

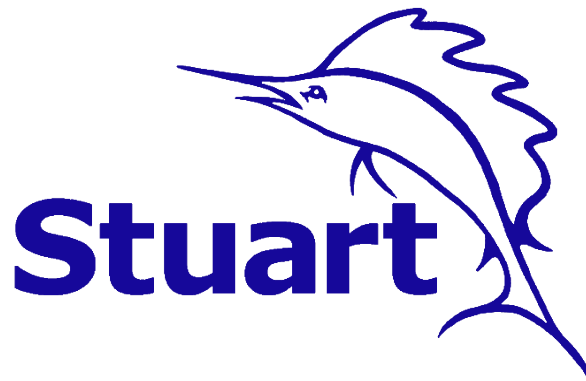
# **Water and Sewer Standard Specifications and Details**

**City of Stuart  
Public Works Department  
121 SW Flagler Ave.  
Stuart, Florida 34994**

**January 2018**

**CITY OF STUART  
WATER AND SEWER STANDARD SPECIFICATIONS  
JANUARY 2018  
TABLE OF CONTENTS**

<b>DIVISION</b>	<b>SHEET NO.</b>
<b>A. General Conditions .....</b>	<b>1 - 10</b>
<b>B. Design Criteria .....</b>	<b>11-22</b>
<b>C. Inspectors Authority .....</b>	<b>23-24</b>
<b>D. Earthwork .....</b>	<b>25</b>
<b>E. Utility Excavation, Backfilling, and Compacting .....</b>	<b>26-30</b>
<b>F. Jack and Bore .....</b>	<b>31-32</b>
<b>G. Trenchless Installation of Pressure Mains by Directional Boring .....</b>	<b>33-46</b>
<b>H. Left Blank for Future Use .....</b>	<b>47</b>
<b>I. Utility Valves and Appurtenances .....</b>	<b>48-52</b>
<b>J. Fire Hydrant Assemblies .....</b>	<b>53-55</b>
<b>K. Potable Water Systems .....</b>	<b>56-63</b>
<b>L. Sewage Force Mains .....</b>	<b>64-69</b>
<b>M. Wastewater Pumping Stations .....</b>	<b>70-79</b>
<b>N. Grinder Pump Systems .....</b>	<b>80-91</b>
<b>O. Gravity Wastewater Collection System .....</b>	<b>92-95</b>
<b>P. Low Pressure Sewer Systems .....</b>	<b>96-97</b>
<b>Q. Performance Testing of Pressure Pipelines .....</b>	<b>98-101</b>
<b>R. Pipeline Cleaning – Poly Pig Method .....</b>	<b>102-105</b>



**DIVISION A**  
**GENERAL CONDITIONS**

**A.1 INTRODUCTION**

The specifications and standards presented herein are subject to the latest revisions, and are designed to assure uniformity and quality of construction of potable water, reclaimed water and wastewater facilities that will be connected to the City of Stuart's Water, Reclaimed Water and Wastewater Systems. These specifications shall be used in the design and construction of such systems, and applicable provisions herein shall be incorporated into all plans and specifications for new systems or connections to existing systems. In case of conflicts, the following precedence will apply: State and local ordinance, City of Stuart Resolutions, City of Stuart approved contracts, FDEP regulations, these design standards, drawings, and specifications. Conflicts should be brought to the attention of the City of Stuart's Public Works Director. Both plan and profile drawings are required, and shall be submitted to the City of Stuart for review and approval. An Engineer's detailed cost estimate must be provided prior to the execution of all regulatory permit applications by the City. For all projects that will connect to the City's water, reclaimed water and wastewater systems, an executed Utility Service Agreement, if required, must be obtained and all review fees must be paid prior to the City approving and executing a regulatory permit application.

**A.2 TERMINOLOGY**

Contractor – The Owner, Developer, Builder, Contractor, or other individual, company, or corporation responsible for the construction of potable water, reclaimed water and/or wastewater facilities covered by these standards.

City- (COS) The City of Stuart, whose offices are located at 121 SW Flagler Ave., Stuart, Florida 34994

Director – The Public Works Director or his authorized representative.

Department – The City of Stuart Public Works Department.

Engineer – Engineer of Record.

He, His – Pronouns used to designate either male or female personnel.

**A.3 COMMENCEMENT OF WORK**

No construction work shall be started without approval by the City of Stuart Public Works Department and by other interested agencies having jurisdiction. A pre-construction meeting shall be held a minimum of 48 hours prior to commencement of construction.

**A.4 USE OF RIGHT-OF-WAY**

Permission for use of right-of-way shall be obtained from the City of Stuart and any other appropriate governing agency having jurisdiction. All required right-of-way use permits shall be obtained prior to construction. Contractor is responsible for applying and obtaining all required permits.

**A.5 OTHER STANDARDS**

These standards and specifications contain certain abbreviated references to standards or specifications of various organizations including, but not limited to, the following:

AASHTO, American Association of State Highway Traffic Officials

ANSI (USASI, ASA), American National Standards Institute (formerly United States of America Standards Institute, formerly the American Standards Association)  
AWWA, American Water Works Association  
CSI, Construction Standards Institute  
DIPRA, Ductile Iron Pipe Research Association  
EPA, Environmental Protection Agency, United States  
FDEP, Florida Department of Environmental Protection  
FDOT, Florida Department of Transportation, State of Florida  
FM, Factory Mutual  
HDPE, High Density Polyethylene  
NEC, National Electrical Code  
NEMA, National Electrical Manufacturers Association  
NSF, National Sanitary Foundation  
OSHA, Occupational Safety and Health Administration (U.S. Department of Labor)  
SFWMD, South Florida Water Management District  
TSS (S), Ten State Standards, i.e., recommended Standards for Wastewater Facilities  
TSS (W), Ten State Standards, i.e., recommended Standards for Water Works  
UL, Underwriters Laboratories

When standards or specifications are indicated herein by reference, the referenced portion shall apply to the most recent edition of the publication and shall have the same force and effect, to the extent indicated by the references thereto, as if they were included herein in their entirety.

#### **A.6 SAMPLING AND TESTING**

Except as otherwise provided, sampling and testing of materials, and the laboratory methods and testing equipment used, when required, shall be in accordance with the latest published standards (including published tentative) or methods of ASTM, (including published tentative) or methods of ASTM, AASHTO, AWWA, or other such organizations recognized as authoritative for the type of test required.

The testing of samples and materials shall be made at the expense of the Contractor, unless otherwise specifically authorized or approved in writing. All test results shall be submitted to the Engineer.

#### **A.7 LEGAL RESTRICTIONS AND PERMITS**

The Contractor at all times shall observe and comply with all Federal, State, County, City, and other laws, codes, ordinances, and regulations in any manner affecting the conduct of the work. He shall further procure all permits and licenses, pay all charges and fees, and give all notices necessary and incidental to the due and lawful prosecution of the work. The Engineer will be responsible for City, County, State, Regional, and Federal permits.

#### **A.8 PUBLIC CONVENIENCE AND SAFETY**

Materials stored at the site of the work shall be so placed and the work shall at all times be so conducted as to cause no obstruction to vehicular or pedestrian traffic. No roadway shall be closed except by expressed permission of the City of Stuart Public Works Department or

other authorized public agency having jurisdiction. Owner is responsible for public convenience.

Precaution shall be exercised at all times for the protection of persons and property. The Contractor shall be responsible for safety on the job site. The safety provisions of applicable laws, building codes and construction codes shall be observed. Machinery, equipment and other hazards shall be guarded in accordance with the safety provisions of OSHA, and the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America.

**A.9 CHEMICAL USAGE**

All chemicals used during project construction or furnished for project operations, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either U.S. Environmental Protection Agency or U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict conformance with environmental regulations.

**A.10 PROTECTION OF PROPERTY - RECORDING BY D.V.D.**

Prior to commencing construction activities, the Contractor shall provide a pre-construction digital video completed by a professional videographer. Tape the entire length of the right-of-way, easement area, public and or private property, and any other areas that may be effected by the construction activities. The Contractor shall provide the City of Stuart Public Works Department with one (1) copy of the video. Contractor shall not enter upon private property for any purpose without first obtaining permission, and he shall use every precaution necessary to prevent damage or injury to any public or private property, trees, fences, monuments, and underground structures, etc., on and adjacent to the site of the work. If work is to be performed in an easement on private property, then affected property owners shall will be notified 24 hours in advance of construction.

The Contractor shall not do any work that would affect any railway track, pipeline, telephone, power transmission line, or other utilities or structure, or enter upon the right-of-way or other land appurtenant thereto, until authority has been secured from the proper persons. Utility location agencies shall be given sufficient notice prior to construction in accordance with Underground Facility Damage and Protection Regulation FS 556.

The Contractor shall be responsible for all damage or injury to property resulting from any act, omission, neglect or misconduct in his manner or method or executing said work, from his non-execution of said work, or from defective work or materials, and he shall not be released from said responsibility until the work has been completed and accepted and the warranty requirements fulfilled.

Once the construction activities have been completed, the Contractor shall digital video tape the entire length of the right-of-way, easement area, public or private property, and any other areas that were effected by the construction activities. The Contractor shall provide the City of Stuart Public Works Department with one (1) copy of the digital video.

## **A.11 RESTORATION OF PROPERTY**

**Responsibility:** All damage as a result of construction work done to existing structures, wetland areas, roadway pavement, driveways, other paved areas, fences, utilities, traffic control devices, and any other obstruction not specifically named herein, shall be repaired, restored, or replaced by the Contractor unless otherwise specified.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof on the part of the Contractor, he shall restore such property, at his own expense, to a condition equal to or better than that existing before such damage or injury was done by repairing, rebuilding, or otherwise restoring, as may be directed, or he shall make good such damage or injury in a manner acceptable to the damaged or injured party.

**Temporary Repairs:** All damage named in above shall be at least temporarily repaired, restored, or replaced immediately following construction efforts at that location. Temporary restoration shall mean putting the affected area back into a safe, usable condition. In no case shall trenches remain open overnight within a street right-of-way unless specific approval is granted by the agency having jurisdiction.

**Permanent Repairs:** All damage named above shall be permanently repaired, restored, or replaced no later than the 30 calendar days following the completion of construction at that location unless otherwise stipulated. Permanent repairs will be accomplished in a professional workmanship-like manner in accordance with specifications contained herein, or contract documents, if addressed. The Contractor may be relieved of the 30-day time limit only by specific written agreement with the Director.

**City of Stuart Restitution:** In the event that the Contractor fails to make the permanent repairs within the time specified above, the City of Stuart, at its option, will complete the repair, restoration, or replacement of the affected area to be accomplished. The costs of such work will then be deducted either from the next pay request or from any other monies owed the Contractor by the City of Stuart.

**Protection and Restoration of Easements on and/or Road Right-of-Way, and Private Property:** During the course of construction, the Contractor shall take special care and provide adequate protection in order to minimize damage to vegetation, surfaced areas, and structures within the construction right-of-way, easement, or site, and take full responsibility for the replacement or repair thereof. The Contractor shall immediately repair any damage to the private property created by encroachment thereon. Should the removal or trimming of valuable trees, shrubs or grass be required to facilitate the installation within the designated construction area, this work shall be done in cooperation with the appropriate agency having jurisdiction in the area in which the work takes place. Said valuable vegetation, removed or damaged, shall be replanted, if possible, or replaced by items of equal quality, and maintained until growth is reestablished. Topsoil damaged in the course of work shall be replaced with at least a four-inch layer of suitable material.

Following construction completion, the work area along the route of the installation shall be finish graded to elevations compatible with the adjacent surface, with grassing or hand raking required within developed areas.

**Sidewalk and Driveway Restoration:** Existing sidewalks and driveways removed, disturbed, or destroyed by construction shall be replaced or repaired. Restoration shall be to the nearest joint, right-of-way line or road apron. The finished work shall, as a minimum, be equal in all respects to the original.

**Cleanup:** Work site cleanup and property restoration shall follow behind construction operations without delay. In order to facilitate an acceptable construction site, debris and waste materials shall be removed from the site daily and trenching length versus pipe laying shall be coordinated to preclude overnight trench opening. Construction site maintenance, along with on-going cleanup and final property restoration acceptance, shall be as directed and approved by Engineer, the Public Works Director, or the City, State, and/or County, if necessary.

#### **A.12 WORK IN STREETS**

**Traffic Control:** The Contractor shall provide bypasses, crossings, and other means for the maintenance of one-way traffic in all streets, and two-way traffic wherever possible, in all streets where work is in progress. Construction operations shall be carried on only between those hours and days as required by the appropriate agency having jurisdiction, except for operations specified for alternate times or in cases of emergency. The Contractor shall plan and schedule his operations to impose the least possible interference with normal traffic flow. The Contractor is required to have a City, County, or State approved traffic control plan for each situation which may occur during the course of construction. This applies to State-controlled right-of-way as well as City or County right-of-way. The traffic control plan must be submitted to the appropriate agency having jurisdiction in adequate time prior to any activity for review and approval.

**Guiderails and Barricades:** The Contractor shall provide, erect, and maintain effective barricades, danger signals, and signs on all intercepted streets or highways and in other locations where required for the protection of the work and the safety of the public. Barricades or obstructions which encroach on, or, are adjacent to, public rights-of-way shall be provided with lights which shall be kept burning at all times between sunset and sunrise. Conformity with State, County, and local laws and regulations is required in the use of streets and highways. The Contractor shall be responsible for all damages resulting from any neglect or failure to meet these requirements. Watchmen shall be provided as required by local regulations or as necessary to fulfill the requirements stated herein.

**Traffic and Services:** Adequate means of access to all public and private properties during all stages of construction shall be provided. Unless approval in writing is secured from the appropriate agency having jurisdiction, there shall be no interruption of service to present customers of such utilities requiring repairs, changes, or modifications caused by the construction work.

**Applicable Codes:** The State of Florida Department of Transportation Roadway and Traffic Design Standards, Uniform Manual for Traffic Control Devices, and the City of Stuart Ordinances, and Martin County Ordinances shall be followed as applicable.

### **A.13 DISRUPTION TO EXISTING SYSTEM OPERATIONS**

The Contractor shall perform operations necessary for connecting to the existing system at times of minimum flow rate. Said operations shall be accomplished expeditiously in order to minimize service disruption. All schedules shall be coordinated with and approved by the Public Works Director. A plan for connection shall be submitted to the Public Works Director at a minimum of 72 hours prior to connection.

### **A.14 MINIMIZING SILTATIONS AND BANK EROSION**

During all dewatering or other operations involving the use and disposal of water, suitable means shall be provided by the Contractor to minimize soil erosion, siltation, and sedimentation of natural or artificial ditches, drainage channels, streams, lakes, or other waterways. The Engineer must approve such means proposed by the Contractor prior to any dewatering, pumping, or other water-involved operations in above areas. If required, in the opinion of the Engineer, methods such as stilling basins, baffles, siltation basins, matting, spread-disposal, recharge pits, etc., shall be used by the Contractor to minimize siltation and bank erosion, with said methods in full compliance with FDEP and SFWMD standards and requirements. Copies of all approved and applicable permits from Federal, State, and local agencies shall be in the possession of the Contractor prior to commencing any work.

### **A.15 SURVEY AND CONSTRUCTION STAKES**

It shall be the responsibility of the Contractor to provide and set in place all construction stakes and marks for lines, grades and measurements necessary or required for the proper execution and control of the work. The Contractor shall be responsible for the accuracy and preservation of the stakes and marks. The plans shall also show or describe the reference points or monuments from which the Contractor shall lay out the work and the Contractor shall scrupulously preserve these reference points. The Contractor shall immediately restore any damaged, dislodged, or lost reference points, at their expense.

### **A.16 BENCHMARKS AND MONUMENTS**

The Contractor shall carefully maintain all benchmarks, monuments, and other reference points. Survey monuments or benchmarks which have to be disturbed by this construction work shall be carefully witnessed before removal and replaced upon completion of the work by a Professional Land Surveyor, registered in and by the State of Florida.

### **A.17 NAMEPLATES**

Each piece of equipment shall be provided with a substantial nameplate of non-corrodible metal, securely fastened in place and clearly and permanently inscribed with the manufacturer's name, model or type designation, serial number, principal rated capacities, electrical or other power characteristics, and similar information as appropriate.

### **A.18 CHARACTER OF EMPLOYEES, SUPERINTENDENTS, AND EQUIPMENT**



Superintendents and Employees: The Contractor shall employ superintendents, supervisory personnel, and employees who are careful and competent. The City of Stuart, at its sole discretion may demand the removal of any person or persons employed by the Contractor who is deemed incompetent, unsafe, or negligent in the proper performance of their duties, or neglect or refuse to comply with the directions given.

**A.19 SANITARY PROVISIONS**

The Contractor shall provide and maintain in a neat and sanitary condition, accommodations for the use of his employees as may be necessary to comply with the requirements and regulations of OSHA, State, local health department, or other agencies having jurisdiction.

**A.20 CONFORMITY WITH PLANS AND ALLOWABLE DEVIATIONS**

The entire installation and each part thereof shall be constructed in the position required, the finished surfaces of structures shall conform to the elevations and gradients specified, and all parts of both substructures and superstructures shall be in proper alignment and adjustment. The Contractor shall provide all frames, forms, falsework, shoring, guides, anchors, and temporary structures that may be required to assure these results. Any deviation from the plans and working drawings that may be required must have prior approval of the Engineer, and the Public Works Director.

**A.21 SUBSTITUTIONS OR “APPROVED EQUALS”**

Whenever a material or article required is specified or shown on the approved plans by using the name of the proprietary product or of a particular manufacturer or vendor, it shall be considered that this was done only for the purpose of establishing a standard of quality for the specified materials. Any material or article which will perform the function imposed by the general design will be considered equal and satisfactory, provided the Public Works Director is assured the material or article so proposed is of like substance, form and function. Such substitutions shall not be purchased or installed without written approval from the Public Works Director or his authorized representative. Substitution may be restricted due to inventory control.

**A.22 INSPECTION BY OTHER AGENCIES**

The U.S. Environmental Protection Agency, the U.S. Department of Labor, the Florida Department of Environmental Protection, and other authorized governmental agencies having legal interest in the project shall have free access to the site for inspecting materials and work, and the Contractor shall afford them all necessary facilities and assistance for doing so. Any instructions to the Contractor resulting from these inspections shall be given through the Engineer or Public Works Director. These rights of inspection shall not be construed to create any contractual relation between the Contractor and these agencies.

**A.23 DEFECTIVE AND UNAUTHORIZED WORK**

All work that has been rejected or condemned shall be removed and replaced at the expense of the Contractor unless a repair is approved by the Public Works Director. Materials not conforming to the requirements of the specifications shall be removed immediately from the site of the work and replaced with satisfactory material by the Contractor at his own expense.

Upon reasonable cause, due justification by, and at the request of the City of Stuart, the Contractor shall, at any time before final acceptance of the work, remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore the said portions of the work to the condition required by the approved plans and specifications. If the work uncovered is rejected, then the Contractor is responsible for restoration, as well as repair. Failure to reject any defective work or material during construction shall not prevent later rejection upon discovery prior to acceptance or obligate the City of Stuart to final acceptance.

#### **A.24 WARRANTY**

**One Year Warranty Period:** If, within one year after the date of release of final payment by City of Stuart 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, the Contractor shall promptly, without cost to the City of Stuart and in accordance with written instructions from the Engineer and/or the Public Works Director, either correct such defective work, or if it has been rejected, remove it from the site and replace it with nondefective work.

If the Contractor does not promptly comply with the terms of such instructions, the City of Stuart may have the defective work corrected or the rejected work removed and replaced, and all direct, indirect, and consequential costs of such removal and replacement (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals) will be paid by the Contractor. In special circumstance where a particular item of equipment is placed in continuous service before substantial completion of all the work, the warranty period for that item may start to run from an earlier date if so provided by the specifications or by written amendment.

**Emergency Repairs:** During the time that a utilities construction project is either under construction or under a warranty period, emergencies which arise must be handled as the situation dictates. In as much as each situation is unique due to time, place, and circumstance, the following guidelines will be used to the extent possible:

An emergency is defined as a situation which develops suddenly and demands immediate action to halt a worsening condition.

Upon notification of an emergency situation, the City of Stuart will respond as rapidly as possible to bring the situation under control, i.e., to terminate the emergency.

The Contractor will be notified of the situation, as soon as practical by the City of Stuart. Repairs which must be affected in the aftermath of an emergency are the responsibility of the Contractor.

Those non-emergency type repairs must be complete or at least in progress within seven (7) calendar days of notification by the City of Stuart.

Any repairs accomplished under this section by the City of Stuart are subject to be paid by the Contractor. If the Contractor fails to pay for this work it may be deducted from monies owed the contractor. If circumstances warrant, notifications should be given to Emergency Operations Center – 911.

### **A.25 UTILITY EASEMENTS**

Required minimum utility easements in subdivisions, residential and commercial are fifteen (15) feet, unless approved in writing by the City of Stuart. The Utility shall be placed in the center of the easement. In addition, all lift stations shall be placed typically within a 25 ‘ by 25’ easement. The City of Stuart Public Works Department may determine that bigger easements are necessary depending on the specific location of the lift station

Sidewalks shall not be constructed within utility easements, unless approved in writing by the City of Stuart.

### **A.26 ACTIVATION OF NEW SERVICES**

**The following items are required by the City of Stuart before activation of new services.**

Letter of Certification from the Engineer, stating all lines or lift stations, etc., have been inspected, tested, and installed according to the Engineer’s specifications and record.

Complete Asbuilt / Record drawing per City of Stuart Specifications. Engineer to provide fire flow test results to the City. Show calculations and test results according to AWWA standards.

Verification from FDEP stating that the facilities have been approved and may be put into use.

### **A.27 RECORD DRAWINGS / AS-BUILT DOCUMENTS**

A complete set of digital record drawings shall be provided. Three sets of 24” x 36” record drawings signed and sealed by a licensed professional surveyor and mapper in the State of Florida, and three digital copies on Compact Disk. In addition, all record drawings must be prepared using AutoCAD 2004 or earlier, and PDF format compatible with the City and be prepared using NAD 83/90 Horizontal Datum NAVD 88 Vertical Datum State Plane Coordinates.

#### **A.27.1 Requirements-**

**A.27.1.1** Location of mains from property or easement lines and alignment distance from centerline of road at 100+/-ft. intervals.

**A.27.1.2** Size, length, and type of material, used to construct all mains.

**A.27.1.3** Show actual location and elevation of all tees, crosses, bends, terminal ends, valves, fire hydrants, air release valves and sampling points, etc.

**A.27.1.4** Elevation and Horizontal location of all storm sewers, gravity mains including laterals, force mains, water mains, other utilities, etc. which are crossed; including clearance dimension at all conflicts or crossings.

**A.27.1.5** OR Book & Page for all recorded easements.

Copy of all release of liens. A copy of all recorded utility easements.

The Contractor is required to make application for service, make payment of applicable fees, execute a Utility Service Agreement, if applicable and provide a bill of sale and maintenance bond.

Send complete package to: City of Stuart, Public Works Department, 121 SW Flagler Ave., Stuart, Florida 34994

**END OF SECTION**

**DIVISION B**  
**DESIGN CRITERIA**

**B. 1 GENERAL**

These general design criteria are established for the design of water distribution, reclaimed water and wastewater collection systems in the jurisdiction of the City of Stuart. This portion of the document shall be utilized concurrently with the applicable sections of the Construction Standards and Technical Specifications.

All design and construction drawings for water distribution, reclaimed water and wastewater collection systems shall comply with these standards, or the standards titled “Recommended Standards for Water Works,” and “Recommended Standards for Wastewater Facilities,” established by the Great Lakes Upper Mississippi River Board of State Public Health and Environmental Managers, or the standards established by the Florida Department of Environmental Protection (FDEP), whichever is more stringent, or unless otherwise approved by the City of Stuart.

The Design Engineer/Developer should supply the following prior to making a utility construction plan submission to the City of Stuart.

Prepare plans on 24” X 36” sheets, appropriate scale no less than 1”=40’. All elevations shown on plans must be NAVD 88 DATUM. Three sets are to be submitted initially. The plans shall be signed and sealed by a professional engineer licensed by the State of Florida.

Obtain and submit Fire Department approval of fire protection system.

Submit paving and drainage and erosion control plan, preliminary plat, master utility plan for multi-phase project, key sheet, and cover sheet with relevant location sketch, lift station calculations and two copies of the completed FDEP forms.

Show appropriate clear phase lines and match lines.

Provide detail sheets with current City of Stuart details to minimize comments.

Provide all applicable detail drawings.

Call out and circle on main plan sheet all interferences with conflicting pipes, with indication of “over” or “under” on detail plan sheet.

Profile sheets are required for gravity sewers and all proposed bores (show all crossings).

All road crossing and pavement cuttings shall be detailed and shall be in accordance with requirements of the particular authority governing the area.

