this Contract you acknowledge and agree that if a surety bond ("Bond") is provided the warranty and/or maintenance guarantee provided for in this Contract and any corresponding liability on behalf of the issuing surety under the Bond is limited to the first twelve (12) months of said warranty and/or maintenance guarantee coverage period. Any warranty and/or guarantee coverage period in excess of said initial 12 month period does not fall within the scope of the Bond and shall be the sole responsibility of Musco.
- d. Musco requires reasonable access for a crane or man lift equipment to service the lighting system. Musco will not be responsible for damage from operating the vehicle on the property when the equipment is operated in the prescribed manner over the designated access route.
- e. **Obsolescence or Environmental Restrictions:** If during any maintenance or other work performed under this Warranty, any of the parts of the Covered Product(s) are found to be either obsolete, no longer available, or prohibited by any state or federal agency, Musco shall replace said parts with comparable parts and materials with equal operating characteristics solely at Musco's discretion. The cost of replacement of any obsolete cellular related technology shall be borne by you. Prior to completing any such work, Musco shall notify you of the cost (if any) you will incur in the replacement of such parts under this section.

- 6. Transfer and Assignment:** Except to owners, you shall not have the right to assign or otherwise transfer your rights and obligations under this Contract except with the prior written consent of Musco; however, a successor in interest by merger, operation of law, assignment or purchase or otherwise of your entire business shall acquire all of your interests under this Contract.

- 7. Governing Law:** The Contract shall be interpreted and enforced according to the laws of the project location.

- 8. Subrogation:** In the event Musco repairs or replaces any Covered Product(s), parts or components due to any defect for which the manufacturer or its agents or suppliers may be legally responsible, you agree to assign your rights of recovery to Musco. You will be reimbursed for any reasonable costs and expenses you may incur in connection with the assignment of your rights. You will be made whole before Musco retains any amounts it may recover.

Signature: 

Vice President of Sales

SECTION V

CONTRACT DOCUMENTS

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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.”

<u>CONTRACTOR</u>	<u>SURETY</u>	<u>OWNER</u>
[name]	[name]	City of Clearwater Engineering 100 S. Myrtle Avenue Clearwater, FL 33756 (727) 562-4750
[principal business address]	[principal business address]	
[phone number]	[phone number]	

PROJECT NAME: Countryside Sports Complex Field Lighting – Phase II

PROJECT NO.: 21-0006-PR

PROJECT DESCRIPTION: Remove & relocate existing light poles which consist of 2 light poles being relocated, two new poles and adding light fixtures to existing poles and other electrical works to provide a complete functional sport lighting system to a minimum 30-foot candles of the northeast soccer field of the sports complex per contract drawings, specifications and to the satisfaction of the Owner.

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 Countryside Sports Complex Field Lighting – Phase II, 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)

 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: Countryside Sports Complex Field Lighting – Phase II

PROJECT NO.: 21-0006-PR

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 AT 727-562-4092, Rosemarie.Call@myclearwater.com, 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: _____ (SEAL)
 William B. Horne, II
 City Manager

Attest:

Countersigned:

 Rosemarie Call
 City Clerk

By: _____ Approved as to form:
 Frank Hibbard
 Mayor

 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: Countryside Sports Complex Field
Lighting – Phase II

Parks and Recreation PROJECT NO.: 21-0006-PR

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
Parks and Recreation
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) _____

(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

Countryside Sports Complex Field Lighting – Phase II (21-0006-PR)

and doing such other work incidental thereto, all in accordance with the contract documents, marked

Countryside Sports Complex Field Lighting – Phase II (21-0006-PR)

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: Countryside Sports Complex Field Lighting – Phase II (21-0006-PR)

Acknowledgment is hereby made of the following addenda received since issuance of Plans and Specifications.

Addendum No. _____ Date: _____

(Name of Bidder)

(Signature of Officer)

(Title of Officer)

(Date)

BIDDER'S PROPOSAL**PROJECT: Countryside Sports Complex Field Lighting – Phase II 21-0006-PR****CONTRACTOR:** _____**BIDDER'S GRAND TOTAL:** \$_____ (Numbers)**BIDDER'S GRAND TOTAL:** _____

_____ (Words)

	BID ITEMS	UNIT	QTY	UNIT	TOTAL
				PRICE	
1	Mobilization and Demobilization	LS	1	\$	
2	Video site condition prior to mobilization to the site and provide a flash drive to the Owner at first progress meeting.	LS	1	\$	
3	Install and remove one (1) project sign at location designated by the Owner. Contractor shall provide and install one (1) Fixed project sign as described in SECTION III, Article 23 of the Contract documents. Contractor shall remove project sign at the end of project.	EA	1	\$	
4	Install and remove temporary construction fencing provided by the Owner to include fence panels, fence panel stands and fence panel clamps for panel connection. Panels are 6 ft. high by 12 ft. long and set on stands, Contractor shall provide one (1) sand bag filled with sand for each stand.	EA	42	\$	
5	Disconnect electrical from existing sport lighting pole, carefully dismantle metal pole from concrete footer, remove exiting concrete footer	EA	2	\$	
6	Provide all materials to be purchased from MUSCO Lighting for Countryside Sports Complex Northeast soccer field (see sheet E0 MUSCO Quote which does not include sale tax.)	LS	1	\$	
7	Electrical Panel and all electrical components required to provide a functional electrical panel	LS	1	\$	

8	Conduits - Contractor to verify existing conduit run from electrical panel location to the new and relocated poles location. This line item is for any additional electrical conduits not existing and the Contractor shall provide a drawing showing all additional conduit run in this line item price.	LS	1		\$
9	Directional Bore three inch diameter electrical conduit (electrical contractor shall confirm size is adequate) and all miscellaneous items to bore this electrical conduit	LF	450		\$
10	Copper Conductors and all miscellaneous items	LS	1		\$
11	Electrical Junction boxes traffic rated, preferably finer concrete with lid labeled electric	LS	1		\$
12	All electrical hardware and components to be provided for a complete operational sport lighting system per contract drawings not specified in any other line item.	LS	1		\$
13	Dispose of all construction debris from the site at proper disposal site	LS	1		\$
14	Fine grade disturbed areas and sod areas with Tiffway 419 Bermuda Sod	LS	1		\$
15	Labor and equipment necessary to perform the work per contract drawings.	LS	1		\$
16	Contractors performance surety bond	LS	1		\$
17	General conditions	LS	1		\$
18	Contractors Fee (profit)	LS	1		\$
SUBTOTAL					
19	10 % CONTINGENCY	LS	1	\$	\$
	TOTAL CONSTRUCTION COSTS (ITEMS 1-19)				\$

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.

**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

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

VENDOR INFORMATION

Company Legal/Corporate Name: _____

Doing Business As (if different than above): _____

Address: _____

City: _____ State: _____ Zip: _____ -

Phone: _____ Fax: _____

E-Mail Address: _____ Website: _____

DUNS #: _____

Remit to Address (if different than above):

Order from Address (if different from above):

Address: _____

Address: _____

City: _____ State: _____ Zip: _____

City: _____ State: _____ Zip: _____

Contact for Questions about this response:

Name: _____ Fax: _____

Phone: _____ E-Mail Address: _____

Day-to-Day Project Contact (if awarded):

Name: _____ Fax: _____

Phone: _____ E-Mail Address: _____

Certified Small Business

Certifying Agency: _____

Certified Minority, Woman or Disadvantaged Business Enterprise

Certifying Agency: _____

Provide supporting documentation for your certification, if applicable.