Specific details for all connections to existing facilities.

A minimum of two (2) sets of shop drawings for all materials used in construction and three (3) sets of final construction plans must be submitted for review by the City of Stuart prior to scheduling of the pre-construction meeting.

## **B.2 WATER MAIN DESIGN**

Minimum system size shall be based on a hydraulic analysis of the maximum day demand plus fire flow requirements or peak hour demands, which ever is greatest, while maintaining a minimum 20 psi residual pressure throughout the distribution system. Maximum day and peak hour demand and method of computation shall be subject to review and approval by the City of Stuart.

Minimum pipe diameter where fire hydrants are required shall be six-inch within loop systems and eight inch on dead-ends, unless otherwise approved by the City of Stuart. In residential areas, design fire flow requirements shall be 500 gpm, while maintaining a minimum 20 psi residual pressure in the system. For commercial and industrial areas design fire flow requirement shall be 1,500 gpm, while maintaining a minimum 20 psi residual pressure in the system. These flow rates represent the minimum system design conditions. Should local fire ordinance and/or the State Insurance Services Office require different flow conditions, then the more stringent requirements shall prevail.

Water mains shall be PVC, HDPE or DIP. PVC (4"-12") shall be DR-18 manufactured in compliance with AWWA C900, and PVC (14"-20") shall be DR-18 in compliance with AWWA C905. HDPE pipe shall be in compliance with D3035 and ASTM F-714. DIP shall be a minimum Class 50, conforming to the latest standards of ANSI/AWWA C150/A21.50 for thickness design of ductile iron pipe and ANSI/AWWA C151/A21.51 for ductile iron pipe centrifugally cast in metal molds or sand-lined molds.

Mains eight inches in diameter and less shall have minimum cover of 36 inches. Ten inch mains and larger shall have 48 inches of cover.

Water mains shall be no less than five feet from the edge of roadway improvements, such as edge of pavement or back of curb/gutter. Where practical and consistent with other main locations in the area, water mains shall be located on the north side of east-west streets and on the east side of north-south streets. Placement of mains on or adjacent to interior property lines or on private property is discouraged, and will only be approved when unavoidable or when necessary for looping and when sufficient easements are provided for operation and maintenance.

For parallel installations, water mains shall be laid with a minimum of 10-foot horizontal separation, edge of main to edge of main, from existing and proposed sewers. In cases where it is not possible to maintain a 6-foot horizontal separation, the water main must be laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer or force main at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

For water mains crossing sanitary sewers, a minimum of 12 inches shall be maintained from the outside of the water main to outside of the sewer main. At the crossing, one full-length joint of water main shall be laid in such a way that both joints will be as far from the sewer as possible. Sanitary sewers, force mains and storm sewers should cross under water mains, wherever possible.

Where it is not practical to design for these separations specific requirements from the regulatory agencies must be followed.

Horizontal separations of 15 feet to buildings, top of banks of lakes and canals and other structures shall be maintained.

Dead ends shall occur only when absolutely necessary and be equipped with a flushing hydrant device or fire hydrant for flushing purposes. All mains that dead end and that are intended for future expansion shall include a line size gate valve and flushing hydrant. The gate valve shall be mechanically restrained per City of Stuart Standard Specifications. The flushing hydrant assembly must be designed to be removed without interruption to service. Flushing hydrant devices shall be sized to provide a minimum of 2 feet per second flushing velocity in the water main.

Pipelines shall be restrained at all valves, bends, tees, crosses and dead ends for specified distance. This distance shall be stated within the City of Stuart Water and Sewer Standard Specification and Details (Detail #12) or approved by the City in accordance to specific conditions/circumstances on each pipeline design project. Determination of distances shall occur during design and be specified within the construction drawing.

### **B.3 VALVES**

All distribution systems shall be valved to facilitate the isolation of each section of pipeline between intersections of the grid system. Generally, the number of valves at an intersection shall be one less than the number of pipes forming the intersection. It is the intent of this criterion to provide for the isolation of mains that serve areas containing more than 25 service connections.

Valves shall generally be spaced no more than 1,000 feet apart. In high-density areas, valves shall be installed as necessary to minimize the number of persons affected by a break.

Valves sixteen inches and smaller shall be gate type, cast iron, resilient wedge and mechanical joints conforming to AWWA C509 latest revision.

Valves shall be designed for a working pressure of not less than 200 psi, and each shall have the pressure rating cast into the body and manufacturer's name or initial cast into the body or bonnet.

Valves larger than sixteen inches shall be butterfly type, ductile iron with rubber seat and mechanical joint ends with side gear operator.

#### **B.4 FIRE HYDRANTS**

Fire hydrants shall be provided at each street intersection within the distribution system and at intermediate points in all water mains, transmission and distribution systems that will provide a 1,000 foot spacing between each hydrant, or in accordance with local fire ordinance and State Insurance Services Office whichever is more stringent. A Fire Department approved plan is required with all preliminary plan submissions.

Location of fire hydrants shall be at least one foot from right-of-way/property line and within 15 feet from edge of pavement, face of curb, etc. (except as required by FDOT), no less than five feet from driveways and not within the swale/ditch area. Hydrants shall be located so as to minimize vulnerability to traffic.

Fire hydrants shall conform to the latest AWWA specifications C502, and shall be of the traffic-model type. The hydrant branch shall be six inch in diameter and have a six-inch isolation gate valve on the branch as close as possible to the main and restrained to the main.

Hydrants shall be furnished with a breakaway feature that will break cleanly upon impact. In commercial/industrial districts, hydrants must be installed on a minimum 8-inch main and hydrants in residential districts installed on a minimum 6 inch looped mains.

#### **B.5 AIR RELIEF**

At points in the water main profile where entrapped air can accumulate, which may result in flow restriction, provisions shall be made to remove the air. This shall be accomplished in distribution systems by use of strategically placed fire hydrants or blow-offs. When air relief assemblies are required, manual above ground assemblies are acceptable where ever flooding is not likely to occur.

#### **B.6 WATER SERVICE CONNECTIONS AND METERS**

Individual service taps shall not be placed closer than thirty-six inches apart. A minimum of 36" inches must be maintained from all water main joints and appurtenances. Individual service taps shall be constructed with stainless steel strap epoxy coated saddles and brass corporation stops. Services shall not exceed 100 feet in length to the meter with the meter generally placed at the property line, at an accessible location.

Services shall have a minimum of 30" cover. All services crossing under roadways shall be installed in a casing not less than 36" between the pavement and the top of the casing. Proper sizing of non-residential meters and services is the responsibility of the Developer or his Engineer subject to the City of Stuart's approval. Dual metering of a single building service (i.e. two one-inch meters instead of one two-inch meter) shall not be permitted.

Construction drawings shall include a typical meter installation for each meter to be installed. Standard piping configurations for all size meters are found in the standard details. Meters 1.5" and larger shall be installed above ground. The backflow prevention assembly shall be installed above ground, and screened in accordance with applicable detail sheet. No taps or connections are allowed between the meter and the backflow prevention device. Meters shall be set in grassy unobstructed areas generally at property lines, clear from buildings, fences,



shrubs, trees, fire hydrants, cable boxes, etc. Meter boxes shall be kept out of pedestrian walkways and out of driveway areas or other concrete/paved surface, unless approved by the City of Stuart.

Meter size shall be as required by the City of Stuart for single residences. Meters 5/8"x 3/4" and 1" shall be provided and installed by the City of Stuart in accordance with the City of Stuart connection requirements. Service lines for existing residences shall be provided with a meter box installed at the end of the service in accordance with the standard construction details.

### **B.7 SURFACE WATER CROSSINGS**

For aerial or sub-aqueous crossing approvals, the City of Stuart should be consulted before final plans are provided for review.

All pipelines must be adequately supported on an acceptable foundation/support. Plans must be signed and sealed by an engineer registered in the State of Florida. The installation must be protected from damage and must be accessible for repair or replacement. Valves should be placed at both ends of the water crossing, at the normal main depth, so that section of main can be isolated.

A minimum of three feet, or as established by the regulatory agency, which ever is greater, shall be maintained from the top of the water main to the design bottom elevation of the open canal/ditch.

Sub-aqueous pipe crossings shall be made of Class 53 ductile iron pipe or HDPE for directional drill. For canal/ditches greater than fifteen feet in width the water main shall be designed with flexible, watertight joints.

Valves should be installed at each end of the sub-aqueous crossing so that the sub-aqueous section of the water main can be isolated.

Valves shall be easily accessible.

For sub-aqueous directional bores the best management practices noted in Section G.6 shall be referenced on the plans for implementation during construction.

### **B.8 BACKFLOW PREVENTION/CROSS CONNECTION CONTROL**

There shall be no physical connection between a safe water supply, reclaimed water, a questionable water supply, or a sanitary or storm sewage system that would allow unsafe water to enter the safe water system by direct pressure, vacuum, gravity or any other means. All potable water services within sewage facilities, reclaimed water service areas shall be provided with an approved backflow prevention device.

### **B.9 CONNECTIONS TO EXISTING SYSTEM**

Tapping sleeves shall be #304 stainless steel with flanged outlets. Tapping valves shall be resilient wedge type with a flanged joint on the inlet side and a mechanical joint on the discharge side of the valves. Tapping valves shall have a 2-inch operating nut. Working

flange faces of the tapping sleeve and tapping valve shall be 1/8" minimum thickness of neoprene rubber.

Taps on the same size main are discouraged and unless otherwise approved by the City of Stuart are prohibited.

#### **B.10 GRAVITY SEWER DESIGN**

Sewer design shall be based on an average daily per capita flow of not less than 100 gallons of sewage flow for the estimated ultimate tributary population. Similarly for institutional, commercial, industrial parks, etc.; sewer systems shall be designed for the ultimate/buildout sewage flow. This may be estimated from existing records for similar developments. Average daily flow will then be adjusted with the appropriate design peak factors for lateral and trunk lines, which is to be based on factors outlined within "Recommended Standards for Wastewater Facilities" (Ten-State Standards).

All developments where foods will be prepared, processed or served shall have a grease trap of adequate capacity installed prior to wastewater entering the sanitary sewer system.

Industrial wastes from service stations and manufacturing plants shall not be connected into the sanitary sewage system without pre-treatment and approval by the City of Stuart.

The minimum allowable diameter for gravity sewer systems shall be eight inches and more specifically sized to accommodate the flows as outlined above.

Gravity sewer mains shall maintain hydraulic slopes sufficient to maintain a minimum velocity of two feet per second, based on Manning's formula using an "N" value of 0.013, when flowing full or half full. As a guideline the following minimum slopes shall be provided; however, slopes greater than these are desirable. Installations where velocities of fifteen feet per second are proposed, due to topography or other unique circumstances, main and appurtenances must be protected against displacement and impact.

Gravity Sewer Diameter (Inches)	Minimum Slope, % (feet per 100 feet)
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08

Gravity sewer mains shall be designed and constructed in straight alignments with uniform slope, not exceeding 400 feet in length between manholes. Straight alignment shall be checked by either using a laser beam, lamping or other approved method.

Gravity sewer mains of different diameters shall connect at a sewer manhole. The invert of the larger main shall be lowered sufficiently below the smaller main to maintain the same energy gradient.

Gravity sewer main direction changes, within a sewer manhole, cannot exceed 90 degrees.

Flow direction changes in excess of 45 degrees shall include an extra 0.1 feet of drop across the inflow and outflow of the manhole.

All gravity sewer mains shall terminate at sewer manholes.

Horizontal separation from water mains shall be 10 feet (3 ft. with vertical separation of 6 in.). Separation from reclaimed water mains shall be three (3) feet. Vertical separation from a water main shall be a minimum of 12 inches between the outside of the pipes. Sanitary sewers and force mains should cross under water mains. All gravity sewer mains shall be designed to prevent damage from all anticipated live and dead loads. Where necessary, as determined by the Engineer, special bedding, haunching and initial backfill or other special construction methods will be required. Dips in gravity main shall not exceed 0.5 inch as determined by the inspection reports as per video by the Contractor.

Polyvinyl Chloride (PVC) shall be acceptable as gravity sewer mains. PVC pipe shall meet the requirements of ASTM D3034 for SDR 26. However, epoxy lined DI pipe shall be required in specific areas such as:

Gravity main passing under or over any other pipeline with less than 12 inches clearance, with no main joint within ten feet of crossing.

When there is less than three feet of cover between the top of the main to the finished grade.

Absolute minimum cover on PVC pipe shall be 36 inches to the top of the pipe.

When the main is placed out of the road right-of-way, between buildings, along property lines, or in areas that will have extensive surface improvements or landscaping.

Carrier pipe inside jack and bore casings.

When the maximum cover over the gravity main is greater than twelve feet then DIP, Class 51, is required to be installed.

Unspecified transitions from DIP to PVC are not allowed.

A clean-out shall be constructed at the end of each service lateral.

For repairs to existing systems Fernco ProFlex or HYMAX couplings shall be used at each of the repairs.

### **B.11 MANHOLES**

Manholes shall be installed at the termination of all gravity sewer mains, grade breaks, changes in the sewer main diameter, changes in alignment and at distances not exceeding 400 feet.

Manholes shall be placed preferable in pavement, in accessible areas and shall be flush with the finished grade. If manholes are placed outside of hardened surfaces, a concrete collar shall be installed around the manhole ring.

The minimum inside diameter of sanitary sewer manholes shall be four feet and have a minimum top opening of two feet. The minimum depth of manholes shall be four feet from the finished grade to invert of the manhole. If DIP gravity sewer main is used, minimum depth can be three feet with approval of the City of Stuart.

Inside manhole drops manufactured by Reliner/Duran or equal shall be installed when the invert of the influent pipe is greater than 2.5 feet above the outgoing invert of the manhole. Where the difference in inverts is equal to or less than 2.5 feet, the invert across the manholes shall be grouted to prevent deposition of solids. The drop shall be appropriately sized to accommodate both manhole and influent line sizes.

The manhole shall have flow channels across the bottom and made to conform as closely as possible in shape and slope to that of the connecting sewers. The channel walls shall be shaped to the full height of the crown of the outgoing pipe in such a way as to not obstruct maintenance or hydraulic capacity of pipe. The minimum drop across a manhole with influent pipes greater than a 45 degree turning angle from the outgoing pipe shall be increased by one-tenth (0.1) of a foot.

All manholes (exterior and interior) shall be coated with ProTech coating EW-1 water based epoxy per manufacturer's specifications.

Pipe connections to manholes shall be made by use of prefabricated, rubber ring, water-stop type boots cast directly into the manhole at the factory or other type system approved by the City of Stuart.

Service connections shall generally be one size smaller than the gravity sewer main. Only one collector service connection may be directed into an end manhole with approval from the City of Stuart. This is acceptable only if it is treated like a main, has proper elevations stated and has proper slopes and flow channels. Service connections will not be allowed into other manholes. Service lines that fall under the responsibility of the operating and maintenance entity of the City of Stuart shall generally be limited to 50 linear feet of pipe.

### **B.12 FORCE MAINS**

Design standards for force mains will be generally the same as the design standards for water mains described earlier, with the exceptions as noted.

Force mains shall not be less than four-inch diameter and have a minimum design velocity of two feet per second. The main shall be sized to adequately handle the build-out peak operational pump flow of the wastewater lift station(s) serving particular areas. The requirements of sufficient scouring velocity, two feet per second, shall apply to the ultimate minimum operational pumping flow. Scouring velocities less than two feet per second, that are temporary, will be considered under special circumstances as approved by the City of Stuart.

As a general guide, force mains shall be on the opposite side of the right-of-way as water mains.

Force mains should cross under water mains at crossings. Maintain a minimum vertical separation of 12" and a horizontal separation of 10' between outside of pipes. Reference B.2 of this section for additional requirements related to separation between sewer and water mains.

PVC sewer force main 4" – 12" in diameter shall be DR-18 manufactured in compliance with AWWA C900.

PVC Sewer force main 14" – 20" in diameter shall be DR-21 manufactured in compliance with AWWA C905.

Ductile iron pipe shall be epoxy coated and shall conform to latest standards of ANSI/AWWA C150/A21.50 for thickness design and ANSI/AWWA C151/A21.51 for manufacture.

Minimum cover to finish grade over force main shall be 4 feet.

### **B.13 GATE VALVES**

Gate valves shall be used with the installation of force mains. Gate valves shall be ductile iron, resilient wedge type, 2" operating nut with mechanical joints conforming to AWWA

C500, latest revision. Location of valves along subsidiary force mains shall generally be every 1,500 feet and at the point of connections to larger trunk mains. Where force mains are to be extended, in high density areas, valves shall be installed at closer intervals as necessary to minimize the number of persons affected by the break. A gate valve and plug must be installed at the future point of connection.

#### **B.14 AIR RELIEF VALVES**

Manual air release valves shall be incorporated into the design of force mains at all high points of the main to prevent air accumulation within the main. The force main must be designed with a minimum of grade breaks and as flat as possible to consistently maintain a full pipe flow. Vacuum relief valves may be necessary to relieve negative pressures at extreme high points. Force main configuration and pumping conditions shall be evaluated for the placement and need of relief valves.

#### **B.15 TERMINATION**

Force mains shall enter a termination wet well at a point equivalent to the operating level of the wet well. At a termination gravity manhole, the force main shall enter no higher than two feet above the flow line of the receiving manhole. Force mains shall never enter a manhole from a direction contrary to the direction of flow out of the manhole.

#### **B.16 CONNECTIONS FOR FORCE MAINS**

Tapping sleeves shall be 304 stainless steel with flanged outlets. Tapping valves shall be resilient wedge type.

#### **B.17 WASTEWATER PUMPING STATIONS (Non grinder type Systems)**

All pumping stations shall be of the below ground type utilizing submersible pumps, unless otherwise justified and approved by the City of Stuart.

Pumping stations shall have a minimum of two equal capacity, submersible pumps. When pumping rates exceed 1,000 gallons per minute, three or more pumps may be required.

Pumps will be sized such that with any one pump off-line then the remaining pump(s) can handle the design flow.

Pumps shall be designed to pass a sphere three inches in diameter. Pump suction and discharge shall be at least four inches in diameter.

Pumps shall be designed to operate under a positive suction head. Pumps shall be explosion proof.

Pump curves and specifications shall be submitted to the City of Stuart before installation of the pumps. Only pump brands approved by the City of Stuart are acceptable.

The pumping design flow (peak design flow) rate shall be the maximum contiguous three month average daily flow times the appropriate peak hourly factor, as established by the Design Engineer, based on established standard engineering practices. The maximum

contiguous three months average daily flow shall be from all contributory areas within the individual pumping station service area based on existing flows within the service area and anticipated flows through the next five years. Average daily flow figures shall be as specified within these specifications.

All pumping units shall have the capacity to pump the peak design flow at the maximum computed system total dynamic head (TDH). This flow condition shall be calculated for the proper force main sizing to preclude scouring velocities below two feet per second. Wet well diameter shall be a minimum of six feet. The floor of the wet well shall have a minimum slope of one to one to the pump intake. Station structures shall be of pre-cast concrete (Class II, 28 day compressive strength of 4000 psi, minimum).

The effective operational capacity of the wet well shall provide a holding period not to exceed twelve minutes for the maximum average daily flow, while not allowing the pump to operate more frequently than once every ten minutes.

Low water level shall be set to provide complete submergence of pumps at shut-off.

Operational water-level shall generally be set two feet above the low water-level. The high water alarm shall be set at the invert elevation of the lowest influent pipe.

Buoyancy calculations shall be performed that do not take into consideration the wet well interior fillets, top slab, pumps and piping. Ground water elevation shall be assumed at natural ground level, at the 100 year flood elevation whichever is greater unless special circumstances dictate other assumptions.

Wet well top slab elevation and electrical components of the station shall be designed to provide protection from physical damage by the 100-year flood and remain fully operational during the 25-year, 3-day flood.

Submersible pumps shall be installed with guide rails, discharge connections, or lifting cables.

Power supply for all lift stations shall be 230 volts, 3 phase, and 60 cycle service with emergency power feed hookup. A non-fused main disconnect shall be provided.

Electrical fixtures within enclosed areas where gas may accumulate shall comply with the National Board of Fire Underwriter's specifications for hazardous conditions. Electrical fixtures/components at the station shall be sized for expansion of the pump and load. Pump control panel housing shall be NEMA type 4X, constructed of stainless steel (14 gauge, minimum).

High-level alarms shall be provided with all pump stations.

Control circuitry within the panel will provide automatic alternation of each pump during each cycle.

Each control panel shall have a main and emergency circuit breaker.

A generator power receptacle shall be provided on the exterior of the pump control panel.

Gate valves with 2-inch operating nut shall be provided on the discharge of each pump. A swing check valve with spring and weighted lever arm shall be provided between the pump and gate valve.

Piping shall be a minimum of 4" in diameter and all piping and valves shall be flanged.

Each pumping station shall be provided with a minimum one inch potable water supply.

Each supply shall have a hose bibb and reduced pressure zone, backflow preventer.

All pumping stations shall be enclosed by six (6) feet high fencing or approved landscape design with a twelve foot wide double gate centered on the wet well. Easements and/or right-of-way of sufficient size shall be provided for vehicle access to the station. An easement or deed for the lift station site will be required.

All pumping station sites shall be provided with a concrete or asphalt driveway that will allow routine access and connected to a paved road which will support all anticipated loads. Necessary driveway culverts shall also be provided in accordance with jurisdictional agency requirements.

The lift station control panel shall be opposite the side of the wet well where vehicle access is provided.

Hinges for access hatches on both top slab and valve pit shall be configured to allow both hatches to open outward or away from the other.

### **B.18 LOW PRESSURE SEWER SYSTEMS**

LPSS shall be designed in accordance with the "Design and Specification Guidelines for Low Pressure Sewer Systems", prepared by a Technical Advisory Committee for the State of Florida Department of Environmental Protection (FDEP), and the City of Stuart Water and Sewer Standard Specifications and Details.

**END OF SECTION**



**DIVISION C**  
**INSPECTORS AUTHORITY**

**C.1 GENERAL**

The City of Stuart's Inspectors or designated representative may inspect all construction and materials and may also inspect preparation, fabrication or manufacture of components, materials and supplies. The Inspector is not authorized to revoke, alter or waive any requirements of the specifications, but is authorized and expected to call to the attention of the Developer's Engineer and/or Contractor any failure of work or materials to conform to the plans or specifications. The Inspector shall have the authority to reject materials or suspend the work until questions of issue can be referred to and decided upon by the City of Stuart's Public Works Director or his designated representative.

The Inspector shall in no case act as foreman or perform other duties for the Project Engineer and/or Contractor or interfere with the management of the work. Advice which the Inspector may give shall in no way be construed as binding to the City of Stuart or releasing the developer, his Engineer or Contractor from performing according to the intent of the plans and minimum City of Stuart Standards.

All work that has been rejected or condemned shall be repaired, or if it cannot be satisfactorily repaired, shall be removed and replaced at the Contractor/Developer's expense. Materials not conforming to the requirements of the specifications shall be removed immediately from the site of work and replaced with satisfactory material by the Contractor/Developer, at his expense. The City of Stuart shall have the right to require additional inspections, certification and/or testing to confirm that the deficient work has been corrected.

Inspections shall be scheduled for regular working hours only, except for nights when service disruptions are involved. Scheduled inspections are required for jack and bores, directional bores and pipe slippage through same, setting of wet wells, lift station start-ups with manufacturer's representative present and any time an existing City of Stuart facility is to be connected (i.e. manhole tie-in and water or sewer taps). Work will not be scheduled for weekends or holidays.

When progress of the project requires the periodic presence of a City of Stuart Representative during non-normal working hours, for the convenience of the Contractor, the Contractor/Developer shall accept the financial responsibility for the overtime hours (at overtime rates) with a minimum of four (4) hours, including travel time. This shall include work done on holidays, weekends, or other non-scheduled work hours. In addition, all inspections and retesting will require the Contractor / Developer to accept the financial responsibility for extra work by the City of Stuart Representatives.

When the Contractor / Developer requests a re-inspections, the City will impose a re-inspections fee at the Contractor / Developer cost of \$100 per each re-inspections. The Fee shall be paid prior to the following scheduled inspection.

The City of Stuart should be provided with at least two (2) full working days' notice for scheduled inspections. Inspectors will make unscheduled visits as needed to inspect such items as materials on site and clearances between conflicting lines.

It shall be the responsibility of the Developer's Engineer to schedule inspections and their qualified representative shall be present at all scheduled tests and inspections. A scheduled inspection will be canceled if the representative is not present and will be subject to a re-inspection fee of \$100.00. The re-inspection fee shall be paid prior to the re-inspection. The Developer's Engineer shall pre-test pressure test and lamping to minimize failures. The Developer's professional land surveyor shall prepare accurate record drawings which shall be submitted to the City of Stuart two (2) days before a lamping to verify adequacy of slopes. In any case, record drawings must be submitted prior to service being provided to any phase of a project.

**END OF SECTION**

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## **DIVISION D** **EARTHWORK**

### **D.1 SECTION DESCRIPTION**

This section includes the materials and installation standards and contractor responsibilities associated with furnishing all labor, materials, equipment, and incidentals required for clearing, grubbing and filling of undeveloped rights-of-way or corridors, as necessary to provide access for pipeline construction. All clearing work shall be done for the full width of the corridor area or right-of-way shown on the drawings.

Unless otherwise specified, all work shall comply with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

### **D.2 PRODUCTS**

Fill material shall be clean granular fine earth, rock or sand, free of vegetation or organic material.

Excess material from other areas of the project may be used, with the approval of the Engineer.

### **D.3 EXECUTION**

Remove existing vegetation including trees, roots and stumps from the corridor areas. Prevent damage to trees or other items outside of the corridor area.

All vegetation material removed shall be disposed of by the Contractor.

### **D.4 GENERAL EXCAVATION**

Unsuitable material shall be removed from the corridor area only as necessary for access and pipeline construction.

Excavation and backfill for utility pipelines shall not be included in this item, but shall be performed as specified in Division E.

### **D.5 FILLING AND GRADING**

Future roadway elevations shall be shown on the drawings when available from construction plans on file with the City of Stuart or proposed by others. These elevations shall be used as guides for the filling and grading of the corridor.

All filling and grading work shall be done to provide corridor access and suitable conditions in preparation for utility pipeline construction.

### **D.6 COMPACTION**

Compaction methods and requirements shall be as specified within Division E (E.6) or by the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, for work within a road right-of way, the most stringent shall apply.

**END OF SECTION**

**DIVISION E**  
**UTILITY EXCAVATION, BACKFILLING & COMPACTING**

**E.1 SECTION DESCRIPTION**

The provisions set forth in this section shall be applicable to all underground water and wastewater piping installations.

This section includes materials, installation standards, and Contractor responsibilities associated with the furnishing of all labor, materials, equipment and incidentals required to properly perform utility excavation backfilling and compacting for all utility pipelines as shown on the Drawings and as specified herein.

All excavations shall be properly shored, sheeted and braced or cut back at the proper slope to provide safe working conditions, to prevent shifting of material, to prevent damage to structures or other work, and to avoid delay to the work, all in compliance with the Occupational Safety and Health Act (OSHA), the State of Florida Trench Safety Act, and under Section 107 of the Contract Work Hours and Safety Standards Act. In all cases where a conflict exists in the requirements of OSHA, the Florida Trench Safety Act, and these specifications, the requirements of the state agency shall prevail.

**E.2 SUBMITTALS**

Contractor shall obtain necessary permits for any required dewatering activity in accordance with the applicable governmental agencies. These permits must be submitted to the City of Stuart and Engineer of Record prior to construction.

**E.3 MATERIALS**

Fill and backfill material shall be clean, fine earth, rock or sand, free of vegetation.

Material may be from onsite excavation and may be imported. Imported material provided by the Contractor will be at no additional expense, unless specifically stated.

Suitable: Suitable materials for fills shall be classified as A-1, A-3 or A-2-4 in accordance with AASHTO Designation M-145 and shall be free from vegetation and organic material. Not more than 12 percent by weight of fill material shall pass the No. 200 sieve. The Contractor shall furnish all additional fill material required.

Suitable Material to be placed in Water: Suitable material for fills to be placed in water shall be classified as A-1 or A-3 in accordance with AASHTO Designation M-145.

Unsuitable: Unsuitable materials are classified as A-2-5, A-2-6, A-2-7, A-4, A-5, A-5, A-7 and A-8 in accordance with AASHTO Designation M 145 or soils which cannot be compacted to specified percentage of maximum density.

**E.4 EXCAVATION**

The maximum amount of open trench permitted in any one location shall be the length necessary to accommodate the amount of pipe installed in a single day. All trenches shall be

fully backfilled at the end of each day. Barricades and warning lights meeting OSHA and FDOT requirements shall be provided and maintained.

**Trench Dimensions:** The minimum width of the trench shall be equal to the outside diameter of the Trench Dimensions: excavation backfill and compaction requirements; the maximum width of trench, measured at the top of the pipe, shall not exceed the outside pipe diameter plus two feet, unless otherwise shown on the drawing details or approved by the Engineer.

**Trench Grade:** Standard trench grade shall be defined as the bottom surface of the utility to be constructed or placed within the trench. Trench grade for utilities in rock or other non-cushioning material shall be defined as six inches below the outside of the bottom of the utility, which six inches shall be backfilled with extra utility bedding material. Excavation below trench grade that is done in error shall be backfilled to trench grade with granular material and compacted.

**Utility Bedding:** The bottom of the trench shall be shaped to provide firm bedding for the utility pipe. The utility shall be firmly bedded in undisturbed firm soil, or hand-shaped unyielding material. The bedding shall be shaped so that the pipe will be in continuous contact therewith for its full length and shall provide a minimum bottom segment support for the pipe equal to springline of the pipe or one-half of the outside diameter of the barrel. Special bedding may be required, due to depth of cover, impact loadings, or other conditions.

**Unsuitable Material Below Trench Grade:** Soil unsuitable for a proper foundation encountered at or below trench grade, such as muck or other deleterious material, shall be removed for the full width of the trench and to the depth required to reach suitable foundation material, unless special design considerations receive prior approval from the City of Stuart or Engineer of Record. Backfilling below trench grade shall be in compliance with the applicable provisions of Subsection E.5, "BACKFILL", with material as specified under Subsection E.3 "MATERIALS".

**Extra Utility-Bedding Material:** When rock or other non-cushioning material is encountered at trench grade, excavation shall be extended to six inches below the outside of the bottom of the utility, and a cushion of granular material rock shall be provided. Utility-bedding material shall be installed as specified in this section.

**Sheeting and Bracing:** In order to prevent damage to property, injury to persons, erosion, cave-ins, or excessive trench widths, adequate sheeting and bracing shall be provided, as required within these specifications, in accordance with accepted standard practice. When the situation arises, sheeting and bracing shall be used as necessary to protect the integrity of the road shoulder. Sheeting shall be removed when the trench has been backfilled to at least one-half its depth, or when removal would not endanger the construction of adjacent structures. When required, to eliminate excessive trench width or other damage, sheeting, bracing, or shoring shall be left in place and the top cut off at an elevation of 5.0 feet below finished grade or 1.0 foot above the top of the pipe, whichever is less, unless otherwise directed. All sheeting and bracing will be in accordance with OSHA, and the Florida Trench Safety Act.

**Excavated Material:** Suitable material to be used for backfill shall be neatly and safely deposited at the sides of the trenches where space is available. Whenever possible, excavated material near a roadway should be deposited on the right-of-way side of the trench away from the travelway. Where stockpiling of excavated material is required, the Contractor shall be responsible for obtaining the sites to be used and shall maintain the operation to provide for natural drainage and not present an unsightly appearance. Also, the contractor is responsible for transporting the material to and from the stockpile material. All sites shall be restored after fill is removed. No excavated material shall be placed within roadside swales for longer than that days work.

**Excess Fill Material:** Clean excess fill shall be the property of the City of Stuart, should they request same. Otherwise, it will be the property of the Contractor to remove from the site. If requested by the City of Stuart, the Contractor shall deliver and stockpile this material to areas designated by the City of Stuart. Resale of excavated material on the project site will not be permitted.

**Material Disposal:** Unsuitable fill material or cleared and grubbed material resulting from the utility installation shall be removed from the work site and disposed of at location(s) secured by the Contractor, and in accordance with the agency having jurisdiction.

**Borrow:** Should there be insufficient satisfactory material from the excavations to meet the requirements for fill material, borrow shall be obtained from pits secured by the Contractor. All borrow shall meet the provisions of these specifications.

**Rock Excavation:** Rock excavation shall be defined as excavation of any hard natural substance which cannot be removed by a one cubic yard bucket and requires the use of explosives and/or special impact tools such as jackhammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock.

**Dewatering:** Utilities shall be laid “in the dry”, unless otherwise approved in writing by the City of Stuart and the Engineer of Record. All dewatering activities are to be performed by the Contractor.

Trench excavations may be dewatered by using one or more of the following methods: well point system; sumps with pumps or other method(s) as approved by the Engineer. Dewatering systems shall be utilized in accordance with good standard practice and must be efficient enough to lower the water level in advance of the excavation and maintain it continuously to keep the trench bottom and sides firm and dry. If the material encountered at trench grade is suitable for the passage of water without destroying the sides or utility foundation of the trench, sumps may be provided at intervals at the side of the main trench excavation, with pumps used to lower the water level by taking their suction from said sumps. Discharge from dewatering shall be disposed of in such a manner that it will not interfere with normal drainage of the area in which the work is being performed, create a public nuisance, or form ponding.

All discharge shall be in accordance with any SFWMD issued permits. The operations shall not cause injury to any portion of the work completed, or in progress, or to the surface of streets, or to private property. The proposed dewatering method(s) and schedule shall be approved by the Engineer of Record and necessary regulatory agencies prior to construction. Additionally, where private property will be involved, advance permission shall be obtained by the Contractor.

**Obstructions:** It shall be the Contractor's responsibility to acquaint himself with existing conditions and to locate structures and utilities along the proposed utility alignment in order to avoid conflicts. Where actual conflicts are unavoidable, work shall be coordinated with the facility owner and performed so as to cause as little interference as possible with the service rendered by the facility disturbed. All affected utilities shall be notified prior to excavation in their vicinity.

### **E.5 BACKFILLING**

**General:** Backfill material shall be clean earth fill composed of sand, clay and sand, sand and rock, crushed rock, or an approved combination thereof. Backfilling shall be divided into three specified areas:

First, from trench grade to a point 12 inches above the top of the utility, called initial backfill; second, from the top of the pipe zone to the bottom of the subgrade called final backfill; and third, from the bottom of the replacement base course to the replacement surface. Where encasements or other below grade concrete work have been installed, backfilling shall not proceed until the concrete has obtained sufficient strength to support the backfill load.

**Initial Backfill:** Granular material shall be carefully placed and tamped around the lower half (springline) of the utility. Backfilling shall be carefully continued until the fill is 12 inches above the top of the utility in layers not exceeding 6 inches (uncompacted thickness), using the best available material from the excavation, if approved.

The material shall be lowered to within two feet above the top of pipes before it is allowed to fall, unless the material is placed with approved devices that protect the pipes from impact.

Initial backfill shall exclude stones, or rock fragments larger than one inch for ductile iron, HDPE or PVC pipe.

Compaction of each lift shall be equal to 98% of maximum density as determined by AASHTO T-180.

**Final Backfill:** The remainder of the trench, above initial backfill and below the subgrade, shall be backfilled and compacted in layers not exceeding 12 inches (un-compacted thickness), except that the last two lifts shall not exceed six inches (un-compacted thickness) per lift. Compaction of each lift shall be equal to 98% of maximum density as determined by AASHTO T-180.

**Shoulder Restoration:** All shoulder restoration shall be in accordance with the applicable permit requirements of the agency having jurisdiction.

In excavated locations outside a 3 (horizontal) to 1 (vertical) slope downward from the shoulder line or the back of the curb (not over City of Stuart utilities), backfill (initial and final) shall be compacted to a density equal to 95% of maximum density, as determined by AASHTO T-180, or to natural existing density of the adjacent undisturbed trench embankments, whichever is greater.

Protective Concrete Slab: Protective concrete slabs shall be installed over the top of trenches, where required, to protect the installed utility against excessive loads, or when insufficient cover exists.

### **E.6 COMPACTING**

Compaction Methods: Specified compaction shall be accomplished using accepted standard methods (powered tampers, vibrators, etc.), with the exception that the first 12 inches of backfilling over the pipe shall be compacted by hand-operated tamping devices. Flooding or puddling with water to consolidate backfill is not acceptable, except where sugar sand is encountered and the operation has been approved by the Engineer of Record

Reference the standard construction details for density test requirements for trenches at flexible pavement.

Test backfill compaction at each specified location from the bottom of the excavation for each 12 inch lift of material.

Density Tests: Density testing and reporting shall be paid by the contractor and reviewed by the engineer of record. Density tests for determination of the above-specified compaction shall be made by a qualified testing laboratory. If any test results are unsatisfactory, the Contractor shall re-excavate, recompact the backfill, and retest, at his expense until the desired compaction is obtained.

Additional compaction tests shall be made to each side of an unsatisfactory test, as directed, to determine the extent of re-excavation and re-compaction necessary. Test results shall be made available to the City of Stuart for their records.

**END OF SECTION**

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## **DIVISION F** **JACK AND BORE**

### **F.1 SECTION DESCRIPTION**

This section includes materials, performance and installation standards, and Contractor responsibilities associated with the furnishing of all labor, materials, equipment and incidentals required to install, complete required boring and jacking installations, or other trenchless methods for pipelines, as shown on the Drawings and as specified herein.

The provision of this section shall be the minimum standards for the installation of casing pipe by the boring and jacking method. Other types of trenchless methods may be acceptable and encouraged if the specific method is at least equal to the performance of typical jack and bores and is comparable in cost.

### **F.2 CASING PIPE MATERIALS AND INSTALLATION**

Casings shall be steel pipe conforming to the requirements of ASTM Designation A-139. The minimum casing pipe size and wall thickness shall be as shown on the drawings. For sizes not included therein, or for special design considerations, approval shall be obtained from the Engineer of Record.

For crossing of State Roads, casing materials and installation shall conform to FDOT Standards.

### **F.3 CARRIER PIPES**

Wastewater and water carrier pipes to be installed within the specified casings shall be equipped with restrained joint connections. Pipe and fittings shall comply with the applicable provisions of these Standards, with minimum Ductile Iron Pipe Class 51.

Non-corrosive casing insulators shall be used. The casing runner height shall be large enough so that it does not interfere with the pipe restrained joints. Stainless steel nuts and bolts shall be used. Installation and spacing of casing insulators shall be as required by the manufacturer, and as shown on the standard construction details.

### **F.4 INSTALLATION**

Casing pipes crossing under roadways/railroads shall be located at suitable approved alignments in order to eliminate possible conflict with existing or future utilities and structures, with a minimum 36-inch depth of cover between the top of the casing pipe and the surface of the roadway. For casing pipe crossings under roadways/railroads, the Contractor shall comply with the regulations of said authority in regard to design, specifications, and construction. Casing installations shall be as specified in the Florida Department of Transportation, "Utility Accommodation Guide", and the American Railway Engineering Association, for railroads.

The boring and jacking operations shall be done simultaneously, with continuous installation, until the casing pipe is in final position. Correct line and grade shall be carefully maintained. Add on sections of casing pipe shall be full-ring welded to the preceding length, developing

watertight, total pipe strength joints. The casing installation shall produce no upheaval, settlement, cracking, movement, or distortion of the existing roadbed or other facilities. Following placement of the carrier pipe within the steel casing, end link seals are to be installed at each open end. Said end link seals shall be suitable for restraining the external earth load while allowing internal drainage. Casing vents shall be required as indicated on the standard construction details. Fiberglass markers to identify bores at each ROW. Each bore shall receive its own marker identifying: depth of cover, material, pipe size (for casing if pipe is equipped with casing), ownership of pipe, and emergency contact information. Placement of markers shall be at the ROW or very near the ROW so that its location is easily found in the event of pipe failure.

Casing pipe holes shall be mechanically bored through the soil by a cutting head on a continuous auger mounted inside the pipe. The distance between the leading end of the first auger section and the leading end of the casing shall be as necessary to maintain a solid plug of spoil material inside the forward portion of the casing.

The casing pipe shall be adequately protected to prevent crushing or other damage under jacking pressures. Backstops shall be provided for adequately distributing the jack thrust without causing deformation of the soil or other damage. Should the casing pipe be damaged, such damaged portion not in the hole shall be replaced; however, if installed, the encasement pipe shall be abandoned in place, grouted full, and suitably plugged, and an alternate installation made. An alternate installation will also be required if the casing alignment or elevation substantially deviates from the plan locations, and results in the installation being unusable, as determined by the City of Stuart and Engineer of Record.

Required boring and jacking pits or shafts shall be excavated and maintained to the minimum dimensions necessary to perform the operation. Said excavations shall be adequately barricaded, sheeted, braced and dewatered, as required, in accordance with the applicable portions of Division E "Utility Excavation, Backfilling and Compacting" and the above-stated regulations specifications. Boring and jacking pits will normally be no closer than ten (10) feet from the edge of pavement, with the permitting agency having final determination of the required setback distance.

**END OF SECTION**

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**DIVISION G**  
**TRENCHLESS INSTALLATION OF PRESSURE MAINS**  
**BY DIRECTIONAL BORING**

**G. GENERAL- SECTION DESCRIPTION**

**G.1 SCOPE OF WORK**

The work specified in this section consists of furnishing and installing underground utilities using open-cut method or the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring or guided horizontal boring. This work shall include all services, equipment, materials, and labor for the complete and proper installation, testing, restoration of underground utilities and environmental protection and restoration

**G.2. QUALITY ASSURANCE:**

The requirements set forth in this document specify a wide range of procedural precautions necessary to insure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification or within any associated permit (i.e.: FDEP, FDOT, Etc.). Adherence to the specifications contained herein, or the COS Representative's approval on any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract. The HDD contractor shall be responsible for the repair of all damage to private and/or public property (at no expense to COS). Repair work shall meet all local and state rules and requirements.

**G.3. PROJECT SCHEDULE AND COOPERATION:**

The project schedule shall be established on the basis of working a normal work schedule including five days per week, single shift, and eight hours per day or four days per week, single shift, ten hours per day. Unless approved otherwise by COS normal or general items of work, such as bacteriological testing, leakage and pressure testing, density testing and final inspections, shall be scheduled during the normal work schedule. Due to operational and manpower limitations on the COS systems, COS may require the contractor to perform work outside of the normal work schedule. These operational and manpower limitations, including but not limited to, line filling and flushing operation, tie-in work, (cut-in work or other work) and other phases of the work which may impact the continued (non-interruptible) service to existing COS customers. The contractor shall plan and anticipate the cost impact of these systems limitations and provide such work or services at no additional cost to COS.

**G.4. WARRANTY:**

The contractor shall supply to COS a one (1) year unconditional warranty. The warranty shall include materials, installation and shall constitute complete replacement and delivery to the site of materials and installation of same to replace defective materials or defective workmanship with new materials/workmanship conforming to the specifications.

**G.5. REFERENCED STANDARDS:**

**G.5.1.** The work shall conform to applicable provisions of the COS Water and Sewer Standards, and the following standards, latest editions, except as modified herein.

**AWWA C906** Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 63 inch, for Water Distribution American Society for Testing and Materials (ASTM) Standards.

**ASTM D618** Standard Methods of Conditioning Plastics and Electrical Insulating Materials for Testing.

**ASTM D638**, Standard Test Method for Tensile Properties of Plastics.

**ASTM D1238**, Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.

**ASTM D1248**, Standard Specifications for Polyethylene Plastics Molding and Extrusion Materials.

**ASTM D1505**, Standard Test Method for Density of Plastics by the Density Gradient Technique.

**ASTM D1598**, Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.

**ASTM D1599**, Standard Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.

**ASTM D1603**, Standard Test Method for Carbon Black in Olefin Plastics.

**ASTM D2122**, Standard Method of Determining Dimensions of Thermoplastics Pipe and Fittings.

**ASTM D2290**, Standard Test Method for Apparent Tensile Strength or Tubular Plastics and Reinforced Plastics by Split Disk Method.

**ASTM D2683**, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

**ASTM D2837**, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

**ASTM D2839**, Standard Practice for Use of a Melt-Index Strand for Determining Density of Polyethylene

**ASTM D3035**, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

**ASTM E3261**, Standard Specification for Butt Heat Fusion Polyethylene Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

**ASTM D3350** , Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.

**ASTM D4218**, Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

**ASTM F412**, Standard Terminology Relating to Plastic Piping Systems.

#### **G.6 PERMITS:**

Permits for all work within the City of Stuart, FDOT, Martin County, South Florida Water Management District (SFWMD), NPDES, and Submerged Land of the State of Florida right of way shall be obtained by the Contractor. The Contractor shall verify the existence of all permits before commencing any work on the project.

#### **G.7. SUBMITTALS (HDD PROJECTS ONLY):**

##### **G.7.1. Work Plan:**

Prior to beginning work, the Contractor must submit to the COS Representative a work plan detailing the procedure and schedule to be used to execute the project. The work plan should include a description of equipment to be used, down-hole tools, a list of personnel and their qualifications and experience (including back-up personnel in the event that an individual is unavailable), list of sub-Contractors, a schedule of work activity, a safety plan (including MSDS of any potentially hazardous substances to be used), traffic control plan (if applicable), an environmental protection plan and contingency plans for possible problems including a Frac-Out and Surface Spill Prevention Control and Countermeasure Plan (SPCC) (for COS approval). Work plan should be comprehensive, realistic and based on actual working conditions for this particular project. Plan should document the thoughtful planning required to successfully complete the project. The HDD contractor shall submit and obtain COS's approval of a pre-construction bore-log depicting a plan and profile (horizontal and vertical alignment) of the proposed bore path. The bore-log shall show all utility crossings and existing structures. For the supply of domestic water during construction, the contractor shall utilize a City of Stuart (COS) construction meter assembly (meter & backflow device) and pay for all water consumed except in the case where the new water main is connected directly into the active water system for line filling and flushing operation. Un-metered reclaimed water may be utilized for flushing and testing of new reclaimed water mains. Un-accountable domestic water quantities shall be minimized, where possible.

##### **G7.2. Shop Drawing Submittals:**

Actual catalog data, brochures and descriptive literature will not be required for items of standard usage which meet the requirements of the COS Water and Sewer Standards Manual. Any specialty item not shown in this manual will require a complete shop

drawing submittal for any material which may, in the Engineer's opinion, not be in compliance with the COS Water and Sewer Standards.

**G.7.3. Record Drawing/As-Built:**

Submit for COS's approval the as-built records in duplicate to the COS Representative within five days after completing the pull back. The record drawings/ as-built records (24" x 36" and Auto CAD with .PDF disk of as-built data, 20 horizontal max scale with 2 foot vertical max scale) shall include a plan, profile (data every 25 LF of main, at a minimum), and all information recorded during the progress of the work, including all subsurface anomalies identified by Ground Penetrating Radar or vacuum excavation. The HDD contractor shall certify the accuracy of all as built record drawings. In NAD 83/90 Horizontal Datum, NAVD 88 Vertical Datum

**G.8. NOTIFICATION:**

The COS representative must be notified 48 hours (minimum) in advance of starting the drilling work. The Directional Bore shall not begin until the proper preparations (see work plan) for the operation have been completed.

**G.9. SITE PREPARATION:**

**G.9.1.** Prior to any alterations to work-site, Contractor shall photograph and/or video tape (digital) entire work area. One copy of which shall be given to Engineer of record., one copy to COS Representative and one copy to remain with Contractor for a period of one (1) year following the completion of the project.

**G.9.2** The Contractor shall coordinate utilities locates with Sunshine State One-Call of Florida, Inc., (#811 or web site [www.callsunshine.com](http://www.callsunshine.com)). Once the locate service has field marked all utilities, the Contractor shall verify each utility (including any service laterals, i.e. water, sewer, cable, gas, electric, phone, fiber, etc.) and those within each paved area. Verification may be performed utilizing Ground Penetrating Radar, hand dig, and/or vacuum excavation. Prior to initiating drilling, the Contractor shall record on the drawings both the horizontal and vertical location of the utilities off of a predetermined baseline. The Contractor shall utilize the Ground Penetrating Radar over the projected bore path whether utilities are located in the horizontal drill pathway or not, in order to reduce the opportunity of conflicting with any unforeseen obstructions.

**G.9.3.** Work site shall be graded and filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

**G.9.4.** Following drilling operations, Contractor will de-mobilize equipment and restore the work-site to original condition. All excavations will be backfilled and compacted to City of Stuart Specifications, as a minimum.

**G.10. ENVIRONMENTAL PROTECTION:**

Contractor shall place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by contract documents,

state, federal and local regulations such as SFWMD and NPDES requirements. Contractor shall place approved protection, to limit intrusion upon project area. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations including environmental condition stated in local, state and federal permits. Fuel may not be stored in bulk containers (greater than 25 gallons) within 200' of any water-body or wetland.

**G.11. SAFETY:**

Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner.

**G.12. PERSONNEL QUALIFICATIONS CERTIFICATION:**

**G.12.1. Directional Boring:**

All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety. (Each person must have been fully trained for over 1,000 hours on all facets of directional drilling, including, but not limited to machine operations, mud mixing, locating, and material fusion.) A responsible representative who is thoroughly familiar with the equipment and type of work to be performed, must be in direct charge and control of the operation at all times. In all cases the supervisor must be continually present at the job site during the actual Directional Bore operation. The Contractor shall have a sufficient number of competent workers on the job at all times to insure the Directional Bore is made in a timely and satisfactory manner.

**G.12.2. Pipe and Fitting Jointing:**

**G.12.2.1. Heat Fusion Joining:**

Joints between plain end pipes and pipe fittings shall be made by butt fusion when possible. Electro fusion welding may also be used to complete when the location is not accessible to butt fusion welding equipment. The on-site welder making the joints (butt fusion or electro fusion) shall have received specific training from the manufacturer of the fittings and/or pipe being welded and shall have written proof of proper training/certification from the associated manufacturers. Only certified welders who have written training certifications from the fitting and/or pipe manufacturer will be allowed to perform this work. That is, to weld a fitting or electro fusion coupling in place, the on-site welder (employee) must be trained and certified by the fitting manufacturer. To butt weld pipe, the on-site welder (employee) must be trained and certified by the pipe manufacturer. The fusion work shall be accomplished (welding and cool-down/closing times) in accordance with the fitting and pipe manufacturers' recommendations, at a minimum. External and internal beads shall not be removed unless approved by COS. A sample (coupon) of the heat fusion technique using the materials to be installed shall be performed in the presence of the COS representative and the engineer of record. The fused coupon shall be tested for strength and consistence of a uniform weld seam.

**G.12.2.2. Heat Fusion Training Services:**

Upon request, the Manufacturer shall provide training and training materials in the Manufacturer's recommended butt fusion, saddle fusion and electro fusion procedures to the Contractor's installation personnel, and to inspectors representing the COS. Only certified (manufacturer certification) employees will be allowed to complete this fusion work.

**GII. MATERIALS**

**GII.1. HIGH DENSITY POLYETHYLENE (HDPE, PEI PIPE AND FITTINGS):**

**GII.1.1. Materials:**

Materials used for the manufacturer of polyethylene pipe and fittings shall be PE3408 high density polyethylene meeting cell classification 345464C per ASTM 03350; and meeting Type III, Class B or Class C, Category 5, Grade P34 per ASTM 01248; and shall be listed in the name of the pipe and fitting Manufacturer in PPI TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade rating of 1600 psi at 73°F per ASTM 0-2837. The Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.

**GII.1.2. Polyethylene Tubing Lines (Low Pressure Sewer Lines Only):**

Tubing shall be manufactured of PE 3408, High Density Polyethylene (HDPE), in accordance with AWWA C901, ASTM 01248, ASTM 02239, ASTM 02737 and ASTM 03350. The tubing shall have a minimum working pressure of)-160psi. Polyethylene tubing shall be copper tube size (CTS) or IPS SDR11 and shall be colored black, green, or black with green stripe for sewer. HDPE pipe shall have ultraviolet (UV) inhibitors for protection against direct sunlight for 1 year. Inserts for polyethylene tubing shall be utilized, and shall be 316 stainless steel. The use of brass fittings (including couplings) is acceptable if not located under the roadway.

The use of brass couplings, tees and "Y" fittings are acceptable on poly service tubing, if not located under the roadway. Tubing shall be approved for use with potable water by the National Sanitation Foundation (NSF-14) and shall be continuously marked at intervals of not more than four feet with the following:

- G11.1.2.1.** Nominal size
- G11.1.2.2.** Pressure rating
- G11.1.2.3.** NSF seal
- G11.1.2.4.** Manufacturer's name or trademark
- G11.1.2.5.** Standard dimension ratio
- G11.1.2.6.** ASTM specification

**GII.1.3. Polyethylene Pipe (4 inch and larger):**

HDPE Pipe shall conform to AWWA C906, DR-11, Ductile Iron Pipe (DIP) size and NSF 61 Standard. For pipe sizes 24-inch and larger, the HDPE shall be IPS size, DR 11.



Polyethylene pipe shall be manufactured in accordance with ASTM F714, Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter and shall be so marked. Each production lot of pipe shall be tested for (from material or pipe) melt index, density, % carbon, dimensions and either quick burst or ring tensile strength (equipment permitting).

**GII.1.4.** Nominal pipe sizes only are indicated on the drawings and bid form. Outside diameter of pipe is generally 1 to 2-inches greater than the nominal pipe diameter.

**GII.1.5. Service Identification:**

Permanent identification of piping service shall be provided by co-extruding multiple equally spaced color stripes into the pipe outside surface or by solid colored pipe shell. The striping material shall be the same material as the pipe material except for color. The following colors shall be used to identify piping service (pressure service):

- G11.1.5.1. Blue - potable water**
- G11.1.5.2. Green - wastewater or force main**
- G11.1.5.3. Purple - reclaimed water**
- G11.1.5.4. Black - raw water**

**GII.1.6. Polyethylene Fittings and Custom Fabrication:**

Polyethylene fittings and custom fabrications shall be molded or fabricated by the pipe manufacturer or trained personnel. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe. Fabricated fittings must have the same working pressure as the mating pipe.

**GII.1.7. Molded Fittings:**

Molded fittings shall be manufactured in accordance with ASTM D3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing, and shall be so marked. Each production lot of molded fittings shall be subjected to the test required under ASTM D3261.

**GII.1.8. Fabricated Fittings:**

Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service equivalent to the full service pressure rating of the mating pipe. Directional fittings 16" and larger such as elbows, tees, crosses, etc., shall have a plain end inlet for butt fusion and flanged directional outlets.

**GII.1.10. Polyethylene Flange Adapters:**

Flange adapter shall be made with sufficient through bore length to be clamped in a butt fusion joining machine without the use of a stub end holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooved to provide gasketless sealing, or to restrain the gasket against blow-out. Below ground flange

adapter may be utilized for 30" and larger, DIP and valves. Adapters for 24 inch and smaller utilize an MJ adapter (see below).

**GII.1.11. Back-up Rings and Flange Bolts:**

Flange adapters shall be fitted with lap joint flanges pressure rated equal to or greater than the mating pipe. Convoluted style backup rings preferred over the flat stock rings. The lap joint flange bore shall be chamfered to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Stainless steel or higher.

**GII.1.12. Manufacturer's Quality Control:**

The pipe and fitting manufacturer shall have an established quality control program responsible for inspecting incoming and outgoing materials. Incoming polyethylene materials shall be inspected for density, melt flow rated, and contamination. The cell classification properties of the material shall be certified by the supplier, and verified by Manufacturer's Quality Control.

**GII.1.13. Polyethylene Mechanical Joint (MJ) Adapters:**

Mechanical connections of HDPE pipe (3" through 24" diameter) to Ductile Iron or PVC piping, mechanical joint fittings, or valves shall be through a self-restraining, fusible mechanical joint adapter with or without an integral, internal stainless steel insert. Mechanical joint adapter shall be of the same SDR rating as the pipe. A separate, loose stainless steel type insert will only be allowed for pipe sizes 4 inch through 8 inches. Provide the mechanical joint adapter, including but not limited to longer tee bolts or all thread rods with nuts at the mechanical joint bell. Note that PE flanged adapters may be utilized for pipe sizes 30 inches and larger.

**GII.1.14. Cast Transition Couplings:**

HDPE to MJ cast transition coupling may only be utilized for 8 inch and smaller pipe size. A stainless steel stiffener is required sized at proper ID of HDPE pipe. The transition coupling must be epoxy lined (3 mils minimum for water use and 12 mils minimum for sewer use). Acceptable is a protecto 401 for sewer or approved equal.

**GII.1.15. Electro Fusion Couplings:**

Polyethylene pipe and fittings may be joined using approved electro fusion couplings. Fittings shall be PE3408 HDPE, Cell Class 345464C as determined by ASTM D3350-99. Electro fusion fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe. All electro fusion fittings shall be suitable for use as pressure conduit per AWWA C906, and have nominal burst value of 3.5 times the working pressure of the fitting. To minimize "toe-in" problems when installing an electro fusion coupling larger than 12 inch size, the contractor shall remove 12 inches (minimum) from all associated "factory ends" and use a re-rounding clamp on the associated pipe. The contractor shall mark pipe insertion depth prior to assembly and construct in accordance with manufacturer's instructions.

**GII.2. POLYETHYLENE SERVICE LINE TUBING:** Shall conform to city of Stuart Water and Sewer Standard Specifications.

**GII.3. SERVICE CONNECTIONS:**

Services 2" and smaller shall include an integral shut-off valve. The contractor shall supply all adapters, couplings, and special connections necessary to transition from the service connection to the COS standard polyethylene service tubing at both ends. Services are to be in accordance with COS Standard Specifications and Details.

**GII.4. DRILLING FLUIDS SHALL BE A BENTONITE SLURRY.**

Bentonite is a clay product typical mined in Wyoming and shall have the natural characteristics as detailed in the MSDS sheet. The bentonite drilling fluid shall be derived from natural-occurring sodium montmorillonite clays. The bentonite shall be non-toxic and commonly used in farming and drilling practices. A copy of a typical MSDS sheets for this material must be submitted Engineer of Record

**GII.5. DELIVERY, STORAGE AND HANDLING OF MATERIALS:**

**GII.5.1.** Inspect materials delivered to the site for damage. All materials found during inspection or during the progress of work to have cracks, flaws, cracked linings, or other defects shall be rejected and removed from the job site without delay.

**GII.5.2.** Unload and store opposite or near the place where the work will proceed with minimum handling. Store material under cover out of direct sun light. Do not store directly on the ground. Keep all materials free of dirt and debris.

**GII.5.3.** Contractor is responsible for obtaining, transporting and sorting any fluids, including water, to the work site.

**GII.5.4.** Disposal of fluids is the responsibility of the Contractor. Disposal of fluids shall be done in a manner that is in compliance with all permits and applicable federal, state, or local environmental regulations. The bentonite drilling slurry may be recycled for reuse in the hole opening operation, or shall be hauled by the Contractor to an approved location or landfill for proper disposal. Contractor shall thoroughly clean entire area of any fluid residue upon completion of installation, and replace any and all plants and sod damaged, discolored or stained by drilling fluids.

**GIII. EQUIPMENT REQUIREMENTS**

**GIII.1. GENERAL:**

The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the drill, a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be re-used, a guidance system to accurately guide boring operations, a vacuum truck of sufficient capacity to handle the drilling fluid volume, trained and competent personnel to operate the system. All equipment shall be in

good, safety 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.

**GIII.2. DRILLING SYSTEM:**

**GIII.2.1. Drilling Rig:**

The directional drilling machine shall consist of a power system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The power system shall be self contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations. The rig shall be grounded during drilling and pull-back operations. There shall be a system to detect electrical current from the drilling string and an audible alarm which automatically sounds when an electrical current is detected.

**GIII.2.2. Drill Head:**

The drillhead shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.

**GIII.2.3. Mud Motors (if required):**

Mud motors shall be of adequate power to turn the required drilling tools.

**GIII.2.4. Drill Pipe:**

Shall be constructed of high quality 4130 seamless tubing, grade D or better.

**GIII.3. GUIDANCE SYSTEM:**

A Magnetic Guidance System (MGS) or proven gyroscopic system shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance shall be capable of tracking at all depths up to eighty 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 to +/-2% of the vertical depth of the borehole at sensing position at depths up to one hundred feet and accurate within 1.5 meters horizontally.

The Guidance System shall be of a proven type and shall be operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies on the surface of the drill path and shall consider such influences in the operation of the guidance system if using a magnetic system.

**GIII.3.1. Bore Tracking and Monitoring:**

At all times during the pilot bore the Contractor shall provide and maintain a bore tracking system that is capable of accurately locating the position of the drill head in the x, y, and z axes. The Contractor shall record this data at least once per drill pipe length or every twenty-five (25) feet, whichever is most frequent and shall be reflected within the submitted record/asbuilt drawings.

**GIII.3.1.1. Downhole and Surface Grid Tracking System:**

Contractor shall monitor and record x, y, and z coordinates relative to an established surface survey bench mark. The data shall be continuously monitored and recorded at least once per drill pipe length or at twenty-five (25) feet, whichever is more frequent.

**GIII.3.1.2.** Deviations between the recorded and design bore path shall be calculated and reported on the daily log. All deviations (horizontal or vertical) from the design path, such occurrences shall be reported immediately to Eng. Of Record and/or COS. The

Contractor shall undertake all necessary measures to correct deviations and return to design line and grade.

**GIIL.3.1.3. Drilling Fluid Pressures and Flow Rates:**

Drilling fluid pressures and flow rates shall be continuously monitored and recorded by the Contractor. The pressures shall be monitored at the pump. These measurements shall be made during pilot bore drilling, reaming, and pullback operations.

**GIIL.4. DRILLING FLUID (MUD) SYSTEM:**

**GIIL.4.1. Mixing System:**

A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid. Mixing system shall continually agitate the drilling fluid during operations.

**G III.4.2. Drilling Fluids:**

Drilling fluid shall be composed of clean water, appropriate additives and clay. Water shall be from an authorized source with a minimum pH of 6.0. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No potentially hazardous material may be used in drilling fluid.

**GIIL.4.3. Delivery System:**

The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and conveyed to the drilling fluid recycling system. A berm, minimum of 12" high, shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid cycling system to prevent spills into the surrounding environment. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage and recycling facilities.

**GIIL.4.4. Drilling Fluid Recycling System:**

The drilling fluid recycling system shall separate sand, dirt and other solids from the drilling fluid to render the drilling fluid re-usable. Spoils separated from the drilling fluid will be stockpiled for later use or disposal.

**GIIL.4.5. Control of Drilling Fluids:**

The Contractor shall follow all requirements of the Frac-Out and Surface Spill Contingency Plan as submitted and approved and shall control operational pressures, drilling mud weights, drilling speeds, and any other operational factors required to avoid hydrofracture fluid losses to formations, and control drilling fluid spillage. This includes any spillages or returns at entry and exit locations or at any intermediate point. All inadvertent returns or spills shall be promptly contained and cleaned up. The Contractor shall maintain on-site mobile spoil removal equipment during all drilling, pre-reaming, reaming and pullback operations and shall be capable of quickly removing spoils. The Contractor shall immediately notify COS of any inadvertent returns or spills and immediately contain and clean up the return or spill.

**GIIL.5. OTHER EQUIPMENT:**

**GIIL.5.1. Pipe Rollers:**

Pipe rollers, if utilized, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall used to prevent excess sagging of pipe.

**GIIL.5.2. Pipe Rammers:**

Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of COS Representative.

**GIII.5.3. Restrictions:**

Other devices or utility placement systems for providing horizontal thrust other than those defined above in the preceding sections shall not be used unless approved by the Eng. Of Record and COS Representative prior to commencement of the work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the projects.

**GIV. DRILLING PROCEDURES**

**GIV.1. DRILL PATH:**

Prior to drilling Contractor shall utilize all verified locate information to determine drill pathway. Marked up drawings (see Site Preparation paragraph) shall be on site at all times, and referred to during the drill operation.

**GIV.2. GUIDANCE SYSTEM:**

Contractor shall provide and maintain instrumentation necessary to accurately locate the pilot hole (both horizontal and vertical displacements), measure pilot string torsional and axial and measure drilling fluid discharge rate and pressure. The Eng. Of Record and/or COS Representative shall have access to instrumentation and readings at all times during operation.

**GIV.3. PILOT HOLE:**

The pilot hole shall be drilled along the path shown on the plans and profile drawings or as directed by the COS Representative in the field. Unless approved otherwise by Eng. Of Record and/or COS, the pilot hole tolerances shall be as follows:

**GIV.3.1 Elevation:** As shown on the plans.

**GIV.3.2 Alignment:** ±5 feet and within 3 feet of right-of-way or easement boundary.

**GIV.3.3. Curve Radius:**

The pilot hole radius shall be no less than 80% of the maximum bending radius as recommended by the pipe manufacturer of the pipe being installed. In no case shall the bending radius be less than 30 pipe diameters, unless approved otherwise by COS.

**GIV.3.4. Entry Point Location:**

The exact pilot hole entry point shall be within ±5 feet of the location shown on the drawing or as directed by the COS Representative in the field.

**GIV.3.5. Exit Point Location:**

The exit point location shall be within ± 5 feet of the location shown on the drawing or as directed by the COS Representative in the field.

**GIV.3.6. Limitations on Depth:**

If not noted on the plans, 6" HDPE pipe and smaller shall be installed with a depth of 3 to 5 feet and 8" HDPE pipe thru 12" pipe shall be installed with a depth of 3 to 6 feet unless it is required to install the pipe deeper due to utility conflicts. HDPE pipe larger than 12" shall be specifically designed by the engineer and approved by COS. Where utilities cross under DOT roads, the depth of cover shall comply with applicable DOT permit.

**GIV.3.7. Water Main and Non-Water Main Separation Requirements:**

The minimum separation requirements between HDPE water main and a non-water main shall be as outlined in the COS Standard Specifications and Details.

**GIV.4. PULL BACK:**

After successfully reaming bore hole to the required diameter, Contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel and reamer to compact bore hole walls. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations Contractor will not apply more than the maximum safe pipe pull pressure at any time. Maximum allowable tensile force imposed on the pull section shall be equal to 80% of the pipe manufacturer's safety pull (or tensile) strength.

**GIV.4.1.** Torsional stress shall be minimized by using a swivel to connect a pull section to the reaming assembly.

**GIV.4.2.** The pullback section of the pipeline shall be supported during pullback operations so that it moves freely and the pipe is not damaged.

**GIV.4.3.** External pressure shall be minimized during installation of the pullback section in the reamed hole. Damaged pipe resulting from external pressure shall be replaced at no cost to the COS.

**GIV.4.4.** Buoyancy modification shall be at the discretion of the Contractor and shall be approved by the COS Representative. The Contractor shall be responsible for any damage to the pull section resulting from such modifications.

**GIV.4.5.** In the event that pipe becomes stuck, Contractor will cease pulling operations to allow any potential hydro-lock to subside and will commence pulling operations. If pipe remains stuck, Contractor will notify COS Representative. COS Representative and Contractor will discuss options and then work will proceed accordingly.

**GIV.4.6.** For HDPE DR-17 pipe with a pulling length greater than 500 IF, the contractor shall utilize a break-away link. Contractor shall provide a break-away link between the swivel and the pipe or a combination swivel and break link. Break-away link shall be rated at 80% of pipe manufacturer's safe pull (tensile) strength. Break pins shall be color coded for easy identification. Contractor shall provide rated break-away link for each material and pipe size(s) for the project.

## **GV. PIPE ASSEMBLY**

**GV.1.** Pipe shall be welded/fused together in one length, if space permits. Pipe may be placed on pipe rollers before pulling into bore hole to minimize damage to the pipe. For pipes 16 inch and larger, a re-rounding clamp tool shall be utilized during the electro-fusion process to ensure pipe roundness. For pipe sizes larger than 12 inch, mechanical scrappers (per the fitting manufacturer's recommendation) shall be utilized during the electro-fusion work. It is critical that all original oxidized pipe surface be removed in order for fusion to take place. The scraping process requires that approximately .10" of the outer "skin" be removed in order to penetrate the oxidation and contamination barrier. Oxidized pipe surface simply will not bond.

### **GV.2. ACCEPTABILITY OF DAMAGED PIPE:**

Cuts or gouges that reduce the wall thickness by more than 10% is not acceptable and must be cut out and discarded.

### **GV.3. BUTT FUSION TESTING:**

When requested by a COS inspector, butt fusion testing will be performed. The test fusion shall be allowed to cool completely, and then fusion test straps shall be cut out. The test strap shall be 12" (min) or 30 times the wall thickness in length with the fusion in the center and 1" (min) or

1.5 times the wall thickness in width. Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new test fusion shall be made, cooled completely and tested

**GV.4. MECHANICAL JOINING:**

Polyethylene pipe and fittings may be joined together or to the materials by means of flanged connections (flange adapters, electrofused couplings, and back-up rings) or mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material. Mechanical couplings shall be fully pressure rated and fully thrust restrained such that when installed in accordance with manufacturer's recommendations, a longitudinal load applied to the mechanical coupling will cause the pipe to yield before the mechanical coupling disjoins. External joint restraints shall not be used in lieu of fully restrained mechanical couplings.

**GV.5. MECHANICAL JOINT AND FLANGE INSTALLATION:**

Mechanical joints and flange connections shall be installed in accordance with the Manufacturer's recommended procedure. Flange faces shall be centered and aligned to each other before assembling and tightening bolts. In no case shall the flange bolts be used to draw the flanges into alignment. Bolt threads shall be lubricated, and flat washers shall be fitted under the flange nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer. At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be 100 ft-lbs. or less as recommended by the Manufacturer.

**GV.6. SPECIAL CONSTRUCTION REQUIREMENTS FOR 24 INCH AND LARGER PIPE:**

For HDPE pipe 24 inch and larger, unless approved otherwise by COS, a foundation bed of granular material (57 stone) shall be placed under and around all ductile iron fittings and valves for additional support of heavy system components A foundation bed of granular material shall be provided for all valves 20 size and larger. For granular materials, the minimum vertical limit is 12 inches under the fitting or valve, up to 1/3 the overall height of the fitting or valve. The minimum horizontal limits of the granular material shall be 12 inches in all directions beyond the outer edges of the fitting or valve. The compaction of soils below the granular material shall be at 98% of the maximum density. Payment for this work shall be included in the associated fitting or valve unit cost. All spool pieces between 24 inch and larger ductile fittings and valves shall be at least 5 feet long. No joint deflection shall be allowed at the fittings or valves.

**GV.7. GENERAL TRACER WIRE REQUIREMENTS :**

All horizontal directional drilling (HDD) method of installation shall include #8 AWG, THHN solid copper wire. (Color of insulation to match the application)

**END OF SECTION**



**DIVISION H**  
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**DIVISION I**  
**UTILITY VALVES AND APPURTENANCES**

**I.1 SECTION DESCRIPTION**

This section includes materials, installation standards, and contractor responsibilities associated with the furnishing of all labor, materials, equipment and incidentals required to properly place and install all utility valves and appurtenances for utility pipeline construction as shown on the Drawings and as specified herein.

Materials shall include, but not be limited to, the following:

Gate Valves	Water Meter Boxes
Curb Stops	Pipe Restraints
Corporation Stops	Tapping Sleeves
Check Valves	Service Saddles
Ball Valves	Air Release Valves
Locating Devices	
Valve Boxes	

**I.2 SUBMITTALS**

Submit shop drawings of all equipment and appurtenances to be installed, showing required size, specific type and specified information for approval prior to ordering materials. Special tools, if required for normal operation and maintenance, shall be supplied with the materials at no additional cost to the City of Stuart.

**I.3 GENERAL**

All equipment and appurtenances shall be of the size shown on the Drawings and as far as possible all equipment of the same type shall be from one manufacturer.

All equipment and appurtenances shall have the name of the maker, the size and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body. Valves shall open left (counterclockwise).

Approved Pipe and Fittings: The valves tabulated below, within the size range indicated and for the applicable service, are approved for system construction:

<u>Valves</u>	<u>Service</u>	<u>Size</u>
Gate	Water Distribution	All Sizes
Gate	Force and Low Pressure Mains	2 inch and above

**I.4 GATE VALVES (GV) 2 inches and larger**

**Underground Service (General):** Valves 2 inches and larger shall be iron body, bronze mounted, conforming to AWWA C509, resilient wedge, mechanical joints, nonrising stem-type, and shall be equipped with two-inch square cast iron wrench nuts.

**Above Ground Service (General):** Valves shall be iron body, bronze mounted, resilient wedge gate valves, conforming to AWWA C-509. Valves shall be OS&Y, rising stem type.

**I.5 BALL VALVES 2 inches and smaller**

Valves shall be brass body, ¼ turn ball-type, meeting AWWA Standard C800-89 or latest version and rated for 150 psi minimum working pressure.

**I.6 CHECK VALVES (CV) 3 inches and larger**

General Service: Force Main valves shall be swing type and meet AWWA C-508. Valve shall be iron body; bronze mounted, outside lever and weight, and equipped with removable inspection covers. Check valves 3 to 12 inches shall have a minimum working pressure of 175 psi, and units 16 to 24 inches shall be rated for 150 psi minimum working pressure and shall permit full flow area equal to that of the connecting pipe.

**I.7 SILENT CHECK VALVES Less than 3 inches**

Valve shall be spring loaded, globe style with a minimum working pressure rating of 175 psi. Valve shall be tight seating and shall be furnished with an easily replaceable bronze seat with a resilient Buna-N Seal. Valve shall have stainless steel trim (type 316) as well as all other internal fasteners and screws.

**I.8 PVC VALVES 1.5 INCHES AND SMALLER (LOW PRESSURE MAINS ONLY)**

Valves shall be a PVC check valve, all rubber flapper type rated for 150 psi. The check valve will provide a full-ported passageway when open. Rubber flapper shall be fabric reinforced, synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A non-metallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating, even at a very low backpressure. The valve body shall be high gloss injection molded PVC type I-II.

**I.9 CORPORATION STOPS AND CURB STOPS**

Units shall be brass, equipped with AWWA “CC” tapered threads and connections compatible with the connecting service pipe-type; must have **grip joint** type connections for polyethylene tubing with grip lock collars and stainless steel inserts.

**I.10 AIR RELEASE VALVES – WATER (VENT ONLY)**

Valves shall comply with AWWA C-512, be cast iron or ductile iron or bronze body, cover and baffle, stainless steel float and stainless steel trim, suitable for domestic water service, rated for a minimum 150 psi working pressure.

**I.11 SERVICE SADDLES**

Saddles for PVC or ductile iron pipe shall be epoxy coated, stainless steel double strap, or brass full circle type saddles, with AWWA “CC” tapered threads as applicable. Sealing gaskets shall be suitable for the applicable service.

## **VALVE APPURTENANCES**

### **I.12 VALVE BOXES**

Units shall be adjustable, cast iron, two-piece screw-type with minimum interior diameter of five inches, with covers cast with the applicable inscription in legible lettering on the top: "SEWER", "WATER" or "RECLAIMED WATER". Boxes shall be suitable for the applicable surface loading and valve size. Extension pieces, if required, shall be the manufacturer's standard screw-type for use with the valve box.

### **I.13 VALVE BOX ALIGNMENT**

All buried gate valves 3 inch through 12 inch requiring a valve box shall be furnished with a valve box alignment device (VBAD). The device shall be of HDPE and colored white. It shall be furnished in two pieces that will lock together under the operating nut without requiring the removal of the op nut. The device shall not affect the operation of the valve. No one-piece device will be accepted. The device shall be the Box Lok as manufactured by Almar Molded Products Inc or approval equal

### **I.14 EXTENSION STEM FOR VALVE OPERATORS**

Where the depth of the operating nut is more than 3 feet (unless otherwise specified), operating extensions shall be provided to bring the operating nut to a point 6 inches below finished grade. The extension shall be high strength, corrosion resistant steel construction and permanently attached with stainless steel pin to the operating nut or handle on the valve. A steel centering plate shall be welded to the extension.

Valve boxes shall be provided with concrete collar and valve nameplate with suitable anchors for casting in concrete. Nameplate shall be 3-inch diameter bronze disk with 1/8 inch high lettering. Information on disk shall be of specific valve type, size, direction and number of turns, etc.

### **I.15 ENCLOSED METER BOX**

Meter boxes shall be high-density polyethylene body and cover with a cast iron meter lid. Meter boxes shall be the same type throughout the project and of the type currently utilized by the City of Stuart.

### **I.16 TAPPING SLEEVES AND VALVES**

Tapping sleeve shall be split-type stainless steel with flanged outlet for connection to tapping valve. Valves shall conform to the specifications set forth previously, for the applicable service conditions. Additionally, units shall be compatible with the connecting sleeve or saddle and specially designed for wet tapping installation operations.

### **I.17 LOCATING WIRE**

The Locator Wire, (color of insulation to match the application) when specifically required to be installed with all pressure mains, shall be connected at each valve per COS Standard Utility Detail #34.

### **1.18 PIPE RESTRAINTS**

All pressure pipe at fittings and for lengths specified within the Construction Drawings shall be restrained by appropriate restraint devices meeting requirements of UNI-B-13 for PVC pipe and Ductile Iron Pipe Research Association for ductile iron pipe, and be UL listed. Specific criteria in establishing required pipe restraint lengths are found within the Standard Construction Details. Shop drawings shall specify the particular system to be utilized and be approved by the City of Stuart or Engineer of Record. After an acceptable restraint device is approved, no substitutions will be allowed without resubmittal of shop drawings and written approval from the City of Stuart or Engineer of Record. All restraints shall be installed in accordance to the manufacturer's requirements for the pipe used and for lengths specified within the construction drawings and Standard Construction Details. During installation, each required joint to be restrained must be observed by the City of Stuart, Engineer of Record or their appointed Field Representative before backfilling at that joint.

### **1.19 INSTALLATION**

Valves and appurtenances shall be installed in accordance with these Standards and, in general, with the manufacturer's recommendations for the applicable service.

#### **Valves**

Valves shall be carefully inspected, opened wide, and then tightly closed, and all the various nuts and bolts thereon shall be tested for tightness. Special care shall be taken to prevent joint materials, stones or other substances from becoming lodged in the valve seat. Valves, unless otherwise required, shall be set with their stems vertically above the centerline of the pipe. Any valve that does not operate correctly shall be adjusted to operate properly or removed and replaced.

Buried valves shall be installed vertically where depth of cover permits. Where depth of cover does not permit, side operators shall be used. Extension stems shall be provided on all buried valves when the operating nut is deeper than three feet below the final grade. Where extension stems are required within valve boxes, approved insert stem guides shall be provided.

Valve boxes shall be carefully centered over the operating nuts of underground valves to permit a valve wrench to be easily fitted to the nut. The tops of valve boxes shall be set to the required grade. The valve box shall not transmit surface loads directly to either the pipe or valve. Care shall be taken to prevent earth and other material from entering the valve boxes. Any valve box that becomes out of alignment or is not to grade shall be dug out and adjusted. Concrete collars will be provided around boxes with brass disc providing information as to valve type, size, direction and number of turns.

#### **Service Connections**

Service Connections (Water Main): Connections to water mains shall be made by installing service saddles. A corporation stop shall be placed at the saddle or fitting, with the service line set at the R.O.W. line at the side property line, perpendicular to said line, and terminating with a curb stop , pending meter installation.

Service Connections (Low Pressure Sewer Main): Connection to low pressure mains will be made by use of a self-tapping saddle, and check valve, with the service line extended to the

R.O.W. line, perpendicular to said line, and terminating with a cap and electronic locating device.

Services crossing under roadways shall be bored or jacked, pushed or moled. Jetting will not be allowed. No open cutting of roads for service lines will be allowed unless specifically stated. The service line shall have a minimum cover of 30-inches with slight grade sloping away from the water main or low pressure main. The service shall be enclosed within a casing pipe. Casing pipe shall be schedule 40-PVC sealed on both ends.

**END OF SECTION**

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**DIVISION J**  
**FIRE HYDRANT ASSEMBLIES**

**J.1 SECTION**

This section includes materials, installation standards and Contractor responsibilities associated with the furnishing of all labor, materials, equipment and incidentals required to properly perform fire hydrant assembly installation as shown on the Drawings and as specified herein.

**J.2**

Submit shop drawings of all equipment and appurtenances required for complete fire hydrant assembly installation.

**J.3 FIRE HYDRANTS**

Fire hydrant assemblies shall include fire hydrant, spool pieces, gate valve, valve box, concrete pad around valve box, tee at the main, necessary bends and fittings, restraining devices, and bedding material.

Fire hydrants shall conform to AWWA C-502 and shall be of the compression, traffic model, self-draining type. Hydrants shall be designed for 150 psi working pressure. The hydrant shall be equipped with two 2-1/2 inch type nozzles and one 4-1/2 inch pump nozzle. Threads shall be National Standard ANSI B26. The 2 1/2 inch nozzle shall have 7 1/2 threads per inch and 3 1/16 inch outside diameter male thread. The 4-1/2 inch nozzle shall have four threads per inch outside diameter male thread. The hydrant, as a minimum, shall have a sealed grease chamber and plug or fitting for the introduction of FDA grade grease or oil. Hydrants shall be furnished with a breakaway feature that will break cleanly upon impact. This shall consist of a two-part breakable safety flange with a breakable stem coupling. The hydrant internal valve shall be 5-1/4 inch minimum. The pentagonal operating nuts and the cap nuts shall be 1-1/2 inch point to flat. The hydrants shall open counter clockwise and the direction of opening shall be cast on the top. Ground flange shall be located no more than 4 inches above finished grade. The hydrant shall be equipped with a 6-inch mechanical joint base inlet. Nozzle caps with gaskets shall be provided for all outlets and shall be chained to the barrel. Cap nuts shall have same dimension of operating nut of hydrant.

All hydrants shall be of the size and type specified and as far as possible all hydrants shall be from one manufacturer.

Hydrant extensions shall not be used unless specifically approved by the City of Stuart or the Engineer.

**J.4 FIRE HYDRANT ASSEMBLY INSTALLATION**

Hydrants shall be located in a manner to provide complete accessibility and that possibility of damage from vehicle, or injury to pedestrians will be minimized. Connect hydrant to main with a 6-inch ductile iron branch controlled by an independent 6-inch gate valve. All pipe, valve and points from the hydrant to the main shall be restrained. Hydrants shall stand plumb and true and shall have their nozzles parallel with or at right angles to the curb or edge of pavement, with the pumper nozzle facing the curb or edge of pavement. Hydrants shall be set to the established grade, with use of Grade Lok if necessary, with nozzles 15 inches above the ground.

All fire hydrants shall be free of corrosion and all working parts shall be properly lubricated and hydrants painted as required by the City of Stuart.

### **J.5 FIRE HYDRANT PERFORMANCE TEST**

Fire Hydrant Performance test shall be completed on all new fire hydrants installed in the City of Stuart system.

The fire hydrant tests are conducted to determine pressure and flow-producing capabilities at any location within the distribution system. The primary function of fire hydrant tests is to determine how much water is available for fighting fires, but the tests also serve as a means of determining the general condition of the distribution system.

Test Procedures and Fire Flows shall be done in accordance with NFPA and current AWWA standards, specifically AWWA Manual M 17 Chapter 6.

All flow testing must have City of Stuart personnel present. Fire Flows need to be certified by the Engineer of Record.

Prior to beginning the field testing, the City of Stuart will require office planning by the Engineer of Record and testing personnel. Specifically the testing personnel shall:

- ✓ Review distribution-system maps and determine which hydrants will be used to measure flow and which will be used to measure the static and residual pressures. All hydrants should be at approximately the same elevation. Otherwise, test results may have to be corrected for elevation.
- ✓ Review previous tests to estimate the flow and pressures that can be expected.
- ✓ Select a day for testing when system consumption will be normal and weather predictions indicate that conditions will be reasonable. The City of Stuart shall be notified as to the time and location of the tests.

Various precautions shall be required in completing the field tests such as: Opening a hydrant rapidly can cause a negative pressure fluctuation. Therefore; hydrants should be opened slowly until fully opened. Closing the hydrants is more critical and it must be done very slowly until after the flow has diminished to about 20 percent of full flow. Closing a hydrant rapidly may cause a pressure surge, or water hammer; which could cause main to fail.

Gauge measurements should be taken only when the water is running clear because sediment could damage the instruments.

The Test Procedures and Fire Flows shall be done in accordance with NFPA and current AWWA standards as outlined in Manual M-17, Chapter 6. In this Chapter the Testing personnel shall review the standard conditions for determining flow, prepare the hydrant properly for the test, conduct the flow test with the required observers and equipment, and record the information in compliance with the AWWA criteria. The AWWA Manual provides the necessary formulas and tables to complete the test. The results of the test shall illustrate the flow in gpm available at the fire hydrant at a residual pressure. When completed in accordance with the City's criteria, all results shall be certified by the Engineer of Record.



**END OF SECTION**

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**DIVISION K**  
**POTABLE WATER SYSTEMS**

**K.1 SECTION DESCRIPTION**

This section includes materials and performance standards, and Contractor responsibilities associated with the furnishing of all labor, materials, equipment and incidentals required to properly install, complete, and make ready for operation all potable water systems and appurtenances as shown on the Drawings and as specified herein.

Materials shall include, but not be limited to, the following:

- ✓ Water Mains
- ✓ Valves
- ✓ Hydrants
- ✓ Tapping Tees and Valves
- ✓ Wire Locators

**K.2 RELATED SECTIONS**

Division A – General Conditions

Division B – Design Criteria

Division H - High Density Polyethylene Pressure Pipe

Division I - Utility Valves and Appurtenances

Division J - Fire Hydrant Assemblies

Division L - Performance Testing of Pressure Pipelines

**K.3 SUBMITTALS**

Submit shop drawings of all materials for water mains, fittings, valves, hydrants and services to be installed for approval, prior to ordering material.

**K.4 WATER MAINS**

All pipe and fittings shall be clearly marked with the name or trademark of the manufacturer, the batch number, the location of the plant, strength designation in accordance to the Florida Administrative Code 62-555, and standards as applicable.

PVC Water Main 4 inch to 12-inch diameter (4” – 12”) shall be DR-18 manufactured to ductile iron pipe outside dimensions and in compliance with AWWA Standard C900 (Pressure Class 150). The pipe shall have an integral bell end and gasket seal with the joint in compliance with the requirements of ASTM D3139. Pipe and fittings must be assembled with nontoxic lubricant. The pipe shall be approved by the National Sanitation Foundation for use as a potable water main.

PVC Water Main 14 inch to 20-inch diameter (14” – 20”) shall be DR-18 manufactured to ductile iron pipe outside dimensions and in compliance with AWWA C905 (Pressure rating 235). The pipe shall have an integral bell end and gasket seal with the joint in compliance with the requirements of ASTM D3139. The pipe shall be approved by the National Sanitation Foundation for use as a potable water main in accordance with The Florida Administrative Code 62-555.

Connections for pipe two inches or greater in diameter shall be rubber compression ring-type. Pipe shall be extruded with integral thickened wall bells without increase in dimension ratio (DR). Rubber ring gaskets shall consist of synthetic compounds meeting the requirements of ASTM Designation D869 and suitable for the designated service.

Fittings: Ductile iron fittings shall be used on all PVC C900 & C905 mains. Fittings shall conform to AWWA/ANSI C110/A21.10 or AWWA/ANSI C or AWWA/ANSI C153/A21.53 for compact fittings with a minimum pressure rating of 350 psi.

Ductile iron pipe shall be a minimum Pressure Class 350. The City of Stuart reserves the right to require a different thickness class for unusual or non-standard laying conditions. Adequate protective measures against corrosion shall be determined by the City of Stuart and the Engineer.

Ductile iron pipe shall conform to latest standards of ANSI/AWWA C150/A21.50 for the thickness design of ductile iron pipe and ANSI/AWWA C151/A21.51 for ductile iron pipe centrifugally cast in metal molds or sand-lined molds. Flanged end pipe shall be Class 53, minimum.

Ductile iron fittings shall conform to AWWA/ANSI C110/A21.10 or AWWA/ANSI C153/A21.53 for compact fittings, with a minimum pressure rating of 350 psi.

Joints for ductile iron pipe shall conform to the latest standard of ANSI/AWWA C111/A21.11 for rubber gasket joints and ANSI/AWWA C115/A21.15 for threaded flanges. All buried joints at fittings must be restrained, mechanical joints. Restrained joint assemblies with mechanical joint pipe shall be by approved restraining devices.

Ductile iron pipe shall be cement-lined and the lining shall conform to the latest standards of ANSI/AWWA C104/A21.4.

Flanged pipes and connections, including all bolts, nuts, and gaskets, shall be in accordance with AWWA/ANSI C115/A21.15. Flanges shall be threaded unless otherwise noted. All above ground flanges shall be flat faced unless they are mating up to existing raised flanges. All gaskets shall be full faced 1/8" thick, minimum. All hardware shall be stainless steel.

Ductile iron pipe shall be required in the following circumstances and in accordance with the Florida Administrative Code 62.555.

- ✓ Water Main 24 inches in diameter and larger.
- ✓ Within 10 feet of sewage facilities or pipes.
- ✓ Within 15 feet of buildings, canals or lakes.
- ✓ Crossings under sewage or storm pipes in accordance with parallel/horizontal separation requirements.
- ✓ Crossings over sewage or storm pipes in accordance with parallel/horizontal separation requirements.
- ✓ Carrier pipe for jack and bores (restrained joints).
- ✓ Aerial crossings.

Ductile iron pipe may be mandated by the City of Stuart in any instance of off-site or on-site construction where damage to the line is possible due to location or special circumstances such as, extensive length of pipe under pavement, or in private properties outside of the County / City rights-of-way.

#### **K.5 HIGH DENSITY POLYETHYLENE PIPE**

High-density polyethylene (HDPE) pipe shall meet all requirements of AWWA C906, latest revisions. See Division H of these specifications for other requirements related to HDPE pipe.

#### **K.6 COATINGS AND LININGS**

Buried Ductile iron pipe and fittings for all water service shall be in accordance with AWWA/ANSI C104/A21.4 and C151/A21.51.

Machined surfaces shall be cleaned and coated with a suitable rust-preventive coating at the shop immediately after being machined.

Ductile iron pipe exposed to the atmosphere and all above ground applications shall be cleaned and given a new inhibitive primer coat at the place of manufacturer. The prime coat shall be compatible with the finish coat of alkyd enamel. A minimum primer dry film thickness of 3 mils is required. A field prime coat shall be applied in areas where the initial prime coat is damaged in the field.

After installation, all above ground ductile iron piping shall receive two or more coats of a high grade, gloss or semigloss alkyd enamel coating. Each coat shall have a minimum dry thickness of 3 mils. All related piping shall be the same color as specified by the City of Stuart.

All required polyethylene encasement shall comply with AWWA/ANSI C105/A21.5, "Polyethylene Encasement for Gray and Ductile Cast Iron Piping for Water and other liquids.

#### **K.7 SERVICE CONNECTIONS, BLOW-OFFS AND SAMPLE POINTS**

Polyethylene tubing shall only be used for service connections, blow-offs, and bacteriological sample points. Polyethylene tubing shall conform to AWWA C901 subject to the following design criteria: Standard Code Designation PE3408, Pipe Class 200, and Dimension Ratio (DR) 9.

Tubing shall bear identification markings, which shall remain legible during normal handling, storage, and installation, and which have been applied in a manner that will not reduce the strength of the product or otherwise damage the tubing. Marking on the tubing shall include the following and shall be applied at intervals of not more than 5 feet: Nominal size, material code designation, dimension ratio, pressure class, manufacturer's name or trademark and production record code, and seal (mark) of the testing agency that certified the suitability of the tubing material for potable water products.

Joints for polyethylene tubing shall be of the compression type utilizing a totally confined grip seal and coupling nut. Stainless steel tube stiffener insert shall also be used for tubing services.

All fittings to be high quality water works brass. No PVC fittings or adapters will be permitted. Fittings shall be brass equipped with compression-type connectors.

### **K.8 VALVES**

Gate valves shall be, resilient wedge type with mechanical joints conforming to AWWA C509, latest revision.

Reference Division I for additional requirements related to valves.

### **K.9 HYDRANTS**

Fire Hydrants shall conform to the latest AWWA specifications C502. Working pressure of hydrants shall be a minimum of 150 psi.

Reference Division J for additional requirements related to fire hydrants.

### **K.10 TAPPING SLEEVES AND VALVES**

Tapping sleeves shall be 304 stainless steel with flanged outlets.

Tapping valves shall be resilient seat type with working pressure of not less than 200 psi.

Reference Division I for additional requirements related to tapping sleeves and valves.

### **K.11 LOCATOR FOR WATER PIPE**

On direct bury pipe construction, 10 gauge THHN insulated stranded copper wire shall be laid and secured on top of pipe and blue in color.

### **K.12 EXISTING FACILITIES**

Contractor is required to verify location of existing utility mains and valve configurations in all connection areas prior to beginning of construction in that area. Any discrepancies between the construction drawings and field conditions shall be brought to the attention of the Engineer of Record prior to construction in that area.

It will be the Contractor's responsibility to verify all existing utilities (telephone, gas, electric, cable, water, reclaimed water, and sewer services, etc.), whether shown in the construction drawings or not.

The locations of all existing utilities indicated on the plans are shown for general informational purposes only. Any damage to existing utilities or services shall be repaired by the particular utility, or the Contractor, under direct authorization and supervision of the particular utility with all repair costs being incurred by the Contractor. Any discrepancies between the construction drawings and existing field conditions shall be brought to the attention of the Engineer of Record or his representative prior to construction in that area.

### **K.13 INSTALLATION**

Piping and fittings shall be installed in accordance with these Standards and in general with the manufacturer's recommendations for the applicable service.

Piping shall be installed along straight line and grade between fittings, or other defined points, unless other definite lines of alignment deflection or grade change have been established.

Modification to approved alignment or grade during construction shall receive prior approval from the Engineer and all resulting design conflict shall be resolved by the Engineer prior to proceeding. The standard minimum cover for utility mains shall be as follows:

Mains 8" diameter & less	36" cover
Mains 10" diameter & more	48" cover
Low Pressure Mains	24" cover

Protective concrete slabs are required in accordance with the construction details when the cover is less than the standard minimums shown above. Where waterways, canals, ditches, or other cuts are crossed, protective concrete slabs are also required across and to ten feet each side of the bottom. Additionally, approved utility crossing signs may be required along the pipe alignment at each side of the canal, etc. Signs shall be approved by the City of Stuart and Agency having jurisdiction over said waterway.

All pipe shall be laid to line in a clean, dry trench on line and grade with all valves and appurtenances plumb. Backfill shall be clean suitable fill.

Materials shall be cleaned and maintained clean, with all coatings protected from damage. The interior of the pipe shall be free of dirt and debris, and when work is not in progress; all open ends shall be plugged, with an approved device.

Pipe and fittings, or other items shall be inspected prior to installation and any items showing a fracture or other defect shall be rejected. Additionally, any pipe or fitting which has received a severe blow that may have caused an incipient fracture indicated beyond that visible, may be salvaged by cutting off the damaged section 12 inches past, providing the remaining pipe is sound. Discoloration of PVC due to exposure to the sun may result in pipe rejection.

Underground piping shall not be driven to grade by striking it. When the pipe has been properly bedded, enough compacted backfill shall be placed to hold the utility in correct alignment. If necessary, precaution shall be taken to prevent flotation.

Jointing shall be by the manufacturer's approved method and shall not require undue force to accomplish full satisfactory seating and assembly. Connections at structures shall be cut accurately and worked into place without forcing and shall align with the connecting point. Flanged joints shall be made up tight, but with care taken to prevent undue strain upon equipment or other items. Suitable flange filler rings shall be installed where required to provide suitable joints. The installation shall be permanently water tight, with no visible leakage at joints, connections with structures or other locations, under operational or testing

conditions. Material that in jointing does not remain completely seated and/or watertight shall be rejected.

Underground pressure piping systems shall be securely anchored by acceptable means at all tees, plugs, caps, bends and valves, and at all other locations where unbalanced forces exist or as directed by the City of Stuart or Engineer of Record. Restrained joints shall be used in accordance with manufacturer's recommendations. Reference the City of Stuart Standard Construction Details for requirements related to pipe restraints.

Shop drawing shall specify the particular system to be utilized and no substitutions will be allowed after approval without resubmittal of shop drawings and written approval by the City of Stuart. Every pipe joint that is required to be restrained shall be inspected by the City of Stuart or Engineer of Record prior to the Contractor backfilling the restrained joint.

Exposed systems shall be supported as necessary to hold the piping and appurtenances in a firm, substantial manner to the required lines and grades indicated, with no undue piping stresses transmitted to equipment or other items. Pipe aboveground outside of buildings shall be supported on concrete supports or premanufactured adjustable pipe supports.

Subaqueous pipe laying may be permitted where conditions make it impractical to lay pipe "in the dry", provided the Contractor submits his plans for laying pipe under water to the City of Stuart and Engineer and obtains advance approval thereof. All subaqueous crossings shall be made in accordance with all approved permits.

Special Exterior Protection for Corrosion: Extra protection shall be provided for underground cast or ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement in accordance with the requirements of AWWA C105, through the area of concern. Soil-test evaluation to determine the necessity for extra protection in suspect areas shall be as set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, cast or ductile iron pipe crossing said utility shall be protected for a distance of 20 feet to each side, and when installed parallel to and within ten feet of, protection shall also be provided. Steel pipe shall not be installed in severe corrosion areas.

In case of conflict between various installation requirements the more stringent requirement shall apply.

All pipeline laying, testing, etc. shall be performed in the presence of the City of Stuart and/or Engineer of Record or their designated representative.

Pipeline joint deflections shall be as stated within Uni-Bell Handbook of PVC Pipe or the manufacturer's maximum allowable deflection, whichever is less.

Ductile Iron Pipe: Installation shall be performed in accordance with the applicable provisions of AWWA Standard C600 and the manufacturer's recommendations.

Polyvinyl Chloride Pipe (C900 & C905): Installation shall be performed in accordance with the applicable provisions of AWWA C-900, ASTM D-2774, AWWA Manual M23 and the

manufacturer's recommendations. Lubrication used for pipe and fitting joints shall be nontoxic.

Reference requirements in Division B Design Criteria for horizontal and vertical separation requirements.

All valves shall be placed according to plan unless relocation is mutually agreed to. Record or as built drawings shall reflect the actual location and size of all mains, hydrants, services and valves.

A City of Stuart representative shall approve each location proposed for connection of the new system to the existing system before the tapping sleeve is installed. Tapping sleeves shall not be installed within 3 feet of any joint or fitting. Before installation of tapping tee, the area to be tapped and the tapping tee shall be swabbed with a chlorine or bleach solution with at least 100 ppm of chlorine. After all sand, dirt and debris have been removed from the main, the tapping tee, the tapping valve and the area where the tapping tee is to be installed on the existing main shall be swabbed with a chlorine or bleach solution with at least 100 ppm of chlorine.

After the tapping tee is attached to the main, the gate valve shall be closed and tapping tee and gate valve assembly shall be pressured tested at 150 psi for a minimum of 15 minutes with water. A City of Stuart representative shall witness the pressure test. No visible leaks or loss of pressure shall be evident. After pressure testing, the main may be tapped. Only shell type cutters shall be used. The coupon from the hole that is cut shall be delivered to the City of Stuart.

THHN insulated, stranded copper wire shall be laid and secured on top of pipe. Wire shall be continuous from valve box to valve box, wrapped two times around each joint of pipe and extended inside each valve box to enable location devices to be attached without digging up the valve box (see Standard Construction Details).

Service wire shall be laid in the trench with all services connected to the main wire and wrapped around the service piping or tubing. Wire for potable water shall be blue in color.

All wire connections shall be made with Dri-Splice wire connectors, Imperial Snip-Snap fittings filled with waterproof silicone sealant or approved equal. All splices shall be inspected by the City of Stuart before burial. Upon completion of the project the locating wire will be tested for continuity by the Contractor and a written certification will be provided to the City of Stuart

After its installation, the complete water system (including all mains, services, hydrants, blow-offs, air release valves and all other appurtenances) shall be thoroughly flushed and pigged to remove all foreign matter. The City of Stuart shall be notified at least 24 hours in advance of any flushing activities.

Reference Division R for additional requirements related to cleaning and flushing.



All mains shall be tested for leakage. Water shall be supplied to the main and pumped to the required 150 psi pressure. The main tested must be isolated from presently potable lines.

The City of Stuart shall be notified at least 48 hours in advance of any testing procedures. After flushing is completed, line pressure shall be applied to the complete water system to determine if any major defects are present. The complete water system shall then be tested at a pressure of 150 psi for a period of not less than two hours. The City of Stuart may, at its discretion, increase the period to four hours.

Reference Division Q for additional requirements related to pressure testing.

After pressure testing, the complete water system shall be chlorinated to achieve a minimum combined chlorine residual of at least 50 parts per million. The chlorine solution shall remain in the water system for at least 24 hours. The complete water system shall then be flushed to remove the strong chlorine solution.

Test samples for bacterial analysis shall be taken by the contractor.

Reference Division Q for additional requirements related to disinfection and bacteriological testing.

**END OF SECTION**

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## **DIVISION L** **SEWAGE FORCE MAINS**

### **L.1 GENERAL**

This Section includes materials, performance standards, and contractor responsibilities associated with the furnishing of all labor, materials, equipment, incidentals required to install and make ready for operation all sewage force mains as shown on the Drawings and as specified herein.

All materials, fittings and appurtenances intended for use in pressure pipe systems shall be designed and constructed for a minimum working pressure of 150 psi unless the specified application dictates higher working pressure requirement.

All construction material shall be first quality, not previously used. Damaged or faulty pipe and materials must be properly replaced.

Force main materials shall be PVC or ductile iron pipe. Standard pressure pipe fittings of size 4 inch ID (inside diameter) and larger shall be ductile iron.

Pipe gaskets shall be as supplied by the pipe manufacturer.

### **L.2 RELATED SECTIONS**

Division B – Design Criteria

Division I – Utility Valves and Appurtenances

Division N – Wastewater Pumping Station

Division O – Performance Testing of Pressure Pipelines

### **L.3 SUBMITTALS**

Submit shop drawings of all materials for sewage force mains, fittings, valves and services to be submitted for approval, prior to ordering material.

Manufacturer and Fabricator Certification

### **L.4 FORCE MAINS**

All pipe and fittings shall be clearly marked with the name or trademark of the manufacturer, the batch number, the location of the plant, strength designation in accordance to the Florida Administrative Code # 62-555, and standards as applicable.

PVC Sewer Main 4 inch to 12-inch diameter (4" – 12") shall be DR-18 manufactured to ductile iron pipe outside dimensions and in compliance with AWWA Standard C900 (Pressure Class 150). The pipe shall have an integral bell end and gasket seal with the joint in compliance with the requirements of ASTM D3139. The pipe color shall be in compliance with The Florida Administrative Code 62-555, with "Force Main" permanently printed on three sides for the entire length of the pipe.

PVC sewer main 14 inch to 20 inch diameter (14” – 20”) shall be DR-21 manufactured to ductile iron pipe outside dimensions and in compliance with AWWA Standard C905. The pipe shall have an integral bell end and gasket seal with the joint in compliance with the requirements of ASTM D3139. The pipe color shall be in accordance with the Florida Administrative Code, with “Force Main” permanently printed on three sides for the entire length of the pipe.

Fittings: Ductile iron epoxy lined fittings shall be used on all PVC C900 & C905 mains. Fittings shall conform to AWWA/ANSI C110/A21.10 or AWWA/ANSI C or AWWA/ANSI C153/A21.53 for compact fittings with a minimum pressure rating of 350 psi.

Ductile iron pipe shall be a minimum Pressure Class 350. The City of Stuart reserves the right to require a different thickness class for unusual or non-standard laying conditions. Adequate protective measures against corrosion shall be determined by the City of Stuart and the Engineer of Record.

Ductile iron pipe shall conform to latest standards of ANSI/AWWA C150/A21.50 for the thickness design of ductile iron pipe and ANSI/AWWA C151/A21.51 for ductile iron pipe centrifugally cast in metal molds or sand-lined molds. Flanged end pipe shall be Class 53, minimum.

Ductile iron pipe shall conform to the latest standards of ANSI / AWWA C150 / A21.50 for the thickness design of ductile iron pipe and ANSI / AWWA C151 / A21.51 for ductile iron pipe centrifugally cast in metal molds or sand-lined molds.

Joints for ductile iron pipe shall conform to the latest standard of ANSI / AWWA C111 / A21.11 for rubber gasket joints. All buried joints at fittings must be restrained, mechanical joints. Restrained joint assemblies with mechanical joint pipe shall be by approved restraining devices.

Interior and exterior epoxy coatings for the ductile iron pipe shall conform to the latest standards of AWWA C210.

All required polyethylene encasement shall comply with AWWA/ANSI C105/A21.5, “Polyethylene Encasement for Gray and Ductile Cast Iron Piping for Water and other liquids.

#### **L.5 VALVES AND APPURTENANCES**

Valves 2” and larger for sewer force mains shall be resilient with 2” operating unit and mechanical joints conforming to AWWA C500, latest revision gate valves rated for 200 psi.

Valving of all systems shall be designed to facilitate the isolation of each section of pipeline as required.

Reference Division I for additional requirements related to valves.

Manual air release valves shall be installed at all high points of the main to prevent air accumulation within the main. Valve body shall be cast iron with stainless steel valve and float, suitable for the application, rated for 150 psi working pressure. Manual air release valves shall be installed in a manhole as shown in the City of Stuart Construction Standard Details.

#### **L.6 WIRE LOCATOR FOR FORCE MAINS**

On direct bury pipe construction 10 gauge, THHN insulated, stranded copper wire shall be affixed to the top of the pipe. Wire shall be continuous from valve box to valve box, wrapped two times around each joint of pipe and extended inside each valve box to enable location devices to be attached without digging up the valve box (see Standard Construction Details).

All wire connections shall be made with Dri-Splice wire connectors, Imperial Snip-Snap fittings filled with waterproof silicone sealant or approved equal. All splices shall be inspected by the City of Stuart before burial.

Wire for sewage systems shall be green in color.

#### **L.7 CONNECTIONS FOR PRESSURE SYSTEMS**

Tapping Tees and Valves: Tapping sleeves shall be split type stainless steel with flanged outlets for connecting to tapping valve. Finish to be fusion applied epoxy in accordance with AWWA C213.

Tapping valves shall be resilient valves with flanged by mechanical joint connections meeting the requirements of Division I and shall be compatible with connecting sleeve and specially designed for wet tapping installations. Tapping valves shall have a two-inch operating nut. Working pressure rating shall not be less than 200 psi. Gaskets between the flange faces of the tapping sleeve and tapping valve shall be 1/8" minimum thickness of neoprene rubber.

Size on Size Taps: Taps on the same size main are prohibited unless otherwise approved by the City of Stuart.

#### **L.8 LOW PRESSURE FORCE MAIN (Less than 6-inch Diameter)**

Refer to Division P

#### **L.9 EXISTING FACILITIES**

Contractor is required to verify location of existing utility mains and valve configurations in all connection areas prior to beginning of construction in that area. Any discrepancies between the construction drawings and field conditions shall be brought to the attention of the Engineer of Record prior to construction in that area.

It will be the Contractor's responsibility to verify all existing utilities (telephone, gas, electric, cable, water, reclaimed water, and sewer services, etc.), whether shown in the construction drawings or not. The locations of all existing utilities indicated on the plans are shown for general informational purposes only. Any damage to existing utilities or services shall be

repaired by the particular utility, or the Contractor, under direct authorization and supervision of the particular utility with all repair costs being incurred by the Contractor. Any discrepancies between the construction drawings and existing field conditions shall be brought to the attention of the Engineer of Record or his representative prior to construction in that area.

#### **L.10 INSTALLATION**

Piping and fittings shall be installed in accordance with these Standards and in general with the manufacturer's recommendations for the applicable service.

Piping shall be installed along straight line and grade between fittings, or other defined points, unless other definite lines of alignment deflection or grade change have been established. Modification to approved alignment or grade during construction shall receive prior approval from the Engineer and all resulting design conflict shall be resolved by the Engineer prior to proceeding.

Underground piping shall not be driven to grade by striking it. When the pipe has been properly bedded, enough compacted backfill shall be placed to hold the utility in correct alignment. If necessary, precaution shall be taken to prevent flotation.

Jointing shall be by the manufacturer's approved method and shall not require undue force to accomplish full satisfactory seating and assembly. Connections at structures shall be cut accurately and worked into place without forcing and shall align with the connecting point. Flanged joints shall be made up tight, but with care taken to prevent undue strain upon equipment or other items. Suitable flange filler rings shall be installed where required to provide suitable joints. The installation shall be permanently water tight, with no visible leakage at joints, connections with structures or other locations, under operational or testing conditions. Material that jointing does not remain completely seated and/or watertight shall be rejected. Underground pressure piping systems shall be securely anchored by acceptable means at all tees, plugs, caps, bends and valves, and at all other locations where unbalanced forces exist or as directed by the City of Stuart or Engineer of Record. Restrained joints shall be used in accordance with manufacturer's recommendations or the City of Stuart Construction Standard Details for requirements related to pipe restraints the more stringent requirement shall apply.

Acceptable pipe restraint devices are per approved Product List, or approved equal restraining systems. Shop drawing shall specify the particular system to be utilized and no substitutions will be allowed after approval without resubmittal of shop drawings and written approval by the City of Stuart. Every pipe joint that is required to be restrained shall be inspected by the City of Stuart or Engineer of Record prior to the Contractor backfilling the restrained joint.

Exposed systems shall be supported as necessary to hold the piping and appurtenances in a firm, substantial manner to the required lines and grades indicated, with no undue piping stresses transmitted to equipment or other items. Pipe aboveground outside of buildings shall be supported on concrete supports or premanufactured adjustable pipe supports.

Special Exterior Protection for Corrosion: Extra protection shall be provided for underground cast or ductile iron pipe and fittings within areas of severe corrosive conditions within all known contaminated sites and river crossings. This shall be accomplished by the installation of polyethylene encasement in accordance with the requirements of AWWA C105, through the area of concern. Soil-test evaluation to determine the necessity for extra protection in suspect areas shall be as set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, cast or ductile iron pipe crossing said utility shall be protected for a distance of 20 feet to each side, and when installed parallel to and within ten feet of, protection shall also be provided. Steel pipe shall not be installed in severe corrosion areas.

In case of conflict between various installation requirements the more stringent requirement shall apply.

All pipeline laying, testing, etc. shall be performed in the presence of the City of Stuart and/or engineer of Record or their designated representative.

Pipeline joint deflections shall be as stated within Uni-Bell Handbook of PVC Pipe or the manufacturer's maximum allowable deflection, whichever is less.

Ductile Iron Pipe: Installation shall be performed in accordance with the applicable provisions of AWWA Standard C600 and the manufacturer's recommendations.

Polyvinyl Chloride Pipe (C900 & C905): Installation shall be performed in accordance with the applicable provisions of AWWA C-900, ASTM D-2774, AWWA Manual M23 and the manufacturer's recommendations. Lubrication used for pipe and fitting joints shall be nontoxic.

Polyvinyl Chloride Pipe (SDR-21): Installation shall be performed in accordance with the applicable provisions of ASTM D-2774, Uni-Bell B-3 for PVC pressure sewer pipe and with the manufacturer's recommendations. Wherever there are conflicts in installation methods, the more stringent installation criteria shall apply.

Reference requirements in Division B, Design Criteria for horizontal and vertical separation requirements.

All valves shall be placed according to plan unless relocation is mutually agreed to.

Record or as built drawings shall reflect the actual location and size of all mains, services, valves and other appurtenances.

A City of Stuart representative shall approve each location proposed for connection of the new system to the existing system before the tapping sleeve is installed. Tapping sleeves shall not be installed within 3 feet of any joint or fitting.

After the tapping tee is attached to the main, the gate valve shall be closed and tapping tee and gate valve assembly shall be pressured tested at 150 psi for a minimum of 15 minutes with water. A City of Stuart representative shall witness the pressure test. No visible leaks or loss of pressure shall be evident. After pressure testing, the main may be tapped. Only shell type cutters shall be used. The coupon from the hole that is cut shall be delivered to the City of Stuart.

After its installation, the complete sewer force main system (including all mains, services, air release valves and all other appurtenances) shall be thoroughly flushed and pigged to remove all foreign matter. The City of Stuart shall be notified at least 24 hours in advance of any flushing activities. Reference Division R for additional requirements related to cleaning and flushing.

All mains shall be tested for leakage. Water shall be supplied to the main and pumped to the required 150 psi pressure. The main tested shall be isolated from existing connecting force mains

The City of Stuart shall be notified at least 48 hours in advance of any testing procedures. After flushing is completed, line pressure shall be applied to the complete sewer force main system to determine if any major defects are present. The complete system shall then be tested at a pressure of 150 psi for a period of not less than two hours. The City of Stuart may, at its discretion, increase the period to four hours.

Reference Division Q for additional requirements related to pressure testing.

## **END OF SECTION**

## **DIVISION M WASTEWATER PUMPING STATIONS**

### **M.1 SECTION DESCRIPTION**

This section includes materials and installation standards, and Contractor responsibilities associated with the furnishing of all labor, materials, equipment and incidentals required to install, complete and make ready for operation all wastewater pumping stations as shown on the Drawings and as specified herein. This section also includes the modifications to existing pumping stations.

### **M.2 SUBMITTALS**

A minimum of two (2) sets of shop drawings shall be submitted to the City of Stuart and Engineer of Record for approval.

Shop drawings will include information on wet well, valve pit, pumps, valves, guide rail systems, pressure gauges, access covers, control panel, electrical schematics and any other materials necessary to complete the lift station installation.

Data shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and operation of component materials and devices; the external connections, anchorages, and support required; and dimensions needed for installation and correlation with other materials and equipment. All part numbers and catalog data required for ordering spares and replacements shall be provided.

The acceptance of drawings returned marked “APPROVED” or “APPROVED AS NOTED” will not constitute a blanket approval of dimensions, quantities, and details of the materials, equipment, device or items shown and does not relieve the Contractor of any responsibility for errors or deviations from the requirements.

The submitted drawings and data shall be published by the manufacturer and shall include, but not limited to, the following:

- ✓ Wet well and valve pit information
- ✓ Mechanical equipment
- ✓ Electric Motors
- ✓ Controls and Wiring Diagram
- ✓ Pump curves at listed RPM. Family curves are not acceptable.

Each pump shall be tested in the manufacturer’s shop to demonstrate the proper operation of all components. The testing shall determine overheating of bearings, motors or other components.

### **M.3 QUALIFICATIONS**

All equipment and materials shall be furnished by a manufacturer who is fully experienced, reputable and qualified in the manufacture of items to be installed/constructed.



#### **M.4 GENERAL**

Pumps, appurtenances and controls will be supplied by the same supplier. The use of stainless steel, minimum grade 316, nuts and bolts is required on all parts exposed to wastewater or hydrogen sulfide gases.

#### **M.5 WET WELL**

Concrete for built-in-place and precast wet wells shall develop a minimum of 4000 psi at 28 days. Precast concrete wet wells shall conform to ASTM C-478 - Latest Revision, Class II, Wall B, Type II Portland Cement. Steel reinforcement shall conform to ASTM A-615 and ASTM A-185, Latest Revisions. Walls shall be 8-inch minimum. Joints shall be assembled with Ram-Neck Sealant or approved equal and overlaid with non-shrink, waterproof grout on the inside and outside of the wetwell.

The base slab and the first ring of the precast wet well shall be cast monolithically.

Provide, with precast shop drawings, a letter stating Precast Fabricator will provide factory trained mechanic guidance to the Contractor during erection of the wet well.

Upon completion of construction, Contractor shall provide a certification from the Precast Fabricator stating that such dated field guidance was provided to the Contractor.

All exterior surfaces of the wet well shall receive two coats of an approved 100% water based epoxy in strict accordance with the manufacturer's instructions (i.e. concrete, grout, etc., shall be thoroughly cured, cleaned and dry). The first coat shall be red with the final coat being black and each shall be 10 mils dry film thickness (DFT). Interior coats shall be applied after discharge piping has been installed, prior to pump installation; and shall be coated with ProTech coating EW-1 water based epoxy per manufacturers specifications or ½ " of RAVEN 405 Epoxy.

Holes to accommodate pipe shall be precast into the section at the manufacturer's plant. Wall penetrations are to use "Link-Seal" or similar approved-equal jointed seal apparatus.

Corrosion protection of holes shall be a 0.125-inch thick cementitious material, Fosroc Epoxy Liner or approved equal. The material shall overlap the wet well wall liner. Holes for anchor bolts and other attachments can be pre-formed or drilled. After installation the joint shall be sealed to the liner using butyl caulking materials, Lap Sealant FR 500 by A-Lock Products, or approved equal.

Any visible reinforcing wire, steel or honeycombs on precast structures shall be cause for rejection.

The wet well shall have a concrete top with a neoprene gasketed pad lockable diamond plate aluminum hatch cover (1/4" thick, minimum), with flush mounted pull up hasp, and frame with stainless steel hardware. Interior of wet well shall be fitted with stainless steel (316) upper guide bar brackets, cable holder, guiderails and grip eye lift cable. Aluminum hatch shall be capable of supporting a 300 lb. per square foot static load or H2O loading if in traffic

areas with rubber gasket seals. Each cover shall have a locking safety handle to retain the covers in an open position. Cover shall be sized and located to allow for unobstructed vertical removal of all pumps.

### **M.6 PIPING SYSTEMS**

Piping within the wet well and valve vault shall be minimum 4” diameter flanged PVC pipe Sch 80 as specified. Unless otherwise approved by the City of Stuart.

### **M.7 VALVE VAULT**

Valve vault (or pit) shall be precast concrete and cast as one integral structure with the bottom slab. The top slab may be cast independently. Dimensions, thickness and reinforcing shall be in accordance with the plans. Vault concrete shall be in accordance with Section M.5 as stated previously. Valve Vault shall be adjacent to the wetwell. Holes to accommodate pipe shall be precast into the section at the manufacturer’s plant. Wall penetrations are to use “Link-Seal” or similar approved-equal jointed seal apparatus.

Valve vault shall be equipped with an access frame complete with hinged and pad lockable, hasp-equipped neoprene gasketed covers of the size shown on the plans. Covers shall support a static load equal to 300 pounds per square foot or H2O loading if in traffic areas. Frame shall be mounted securely in the top slab, aligned above the valves in the manner necessary to maximize free and unobstructed access to the valves for operation and maintenance. Each cover shall have a locking safety handle to retain the covers in an open position. Frame and cover shall be aluminum and all hardware to be 316 stainless steel.

Valve vault interior walls, pipes, valves, and fittings within the valve vault to be coated with water based epoxy as specified in Section M.5.

Check valves to include external spring and lever.

Shutoff valves to be resilient seated gate valves with 2” operating nuts.

An emergency pump by-pass connection device shall be provided and shall include a male aluminum or bronze “3” CAM-LOC” fitting with dust cap and isolation gate valve, installed downstream of the valve vault.

All fittings within valve vaults to have flange ends.

All hardware to be 316 stainless steel.

A two-inch PVC drain with "P" trap shall be installed between the valve vault and the wet well.

Each discharge pipe shall be provided with a 4” diameter face pressure gauge, which shall be an oil-filled gauge. The gauges shall read in pounds per square inch (1-60 P.S.I.), with a range suitable for the required service and shall include isolation petcocks. Where the

pressure source is wastewater, gauges shall be equipped with diaphragms (neoprene or stainless steel), or other suitable separating device, to preclude wastewater from entering the mechanism.

### **M.8 PUMPS**

Pumps shall be explosion-proof, non-clog, mechanical seal submersible pumps, compliant with the latest FDEP permit requirements and capable of passing a 3" diameter spherical solid.

The pump electrical conductor shall be continuous multiconductor, copper cable (no splices), in compliance with industry standard for load and resistance against sewage. The conductor shall enter the pump through a heavy-duty entry assembly, which shall be provided with an internal grommet assembly to protect against leakage once secured and must have a strain relief assembly as part of standard construction. The pump conductor shall be the length required to properly connect the pump and panel, but in no case shall be less than forty (40) feet.

Each pump shall be provided with a guiderail assembly designed so that each pump automatically connects to the discharge piping when the pump is lowered into place. Lowering of the pump shall be accomplished by simple linear downward motion of the pump with the entire weight of the pump guided by two (2)-inch guide rails of schedule 40 316 stainless steel construction. Each pump casing shall have a sealing flange to mate with the discharge connectors provided with the bottom of each guide rail assembly. Discharge connection shall be bolted to the sump floor and shall mate and seal with the pump flange without the immediate installation of any bolts or nuts. When lowered into place, no rotary motion of the pump shall be required for sealing with the discharge connection. The pump shall be easily removable for inspection and/or service and there shall be no need for personnel to enter the pump wet well for purposes of removing the pump. All hardware, lifting assemblies and guide bars shall be stainless steel.

Pumps shall have a tandem mechanical shaft seal system, mechanical seals shall be made of tungsten-carbide or silicon-carbide with a stainless steel case. Wearing rings shall be abrasion resistant and shall be installed at the inlet side of the pump to provide protection against wear to the impeller. Volute and impellers shall have no parts that have to be periodically adjusted to correct tolerances due to normal wear. The lifting handle shall be stainless steel and be large enough to hook the pump with a standard assembly from a height of 20 feet and be equipped with a grip eye lifting cable and tool.

The pumps shall be equipped with a moisture sensor (depending on horse power) to detect seal failures, if required by the pump manufacturer for warranty purposes. A visual signal with a manual override shall be used at the control panel.

Pump motor shall be housed in an air-filled watertight casing and shall have Class F insulated windings which shall be moisture resistant. The motor shall be Nema Design B rated 155° C maximum and have a minimum 1.15 service factor. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially, or nonsubmerged

condition. The pump shall be capable of running dry continuously in a totally dry condition. Cable junction box and motor shall be separated by a stator-lead sealing gland or terminal board which shall isolate motor from any water or solids gaining access through pump cable.

In the event that a pump cannot be supplied to meet the required field conditions, alternate pumps may be approved on a conditional basis.

## **M.9 CONTROLS**

The panel manufacturer shall be experienced in the construction of lift station control panels, shall have a UL approved shop, and shall be able to provide both a UL 508 label for the panel, itself and a UL label for the service rated.

The panel manufacturer shall warrant the panel for one (1) full year minimum from the date of start-up.

The panel manufacturer or qualified technical representative shall check-out and test the panel as part of the lift station start-up with the City of Stuart and Engineer of Record.

The panel components are specified in the Construction Standard and Contract documents. All panel components may not be specifically specified, however that does not relieve the Contractor from furnishing such components that would normally and customarily be required for wastewater pumping stations.

The panel itself shall be 36 inch wide by 48 inch high by 12 inches deep (36"W x 48"H x 12"D) The panel shall be of a NEMA 4X construction with the following features; 316 stainless steel 14 gauge with a #3 polish on the exterior with sealed conduit at the wetwell and control panel.

All external hardware shall be stainless steel with piano hinge, three-point latch with roller fitting top and bottom and single handle with padlock fitting and stainless steel external parts.

Drip shield to deflect water from the door, closed cell neoprene gasket on the door.

Blank outer door with dead front inner door of 1/8" thick aluminum hinged on the left with the operator's controls mounted on or projecting through it.

Aluminum back mounting plate for heavy components.

The lightning arrestor and surge capacitor shall be mounted to the service disconnect.

The outer door is to have a nine inch by eleven inch (9" x 11") stainless steel pocket for log book, tack weld to door.

Arms and latches shall hold both outer door and inner door in an open position; these must be sufficiently rigid and secure to hold doors open under windy weather conditions.

Sliding locking bar to allow only main or emergency breaker to be closed. Bar shall be aluminum with stainless steel hardware.

All hardware shall be 316 stainless steel.

All wiring shall be copper THHN or approved equal, AWG 14 minimum. Color code wires in accordance with the latest revision of NEC.

Different control wiring colors are acceptable if clearly identified. Power wiring shall be kept separate from control wiring, and shall be identified by phase. The high leg shall be the center terminal on the main breaker.

All wires shall be numbered with machine made plastic wrap around labels at both ends.

All external connection and internal connections, where shown on the drawings, shall be brought to the numbered terminals.

Wiring shall be enclosed in panduct or equivalent wireways and wiring between the doors and the panel shall be enclosed in a spiral wrap or approved equal with sufficient slack to allow full opening of the door.

Wiring shall be secured with screw-on tabs; tabs with adhesives shall not be used.

All wiring shall be front accessible.

All conduit to be stainless steel or U.V. Resistant PVC Schedule 80 listed for electrical use.

All components shall be securely mounted with stainless steel hardware. Self tapping screws are not acceptable.

All relay bases shall be front mounted with screw terminals, no soldered connections shall be used. All base terminals shall be numbered to correspond to relay numbers. Where plug-in components are not firmly secured in bases, hold down clamps shall be provided.

All components shall be identified in accordance with the schematic diagram, using permanent nametags on the panel of laminated micarta or approved equal. The permanent nametags shall be securely attached and in a position where they are clearly visible.

All operators' controls shall be provided with laminated micarta or equal nametags attached with stainless steel screws, with minimum lettering height of 1/8 inch.

Provide a laminated as-built schematic drawing attached to the inside of the outer door - minimum size 11 inches by 17 inches (11" x 17").

Attach a separate laminated label showing the following details:

**PUMP**

Brand  
 Catalog number  
 Impeller number and size  
 Design head  
 G.P.M.  
 Serial numbers  
 Date of manufacture

**MOTOR**

Horsepower  
 Speed  
 Voltage  
 Full load amps  
 Catalog number  
 Serial numbers  
 Phase

**Main and Emergency Breaker:** The panel shall include circuit breaker sized as required for main power and emergency power disconnect. Breakers shall be mounted on the subpanel with handles through inner door and shall include a mechanical interlock on the handles to insure that only one breaker can be in the “ON” position at any one time. Circuit breaker ampacity, voltage and interrupting capacity shall be listed on the Drawings. Panel shall also include an externally mounted generator power receptacle pre-wired to the emergency breaker angled down to prevent water intrusion. Receptacle shall be Pyle-National CAT # JRE-4100

**High Level Alarm System:** The panel shall include a vapor-proof red light mounted in a red glass cover on the enclosure for high level alarm visual indication and a weatherproof horn mounted on the upper left hand side on the hinged side of the powerbox. The alarm light and horn shall be pre-wired to terminals to operate on a high-level control signal. An alarm silence push button labeled “Alarm Silence” shall be mounted on the outside of the enclosure and pre-wired to a relay which will silence the horn under all conditions, and automatically reset when high level condition is corrected. The high level light shall have a flasher to pulse the red external visual indicator light during a high level condition. The Alarm system set to automatically reset when the high level condition is corrected. The alarm light is to be designed and positioned to provide an unobstructed access for changing light bulb.

**Convenience Receptacle:** The panel shall have two GFI (ground fault interrupter) type convenience receptacles, mounted on the inner door and on the external bottom of the control panel to provide plug-in 120V power with ground fault protection. A circuit breaker sufficiently sized shall be provided with the convenience receptacle.

**Lightning Arrestor/Surge Suppressor:** The panel shall have three-phase transient voltage lightning arrestor/surge suppressor protection. The suppressors shall be pre-wired to the point of incoming line service (service disconnect). The suppressor shall be Atlantic Scientific or approved equal with voltage as required.

**Level Control Circuit:** The panel shall contain the necessary relays and PLC for the multi-level type level switch/controller system; i.e., off-lead-lag-alarm. The level controller shall be weighted non-mercury float type switches with data flow controller. The operating levels of the pumps as well as the alarms shall be settable from the controller.

Provide separate circuit breakers for each motor.

Provide a spare contact for each alarm. These contacts shall be terminated on a terminal strip for future use.

An open frame, across-the-line, NEMA rated, magnetic motor starter with 120 volt, 60 Hz coils shall be furnished for each pump motor. Each motor starter shall be equipped with appropriate over load protection. Contacts and coil shall be easily replaceable without removing the starter from its mounted position.

Shall included a 316 SS service disconnect fused knife switch, non fused approved for outdoor use and be U.L. approved for disconnecting main power to panel box and will be housed in separate enclosure mounted behind main panel box. Where required by the power company, an additional disconnect will be provided prior to the meter.

**For lift stations to remain private, dataflow connectivity is not required. For those stations; the following additional criteria shall apply:**

Elapsed Time Meters: The panel shall include a non-resettable type elapsed time meter for each starter mounted on the inner door to record the accumulated running time of each pump. A totalizer to record running time of all pumps shall also be provided.

Phase and Voltage Monitor Relay: The panel shall have a line voltage rated phase sequence and loss monitor relay. The monitor relay shall be the adjustable type to be field set for nominal available incoming voltage. The 3 phase incoming line to the monitors shall be fused. The monitor relay will be pre-wired to take the control circuit out of service if a phase is reversed, one or more phases are lost, or drops below nominal voltage or if all three phases drop below nominal voltage. The unit will automatically restore when normal conditions are restored; phase monitor by-pass switch shall be required. Relay shall be the socket mounted type. This is only required for non-dataflow equipped systems.

Seal Failure Indicator: The panel shall have a seal failure (leak detector) indicator pilot light for each pump. These pilot lights shall be operated by moisture sensing monitors which are signaled by probes supplied in each pump for non-data flow systems only. All items shall be installed in accordance with the requirements of the pump manufacturer.

Hand-Off-Automatic (HOA) control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control component shall provide a means to automatically alternate the position of the “Lead” and “Lag” pumps after each pumping cycle. Operation of the pumps in the manual mode shall bypass all control circuits except pump motor overload shutdown.

HOA switches shall be NEMA 4 watertight units. Indicator lamps shall be mounted in NEMA 4 modules. Lamps shall be easily replaceable from the front of the control compartment door without removing the lamp module from its mounted position.

## **M.10 LIFT STATION INSTALLATION**

Installation of the wet well, valve pit and piping shall be in accordance with the specifications set forth in other applicable sections of these Specifications.

All installations shall be performed in such a manner so that components are plumb and true and aligned in such a manner that the station is fully operable and functional and no additional maintenance or restorative action is required. All electrical installations shall be performed by a licensed Electrical Contractor in accordance with prevailing codes and licensing requirements and shall result in a fully functioning station meeting the full intent of these specifications and the drawings.

The Contractor shall install the required fence in a true and straight manner or landscaping as directed by the City of Stuart, construct the required water service with RPZ backflow preventor, construct the paved driveway access, construct all necessary conduit and electrical connections and all other appurtenances shown on the standard City of Stuart Details, the Contract Drawings. Modifications to the existing pumping stations shall be completed in accordance with these specifications and the details shown on the Standard City of Stuart Details and the Contract Drawings. This includes all work materials, and cleaning to provide a fully operational station in a "Like-new" condition.

Particular attention should be given to the following items by the Contractor during installation of the lift station.

Reaction plates and restraining rods must be secured to eliminate vibrations that may crack grout.

All guiderails shall be attached to access lid frame with approved bracket assemblies. Intermediate guiderail supports shall be provided per manufacturer's recommendations. Guiderails shall be 316 stainless steel piping.

Lifting rings for the wet well or valve vault shall be removed below the surface and grouted flush to avoid tripping hazards.

Concrete work to be of a professional quality with nonskid finish.

All discharge elbows shall be level and plumb to ensure all guiderails will work properly and that pumps can be removed easily and seat properly.

All adapter flanges shall be installed according to drawings to allow easy removal of valves. All bolts shall be torqued according to the manufacturer's recommendations.

The lift station site, within the fenced area shall be laid with filter fabric and  $\frac{3}{4}$  inch rock, no less than 6" deep.



## **M.11 INSPECTIONS**

Inspections shall be coordinated with the Engineer of Record, the City of Stuart, Contractor and Contractor's manufacturer's representative for the station. The following items shall be the basis of acceptance:

- ✓ The pumps are reasonably pumping on the design curve(s).
- ✓ The design amperage is not being exceeded.
- ✓ The station is functioning as designed.
- ✓ The station was built in accordance with these standards.

The pumps shall be pulled to the surface and put on the ground, then reinstalled on the guide rails and lowered in place by the manufacturer's representative prior to testing of the pumps.

## **M.12 START-UP**

The Engineer of Record and the City of Stuart shall be notified 48 hours prior to start-up of the lift station. During start-up the Contractor's manufacturer's representative shall be present at the job site.

The manufacturer's representative shall be responsible for delivery of the following:

- Two (2) parts manuals.
- Two (2) station/pump operation and maintenance (O/M) manuals.
- Two (2) complete sets of electrical schematics.

Three (3) start-up reports including all start-up parameters tested and their results and a pump performance certification signed by the representative certifying the pumps meet the specifications and are ready for operation by others. The pumps shall be tested in the presence of the Engineer of Record and a City of Stuart Representative at a minimum of three (3) points on the curve including the design and shutoff heads. Certified test results shall be provided upon completion of the testing. Failure to meet the specified pump requirements will result in replacement and re-testing of the pump at the contractor's expense.

Backflow assemblies shall be certified complete by a technician certified to do so.

## **M.13 WARRANTY**

Pumps shall have a minimum 5 year warranty covering 100% of all parts and labor for the first year and 50% of all parts and labor the remaining 4 years. The warranty period shall commence at the time of pump station acceptance by the City of Stuart.

## **M.14 SERVICE**

Pump suppliers shall have adequate repair/service facilities and parts inventory to ensure timely and efficient repair of all equipment supplied. The pump supplier shall provide a reference list of existing installations upon request.

**END OF SECTION**

**DIVISION N**  
**GRINDER PUMP SYSTEMS**

**N.1 SECTION DESCRIPTION**

This section includes materials, performance, installation standards associated with the furnishing of, labor, materials, equipment and appurtenances required to install complete and operational commercial and residential grinder pump systems. These Specifications are the minimum requirements regarding the equipment application; furnishings, installation, delivery, shop and field-testing of all materials, equipment and appurtenances for the individual types of grinder pump systems as specified herein. The Manufacturer's recommendations and Construction Drawings may contain additional requirements pertinent to the installation of the individual types of grinder pump systems, including accessory and auxiliary equipment and material types, which are not specified herein.

**Standardization**

At the discretion of the City Commission, and or the Director of Public Works or his/her designee a single manufacturer may be chosen to supply the grinder system(s) to assure continuity of the system. A single approved manufacturer(s) shall be responsible for supplying the entire grinder system(s) including, but not limited to, pumps, motors, basins, rail assemblies, electrical controls and appurtenances. All equipment shall be new and unused standard equipment for the intended use as specified herein.

**N.2 GENERAL**

The systems covered by these Specifications are intended to be standard grinder systems of proven ability. The pumps and appurtenances furnished shall be designed and constructed in accordance with the industries standards and methods, and shall operate in accordance with the design and specifications for each individual type system as specified herein. All Pumps shall be manufactured in accordance with the Hydraulic Institute Standards. All equipment and materials furnished shall be new and unused and shall be the standard product of manufacturer.

**N.3 TYPES OF SYSTEMS**

**Simplex Grinder Systems**

A single pump system operating on 230 volt, single-phase electrical power, in a 2-foot diameter, 5-foot deep fiberglass basin, The simplex system is approved for use in all single-family residential units and commercial applications where the wastewater flows are 250 gallons per day (1.0 ERC) or less. Unless otherwise approved by the Director of Public Works, the simplex system is however, prohibited, regardless of the flows, for use at the following commercial locations:

- ✓ Hair salons
- ✓ Barber shops
- ✓ Laundries
- ✓ Car washes and other washing facilities
- ✓ Facilities with food preparation

- ✓ Industrial flows
- ✓ Multiple structures

### **Single-Phase Duplex Grinder System**

A dual pump system that operates on 230-volt, single-phase electrical power, in a 4-foot diameter (min.), varying depth fiberglass basin (depth of the basin shall be site specific, minimum of 6-foot deep). The single-phase duplex system is approved for use in all commercial applications where the wastewater flows are 1,000 gallons per day (4.0 ERCs) or less, and providing the minimum design standards contained herein are maintained.

### **Three-Phase Duplex Grinder Systems**

A dual pump system that operates on 230 volt three-phase electrical power, in a 4-foot diameter (min.), varying depth fiberglass basin (depth of the basin shall be site specific, minimum of 6-foot deep). The three-phase duplex system is approved for use in all commercial applications, providing the minimum design standards, contained herein, are maintained.

## **N.4 SUBMITTALS**

**DESIGN** – The Engineer shall provide calculations including, but not limited to, the average daily flows (ADF), maximum daily flows (MDF), peak hourly flows (PHF), ADF/MDF/PHF cycle / run times and starts per hour, total dynamic head (TDH) and buoyancy calculations.

Pump data including the pumps performance curve, capacities and efficiency based on the manufacturer’s shop testing of like units. Curves shall be submitted in an 8-1/2” x 11” format, at as large a scale as practical. Curves shall be plotted from zero flow at the pumps shut off head to the pumps capacity. The Engineer of Record shall plot the specific system design on the Manufacturer’s curve, plotting from zero flow at the designed static head, to and through the selected pump performance curve. Pump family curve tables shall not be acceptable.

**PRE-CONSTRUCTION** - Contractor shall provide to the City copies of all required building and/or construction permits.

**POST-CONSTRUCTION** - Three (3) Operation and Maintenance Manual(s) shall be prepared specific to the individual installation(s) and shall include the complete pump and motor data, a bill of materials of all equipment (including weights), copies of the Manufacturer’s shop and field testing of the equipment, drawings of the system and recommended maintenance and operation procedures.

**SHOP DRAWINGS** - Shop drawings are required for the complete construction, including dimensions and anchor bolt locations.

Descriptive literature, bulletins, and/or catalogs of the equipment.

A complete total bill of materials of all equipment including the weights of equipment furnished.

A list of the Manufacturer's recommended spare parts to be supplied in addition to those specified herein by the paragraph entitled Tools and Spare Parts, with the Manufacturer's current price for each item. Include gaskets, packing, etc. on the list. List bearings by the bearing Manufacturer's item numbers only.

Complete motor data.

Copies of all factory test results.

In the event that it is impossible to conform to certain details of the specifications due to different manufacturing techniques, describe completely all nonconforming aspects.

Upon receipt and review of submitted material, provide the required number of certified prints and one reproducible tracing of all Drawings.

#### **N.5 PRODUCT HANDLING**

All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation. All equipment and parts must be properly protected against any damage during a prolonged period at the site. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted thereto. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage and handling. Each box or package shall be properly marked to show its net weight in addition to its contents.

#### **N.6 OPERATING INSTRUCTIONS**

Operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operation and maintenance personnel unfamiliar with such equipment.

A factory representative of all major component manufacturers, who has complete knowledge of proper operation and maintenance, shall be provided for two (2) days to instruct representatives of the City of Stuart and the Engineer on proper operation and maintenance. With the City's permission, this work may be conducted in conjunction with the inspection of the installation and test run. If there are difficulties in operation of the equipment due to the Manufacturer's design or fabrication, additional service shall be provided at no cost to the City of Stuart.

#### **N.7 WARRANTY**

The equipment manufacturers shall warrant all equipment supplied under this section for a period of two years upon delivery to the City of Stuart or twenty-seven months from the manufacturing date. The equipment shall be warranted to be free from defects in

workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced at no expense to the City of Stuart.

All grinder pumps shall be of a submersible grinder type. The configuration of the grinder pump, rail and discharge assemblies shall be located and arranged per the Manufacturer's recommendation. The pumps shall be capable of handling raw, unscreened sewage and equipped with a rail and discharge connection assembly, which will allow the removal of the pumps from the basin without the need for personnel to enter the basin. The pumps shall operate with water level variations and pump level settings per the Manufacturer's recommendation.

All replacement parts for the pumps and motors, such as bearings, wearing rings, shafts, sleeves, motors, etc., shall be of standard dimension built to limit gauges or formed to templates so as the parts will be interchangeable between like units, in stock or in the future obtain such replacement parts. All such parts shall be identified in the operation and maintenance manual to be furnished by the Manufacturer. The pumping units shall be complete including pumps and motors with proper alignment and balancing of the individual units. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the service to be performed. Ample room for inspection, repairs and adjustment shall be provided.

Stainless steel nameplates giving the name of the Manufacturer, the rated capacity, head speed and all other pertinent data shall be attached to each pump and motor.

Each pumping unit and its driving equipment shall be designed and constructed to withstand the maximum turbine run-away speed of the unit due to backflow through the pump with the maximum TDH specified available at the pump discharge connection.

## **N.8 PRODUCTS**

**GENERAL** - The Manufacturer/Supplier shall be responsible for the supply of an entire system including pumps, motors, electrical controls, wet-well basins, etc., as specified herein. All grinder pumps shall be of a submersible grinder type. The configuration of the grinder pump, rail and discharge assemblies shall be located and arranged per the Manufacturer's recommendation as shown on the Construction Drawings, or as specified herein.

The pumps shall be capable of handling raw, unscreened sewage and equipped with a rail and discharge connection assembly which will allow the removal of the pumps from the basin without the need for personnel to enter the basin.

The pumps shall operate with water level variations and pump level settings per the Manufacturer's recommendation as shown on the Construction Drawings, or as specified herein.

All replacement parts for the pumps and motors, such as bearings, wearing rings, shafts, sleeves, motors, etc., shall be of standard dimension built to limit gauges or formed to templates so as the parts will be interchangeable between like units, so as the City of Stuart

may stock or in the future obtain such replacement parts. All such parts shall be identification in the Operation and Maintenance Manual to be furnished by the Manufacture.

The grinder pumps shall be installed as shown on the Construction Drawings or as specified herein. The configuration of the pumps, rails and discharge assembly has been made using the arrangement and dimensions recommended by one Manufacturer. The selection of the equipment is limited to the product of one Manufacturer. If the equipment requires an arrangement or dimensions different from those shown on the Construction Drawings or as specified herein, the Manufacturer/Supplier shall prepare and submit to the Engineer and the City of Stuart, for review and approval, Shop Drawings showing all necessary changes. Such changes, including labor, accessories, controls, etc. to accommodate the equipment, shall be made with no additional cost to the City of Stuart. All arrangements and dimensions of the equipment provided shall be in accordance with the Manufacturer's recommendations.

The pumping units required under this section shall be complete including pumps and motors with proper alignment and balancing of the individual units. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the service to be performed. Ample room for inspection, repairs and adjustment shall be provided.

Stainless steel nameplates giving the name of the Manufacturer, the rated capacity, head, speed and all other pertinent data shall be attached to each pump and motor.

Each pumping unit and its driving equipment shall be designed and constructed to withstand the maximum turbine run-away speed of the unit due to backflow through the pump with the maximum TDH specified available at the pump discharge connection.

## **N.9 PUMPS**

**GENERAL** - The pumps shall be totally submersible grinder type, designed to pump raw unscreened wastewater. The pumps shall be standard dimensions such that parts will be interchangeable between like units.

The same Manufacturer shall supply all units.

**MANUFACTURER** - The pumps shall be manufactured units meeting the detailed requirements as specified herein. The pumping equipment Manufacturer shall be responsible for all patents or licenses that exist because of the equipment that may be provided. The Manufacturer shall assume all costs of patent fees or licenses for the equipment or process and shall safeguard and save harmless the City of Stuart from all damages, judgments, claims and expenses arising from license fees, or claimed infringement of any letters, patent or patent rights or fees for the use of any equipment or process, structural feature or arrangement of any of the component parts of the installation, and the price bid shall be deemed to include payment of all such patent fees, licenses of other costs pertaining thereto.

**PERFORMANCE REQUIREMENTS** - When operating at the design output speed, each pump shall have a characteristic performance curve that meets all the minimum conditions. The pumps and drive motors shall be capable of operating satisfactorily under the full range of conditions. The intermediate pump capacity, head and efficiency as defined herein, shall

take into consideration all losses from the pump intake suction bell to the pump discharge connection.

There shall be no significant change in vibration and noise level over the entire listed range of flow for the pumping system.

Maximum motor speeds shall not exceed those listed in Specifications to satisfy the specified hydraulic duty requirements. The pump "design speeds" shall be the motor output speed when operating at the pump "intermediate" capacity and head.

With the pumping units operating at full motor speed, the maximum brake horsepower required by the pumps shall not exceed the maximum horsepower listed in specification. If the pumping units require more than the maximum horsepower listed in the specification at the motor output shaft at any full motor speed operation point between primary and secondary discharge head, they will be rejected.

A certified Hydraulic Institute test curve from an identical pump shall be submitted, including head, capacity, brake horsepower, and pump efficiency for each pump type supplied.

**GRINDER PUMP CONSTRUCTION** - The pump and motor housing shall be cast iron with all parts coated with a sewage resistance coating. All exposed hardware shall be of 304 stainless steel. All mating surfaces where watertight sealing is required shall be machined and fitted with gaskets or O-rings. The pump shall be of the centrifugal design rated at (TBD) gpm (average flow) at (TBD) TDH, (TBD)gpm (minimum flow) at (TBD)TDH, and (TBD) gpm (maximum flow) at (TBD)TDH. The shutoff head shall be no less than 105 feet. The grinder assembly shall consist of a rotating radial cutter and a stationary shredding ring, and shall be mounted directly below the volute passage. The rotating cutter shall be threaded on to the stainless steel shaft and shall be locked with a screw and washer. The stationary ring shall be pressed on to an iron holding flange for easy removal. The flange shall be provided with tapped back-off holes so that screws can be used to push the shredding ring from the housing. Both the radial cutter and shredding ring shall be removable from the outside without dismantling the pump. Grinder assembly shall be of such construction that no clearance adjustments are required when assembling. All grinding of solids shall be from the action of the radial cutter against the shredding ring. The radial cutter and shredding ring shall be of 440 stainless steel hardened to 58-60 Rockwell C. Pump impeller shall be of the recessed type to provide an open, unobstructed passage through the volute for the ground solids. The impeller shall be constructed of (cast iron) (bronze) and shall have pump out vanes on the backside of the impeller to keep solids from lower seal and reduce pressure at the seal faces. Impeller shall be threaded on to the stainless steel shaft.

The common pump and motor shaft shall be 416 stainless steel supported by a heavy-duty double row ball bearing and an upper sealed single row ball bearing. The cutting element shall be designed to keep overhung load distance to a minimum. All fasteners shall be 304 stainless steel.

Two (2) rotary shaft seals mounted in tandem with an oil-filled chamber separating the seals shall protect the motor. The seals shall have carbon and ceramic seal faces diamond lapped to a tolerance of one light band. Metal parts and springs for seals shall be stainless steel. An electrical sensing probe shall be mounted in the seal chamber to detect any water leakage past the lower seal.

A lift-out guide rail assembly shall permit easy removal and installation of the pump and lower check valve without the necessity of personnel entering the basin. Corrosion resistant guide brackets with guide yokes of sufficient bearing strength to prevent binding shall bolt on the pump. The yokes shall mate over two (2) guide rails of a minimum of 1-inch non-corrosive material running between an upper rail support and the corrosion resistant discharge case. A lower discharge nozzle, downstream from the check valve, shall be guided into a chamfered cavity in the discharge case. A shoulder on the nozzle shall bottom on the discharge case when the pump is properly located and shims shall not be required to insure alignment for a leak tight seal. Dual "O" rings shall affect a hydraulic seal around the nozzle when it is in its operating position. A brace, easily removable from the top of the basin, shall be provided to lock the parts together, preventing line surges from breaking the seal and allowing leakage. The discharge case shall have a discharge opening with piping to a coupling through the basin wall. The discharge case shall be securely bolted to the basin floor and arranged in such a way that slight deflection caused by the discharge pipe will not cause the quick-connect pump flange to leak. A rope shall be securely fastened to the top of the pump and to the top of the basin to facilitate removal of the pump. The rope shall be of adequate strength, required to effectively support the weight of the pump assembly while removing and installing.

The pump motor shall be of the submersible type rated for 2-horsepower at 3450 RPM. Motor shall be single phase, 230 volt, 60 Hertz. Single-phase motors shall be of the capacitor start – capacitor run type for high starting torque. The stator winding shall be the open type with Class B insulation rated for 266° F. maximum operating temperature. The winding housing will be filled with dielectric oil that will lubricate bearings, seals and transfer heat from the windings to the outer shell. The motor stator is to be pressed into the motor housing for optimum concentricity and alignment and maximum heat transfer. The motor shall be capable of operating over full range of performance curve without overloading motor and causing any offensive noise or vibration. The motor shall have two bearings to support the rotor; an upper ball bearing to accommodate thrust loads and a lower ball bearing to take radial loads. Ball bearings shall be designed for a LB-10 life (50,000 hours). A heat sensor thermostat and overload shall be attached to the top end of the motor windings and shall stop the motor if the motor winding temperature reaches 200° F. The high temperature shutoff will cause the pump to cease operation, should a control failure cause the pump to run in a dry wet well. The thermostat shall reset automatically when the motor cools to a safe operating temperature. The motor power cord shall be 14-5 SOW/SOW-A and shall be fastened by means of a cord grip in the top of the pump. The top of the pump shall contain a waterproof junction box, which will provide space to connect the power cord to the motor leads. The motor leads shall seal between the motor housing and junction box by means of a rubber compression fitting around each wire. The cable entry system will consist of three (3) separate seals. A rubber grommet that seals both outer cable jackets shall be clamped onto the



cords by an end holding cap. An “O” ring shall seal the end holding cap to the bottom half of the cord cap. The motor leads shall seal between the motor housing and junction box by means of a rubber compression fitting around each wire. Cords shall be able to withstand a pull of 300 pounds without loosening or losing seal integrity. Each pumping unit and its driving equipment shall be designed and constructed to withstand the maximum turbine run-away speed of the unit due to back flow through the pump.

#### **N.10 BUILDING SEWER**

The building sewer is the line from the cleanout of the building served to the basin. Special attention shall be given to ensure watertight joints and a grade that will allow for gravity flows.

For single-family residential or commercial installations requiring a single phase simplex or duplex grinder system, this line shall be installed by the City of Stuart and shall be the responsibility of the City of Stuart.

#### **N.11 VALVES AND PIPING**

A 2” heavy duty check valve, all rubber flapper type rated for 150 psi shall be inserted in the discharge line of each pump as shown on the Drawings. The check valve will provide a full-ported passageway when open. Rubber flapper shall be fabric reinforced, synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A non-metallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating, even at a very low back pressure.

All valves shall be designed to be fully open and shall be full port design with bi-directional sealing rated for 150-psi minimum working pressure.

All PVC valves shall be true union type, made from high gloss injection molded PVC, type I-II. Teflon seats against PVC Ball.

Gate valves shall be 1 ¼” diameter and be female IPT by female IPT with a working pressure of 150 PSI minimum.

If valve is buried more than 24-inch from surface, a handle extension shall be supplied and fitted onto the valve handle, within a valve box.

Discharge piping shall be per City of Stuart Specifications, completely assembled to the pump and terminating as shown on the Drawings. The pipe shall have threaded fittings for connections to valves and fittings.

#### **N.12 BASIN AND ACCESS COVER**

The basin shall be sized as specified in the construction drawings and made of molded reinforced polyester resin and fiberglass construction. The basin shall have a minimum wall thickness of 1/4-inch. A 4-inch diameter inlet hub of the O-ring seal type shall be provided for field installation of the lateral. Other wall penetrations for electrical conduits and all venting shall be provided. The basin shall be equipped with an anti-flotation device so that the basin

shall not float under high groundwater conditions. The anti-flotation device shall be covered with concrete as shown on the drawings.

The basin Manufacturer shall furnish wet well access covers and frames as shown on the plans for the wet well basin. The cover shall be made of fiberglass, gasket sealed, with 316 stainless steel bolts used to secure the cover to the basin. The cover shall be capable of bearing a 200-pound per square foot live load.

#### Polyethylene Basin

Basin shall be made from medium density polyethylene compound. Resins used shall be acceptable for the intended environment and have excellent long-term outdoor weatherability and excellent low temperature impact resistance. The completed material shall be inert and acceptable to the environment, and have UL component recognition listing. The basin shall be water-tight with a wall thickness not less than 0.325”.

Inner and Outer Surfaces – All surfaces shall be smooth and resin rich, free of cracks and porosity, with uniform molded in color and thickness. Air bubbles are not acceptable.

Tank Wall – Wall thickness shall provide the aggregate strength necessary to meet the tensile and flexural physical properties requirements. The basin wall must be designed to withstand wall collapse or buckling based on:

1. Wall thickness (see prior statement)
2. Hydrostatic pressure (62.4 lbs per square foot)
3. Saturated soil (120 lbs per cubic foot)
4. Soil Modulus (700 lbs per square foot)
5. Pipe stiffness values as specified (ASTM D3753)

Tank wall must be constructed to withstand or exceed (2) time the actual imposed loading on any depth of basin.

Tank Bottom – The basin bottom shall be of sufficient thickness to withstand applicable hydrostatic uplift pressure. In saturated conditions, the center deflection of the empty basin bottom shall be less than 3/8” (elastic deflection) and shall not interfere with bottom pump mounting requirements. Any mounting studs, plates, cap screws into tank bottom should be stainless steel and resin covered for threads. Any inserts should be stainless steel or brass and resin covered except for threads.

Tank Collar (Anti-Flotation) – A means to counteract buoyancy forces shall be provided on the tank bottom in the form of a ring, and shall extend a minimum of 2” beyond the O.D. of the basin wall.

Top Flange – The top flange should be parallel to the tank bottom / collar and perpendicular to the tank wall. Corrosion resistant inserts shall be embedded in the top flange for securing the basin cover. The inserts shall be totally encapsulated to prevent running (minimum turning torque should not be less than 30 foot/lbs.), pullout and corrosion.

Venting – Tank shall be vented to the atmosphere via non-degradable integrated venting screen at the ground level with at least 10 square inches of perforated surface area.

Lifting Lugs – 2 lifting lugs shall be provided integrally molded into the side walls of the basin for use in lifting, transport, and tie-down of the basin while in transit and at the job site.

Capacity – Tanks with a nominal outer diameter of 24” shall be capable of holding at least 45 gallons of water in the bottom 16” (anti-float region), and a minimum of 28 gallons of water per vertical foot above the anti-float region.

### **N.13 PUMP CONTROL SYSTEM**

GENERAL - A pump controller shall be provided for each grinder pump unit. The controller shall automatically start and stop pump(s). In a duplex pump station, the controller shall automatically switch the lead and lag pump.

The pump controller shall be the standard system of the Manufacturer as modified for this application.

The pump controller shall be located and mounted as described in the Design Criteria and Construction Standards. The exact location and type of mounting of the pump controller shall be determined in the field by the Engineer Of Record and/or Utility.

A terminal strip shall be supplied to make all power and control connections for the pumps. All terminals shall be marked for easy identification. A ground terminal strip shall also be provided.

OPERATION REQUIREMENTS - The control panels shall consist of a lightning arrestor, a disconnect switch, a circuit breaker and NEMA rated magnetic starter for each pump motor. A high level alarm and pump shut-off shall be accomplished by a float type liquid level control system. Control switches shall provide means to operate each pump manually or automatically.

A float type liquid level control system shall continuously monitor wet well liquid level and control operation of the low-level cutoff for the pumps.

An exterior alarm light shall be activated upon high level.

CONSTRUCTION - The electrical control equipment shall be mounted within a NEMA 4X Fiberglass dead front door-in-door with all stainless steel hardware. The enclosure shall be U.L. listed as an assembly 14"x 12"x 5-7/8" (internal dimensions) and shall incorporate a removable back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar studs. A high level alarm light shall be mounted on top of the control cabinet. The light shall be enclosed in a red polycarbonate enclosure. The high-level alarm float installed in the wet well shall activate the light. Seal failure alarm circuitry shall only be provided if required to obtain manufacturer's warranty.

INSTALLATION - Installation shall be in strict accordance with the Manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the Manufacturer's recommendations.

SHOP PAINTING - Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter.

All pumps and motors shall be shop coated with Manufacturer's standard coating.

All nameplates shall be properly protected during painting.

Gears, bearing surfaces, and other similar surfaces obviously not be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the Engineer Of Record up to the time of the final acceptance test.

SERVICES - The Contractor shall furnish the services of a Manufacturer's field service technician who has complete knowledge of proper operation and maintenance of the equipment for a period not less than two (2) days to inspect the installed equipment, supervise the initial test run, and to provide instruction to the City of Stuart personnel. The first day will be for checking and inspecting the equipment after it is installed and to operate and supervise the initial field test.

The instruction of City of Stuart personnel in operation and maintenance of the equipment. This instruction period shall be scheduled at least ten (10) days in advance with the City of Stuart and shall take place prior to start-up and acceptance by the City of Stuart.

The final copies of operation and maintenance manuals specified previously must have been delivered to the Engineer prior to scheduling the instruction period with the City of Stuart.

#### **N.14 INSPECTION AND TESTING**

GENERAL - The services of a factory representative shall be furnished for two (2) days and shall have complete knowledge of proper operation and maintenance to inspect the final installation and supervise the test run of the equipment. With the permission of the City of Stuart, field tests shall not be conducted until such time that the entire installation is complete and ready for testing.

PUMPS - After all pumps have been completely installed and working under the direction of the Manufacturer, conduct, in the presence of the Engineer, such tests that are necessary to indicate that pumps conform to the Specifications. Field tests shall include one representative pump included under this Section.

If the pump performance does not meet the Specifications, corrective measures shall be taken or pumps shall be removed and replaced with pumps that satisfy the conditions specified. A 24-hour operating period of the pumps will be required before acceptance. During this 24-hour operating period, the Contractor shall supply all power necessary.

**MOTORS** - The Contractor/Manufacturer representative shall check direction of rotation of all motors and reverse connections if necessary.

Should any item of equipment fail to meet the Specifications, the Contractor shall take corrective measures or the item shall be removed and replaced with one that satisfies the conditions specified.

All pump operation settings, alarms, and shutdown devices shall be calibrated and tested during the field tests.

Deliver four (4) copies of certified test results to the Engineer upon completion of satisfactory testing of the equipment.

**END OF SECTION**

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**DIVISION O**  
**GRAVITY WASTEWATER COLLECTION SYSTEM**

**O.1 SECTION DESCRIPTION**

This section includes materials and installation standards, and Contractor responsibilities associated with the furnishing of all labor, materials, equipment and incidentals required to properly install, complete and make ready for operation all gravity collection lines and appurtenances as shown on the Drawings and as specified herein.

Materials shall include but not limited to, the following:

- ✓ Gravity Wastewater Main
- ✓ Wastewater Manholes
- ✓ Services

**O.2 SUBMITTALS**

Submit shop drawings of all materials for wastewater mains, manholes and services to be installed, for approval prior to ordering material.

Manufacturer and Fabricator Certification

**O.3 GRAVITY WASTEWATER MAIN**

PVC pipe shall conform to ASTM D-3034, SDR 26 and meet requirements of ASTM D-3212 on joints for sewer pipe using flexible elastomeric seals. Pipe shall be green or white in color with the words "Sanitary Sewer" written on the pipe at regular intervals of third points around the pipe. Pipe bell shall consist of an integral wall section with a solid cross-section rubber ring, factory assembled, securely locked in place to prevent displacement during assembly.

For excavations greater than 12 feet utilize AWWA C-900 SDR 18 PVC pipe, with the same color designations as stated above, shall be used.

Where DIP is used, DIP shall be minimum Class 50 conforming to AWWA C-150 and ANSI A21.50. DIP shall be epoxy lined and bituminous coated. Lining shall be applied in accordance with the manufacturer's recommendations. DIP shall be required where the separation from finished grade to invert is less than 4 feet, sewer lines cross other pipeline with less than 12 inches separation, in accordance to FDEP specifications. Absolute minimum cover for DIP shall be 24 inches to top of pipe.

Fittings shall be of the same type of material used for the pipeline.

**O.4 WASTEWATER MANHOLES**

The minimum inside diameter of manholes shall be 48 inches for wastewater main sizes up to 12 inches in diameter, with submittal of special designs for larger pipes. Non penetrating lift pen inserts shall be installed by precast Fabricator. Precast reinforced manholes shall be in accordance with ASTM C478, Class II, made with Type II acid resistant cement, shall attain a minimum compressive strength of 4,000 psi in 28 days. Joint material for manhole sections

shall be butyl rubber sealant. After the sections are assembled, the remaining space shall be grouted with dense cement mortar, inside and outside. Installation of precast manholes shall comply with the details shown in the Construction Standards and in accordance with the manufacturer's recommendations.

Manhole frames and covers shall be grey cast iron traffic rated heavy duty conforming to ASTM Designation A48, Class 30. Covers shall be marked with the word "SANITARY SEWER " in 2-inch raised letters. Frames and covers shall be set to the correct finish grade elevation, with adjustment precast concrete manhole rings placed below, as detailed, for precast manholes. Frames shall be suitable for the future addition of cast iron rings for upward adjustment of top elevation.

The base slab and first ring of the precast manhole shall be cast monolithically.

The manhole invert shall be carefully shaped to conform to the pipe flow channel. Flow channels within the manhole involving changes in direction or drops shall smoothly direct the flow in accordance with the Contract drawings and the Construction Standards.

### **O.5 INSTALLATION**

Manholes shall be set according to construction plans and shall be precast in accordance with approved shop drawings, specifications and Construction standards.

Manhole Interior and Exterior shall receive two (2) applications, minimum 4-5 mils each of ProTech EW-1 water based-tar epoxy. Application shall be per manufacturer's specifications by an approved applicator.

All manholes shall have sewer rain guards installed. Rain guards shall be manufactured by Fosroc-Preco Industries or approved equal.

All manholes shall require backfill compaction as specified in compaction specifications. Backfill shall be of a suitable material. Construction debris or other unstable or unsuitable materials shall not be used.

Gravity mains shall be laid accurately to both line and grade. Visible leakage, deflections, horizontal misalignment, significant bowing, non-constant slopes between manholes and sagging joints shall each be grounds for rejection of lines.

Where navigable waterways are crossed, ductile iron pipe shall be installed across and to ten feet each side of the crossing. Approved utility crossing signs shall be placed on the pipe alignment at each side of the waterway.

Special care shall be exercised in design and installation to provide adequate bedding for the type of pipe used, taking into consideration trench width and depth, superimposed loadings above grade, and the material below trench grade. Pipe loading capabilities shall be computed in accordance with established design criteria and special supporting bedding or facilities shall be provided as required by the Engineer. Trenches and excavations shall be

kept dry while work is in progress. The Contractor shall be responsible to ensure that all safety requirements are met. The pipe barrel shall be uniformly supported along its entire length on undisturbed soil or bedding material. Pipe shall be laid in trenches having dry and stable bottom. Reference Division E, Utility Excavation, Backfilling and Compacting included in these Technical Specifications for further requirements pertaining to pipeline installations.

Extra protection shall be provided for underground ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement, through the area of concern.

Service Connections: Installation of service laterals shall be as shown within the Construction Standards. The service pipe lateral and required fittings shall extend to the property line, perpendicular to said line, terminating with stoppered ends or fittings, as indicated. The minimum service pipe size shall be four inches in diameter for a single service and six inches for a double service. All commercial services shall be six inches, minimum. The exact location for each installed service shall include a clean-out installed at the terminus location at each property line. Services connections to existing mains shall be made via rigid couplings at each side of the tee.

#### **O.6 FIELD QUALITY CONTROL**

The Contractor shall perform testing of all wastewater gravity mains, as set forth in the following, and shall conduct said tests in the presence of representatives from the City of Stuart and Engineer of Record. Testing shall not proceed until the facilities have been backfilled, the laying of roadway base is complete and Record Drawings are obtained.

For sanitary lines 100' or less in uninterrupted length (services excluded), the following shall apply:

Inspection lamping performed by the contractor shall be required. Lamping shall be performed in presence of the City of Stuart and Engineer of Record. If deemed appropriate, the City of Stuart requires a final T.V. Report, and/or infiltration/exfiltration test. All testing performed shall be at the contractor's expense.

For sanitary lines greater than 100' in uninterrupted length (services excluded), the following shall apply:

The installed wastewater gravity main shall undergo television inspection performed by the contractor or representative of Contractor, prior to final acceptance by the City of Stuart. Color D.V.D. along with inspection logs shall be provided to the City of Stuart for each inspection. At time of video taping, the lines shall be clean with sufficient water having been introduced into each segment of the line to show any sags or dips present. The video camera shall have a depth gauge attached to the front of the camera that will show depth of water in the line. If inspection reveals cracked, broken or defective pipe or pipe misalignment resulting in vertical sags of ½ inch or excess of, or excessive water due to infiltration, the contractor shall be required to repair or replace the pipeline. Prior to repair or replacement of



failed sewer pipe, the method of replacement shall be submitted to the City of Stuart for approval. Pressure grouting shall not be considered as an acceptable method of repair. The results of all testing shall be provided to the City of Stuart in legible form by the contractor. Notify the City of Stuart and the Engineer of Record prior to conducting video inspection. The original videotape and three sets of record drawings shall be submitted to and become the property of the City of Stuart.

The video tape and record drawings must clearly show:

- ✓ Project name, date & time of video taping, segment of line being taped (i.e., MH #1 to MH #2), and direction of taping process (i.e., with the flow or against the flow).
- ✓ All lateral sizes, locations and orientation.
- ✓ Depth of any sags/dips found in the line.
- ✓ Entire length of line between manholes.
- ✓ Any sand, rock, dirt or debris found in the lines shall be removed by the Contractor.

The sewer main, house laterals, and manholes shall be subjected to infiltration and exfiltration tests (method to be agreed upon by Engineer and the City of Stuart). The allowable leakage shall not exceed 50 gallons/day/inch of diameter/mile.

Should the test fail, necessary repairs shall be accomplished by the contractor and the test repeated until the results are within the established limits. The contractor shall furnish the necessary labor, water and all other items required to conduct the required testing and shall perform the necessary system repairs required to comply with the specified test. All retesting shall be at the contractor's expense.

**END OF SECTION**

## **DIVISION P LOW PRESSURE SEWER SYSTEMS**

### **P.1 SECTION DESCRIPTION**

Low pressure pumping units shall be owned, operated or maintained by the City of Stuart; however, Low pressure pumping units shall be located so that surface water run off shall not interfere with electrical components, nor be located under roof overhangs or downspouts.

Site drainage must be directed away from wet well. Wet well lid shall be set above the 100 year flood elevation and shall be 3" minimum above surrounding ground. All vents shall be set 6" above 100 year flood elevation.

Lift stations and control panel shall be located so that both are accessible for maintenance, and the panel is in full view of the wet well.

The lift station location is to be approved by the City of Stuart prior to installation. The wet well must be inspected by the City of Stuart prior to installation. Inspections shall include water leakage test, with zero leakage allowable. Additional inspections are required prior to back-fill and start-up.

Manufacturer shall supply and attach electrical control panel schematic to inside face of control panel door

Residential low pressure force mains from the right-of-way line to the low pressure pumping unit shall be the ownership and maintenance responsibility of the entity responsible for the pump station.

Prior to placing the lift station into service, the lift station shall be started up to ensure its performance. The startup shall include starting the station on permanent power and also on generator power.

### **P.2 RELATED SECTIONS**

Division D, Earthwork

Division H – High Density Polyethylene pressure pipe.

Division L – Sewage Force Mains

Division N – Grinder Pump Systems

### **P.3 QUALITY AND WORKMANSHIP**

#### **COMMERCIAL / RESIDENTIAL LOW PRESSURE SEWER SYSTEM**

**Main** - SDR21, ASTM D2241 PVC, 200 psi. Pipe shall be push-on type joints with integral bell end and gasket seal. No solvent welded pipe/fittings are allowed.

**Main Line Fittings**- SDR-21 IPS gasketed fittings (Multi Fittings, Harco) , MJ Ductile Iron Class 350, AWWA C153 (Epoxy lining).

**Valves-** 2” or larger to be R.W.G.V. w/ 2” operating nut. Conforming to AWWA C500 latest version.

**Valve Boxes-** (2” valves or larger) Tyler 5.14 cast iron w / “sewer” designation.

**Tracer Wire-** #10 AWG, stranded copper (open trench construction), #8 AWG, solid copper (directional bores) Type THHN with green insulation.

**Terminal Clean-out, Pressure Clean-out Boxes –** 13” x 24” (box to be green in color) w / “sewer” marked lid.

**2” or Smaller Plugs-** Sch 40 red brass, solid type with square head. (Brass plugs in brass fittings, PVC plugs in PVC fittings)

**Service Disconnect-** Separate fused service disconnect required in NEMA 4X box (pull-out type).

**END OF SECTION**

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**DIVISION Q**  
**PERFORMANCE TESTING OF PRESSURE PIPELINES**

**P.1 SECTION DESCRIPTION**

This section includes materials and performance standards, and Contractor responsibilities associated with the furnishing of all labor, materials, equipment and incidentals required to properly perform flushing and hydrostatic testing of all pressure mains and disinfection and bacteriological testing of all pressure water mains, as shown on the Drawings and as specified herein.

The following performance testing must be conducted:

- ✓ Water Main: Hydrostatic, Leakage and Bacteriological Testing
- ✓ Force Main: Hydrostatic and Leakage Testing
- ✓ Reclaimed Water Main: Hydrostatic and Leakage Testing
- ✓ Low Pressure Main: Hydrostatic and Leakage Testing

**P.2 RELATED SECTIONS**

Division K – Potable Water Systems

Division L – Sewage Force Mains

**P.3 REFERENCES**

ANSI/AWWA B300 - Standard for Hypochlorites.

ANSI/AWWA B301 - Standard for Liquid Chlorine.

ANSI/AWWA B303 - Standard for Sodium Chlorite.

ANSI/AWWA C600 - Standard for Ductile Iron Pipe Installation, Testing.

ANSI/AWWA C651 - Standard for Disinfecting Water Mains.

ANSI/AWWA C900 - Standard for PVC Pipe, 4"-12" for Water Distribution.

**P.4 SUBMITTALS**

Test Reports: Indicate results comparative to specified requirements.

Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.

**P.5 REPORT DOCUMENTS**

Disinfection report (Water System Only), record:

- ✓ Type and form of disinfectant used.
- ✓ Date and time of disinfectant injection start and time of completion.
- ✓ Test locations.
- ✓ Initial and 24 hour disinfectant residuals (quantity in treated water) in PPM for each outlet tested.
- ✓ Date and time of flushing start and completion.
- ✓ Disinfectant residual after flushing in PPM for each outlet tested.
- ✓ Bacteriological report; record: (Water System Only)
- ✓ Date issued, project name, and testing laboratory name, address, telephone number and State Certification Number.

- ✓ Time and date of water sample collection.
- ✓ Name of person collecting samples.
- ✓ Test locations.
- ✓ Initial and 24 hour disinfectant residuals in PPM for each outlet tested.
- ✓ Coliform bacteria test results for each outlet tested.
- ✓ Certification that water conforms, or fails to conform to bacterial standards of AWWA.
- ✓ Bacteriologist's signature and authority.

Hydrostatic Test Report (Water, Sewer, Reclaimed Water), record:

- ✓ Time and Date of Testing.
- ✓ Name of Person/Persons conducting test and present during test and Company name.
- ✓ Test locations.
- ✓ All pressure gauge locations w/pressure at time.
- ✓ Allowable leakage per specifications.
- ✓ Actual leakage during test with finishing time and pressure.

#### **P.6 QUALITY ASSURANCE**

Perform work in accordance with all ANSI/AWWA standards.

#### **P.7 REGULATORY REQUIREMENTS**

Conform to applicable code or regulation for performing the work of this Section.

The water system shall not be put into service until after the necessary bacteriological samples have been approved by the applicable regulatory agencies.

#### **P.8 DISINFECTION CHEMICALS**

Chemicals:

- ✓ ANSI/AWWA B300, Hypochlorite.
- ✓ ANSI/AWWA B301, Liquid Chlorine
- ✓ ANSI/AWWA B303, Sodium Chlorite

#### **P.9 GENERAL**

Verify that piping system has been cleaned and properly isolated.

The maximum length of line to be tested as one section shall not exceed 2,500 feet.

Bacteriological testing shall not begin until after the pipeline has been flushed and the pressure test has been passed.

#### **P.10 CLEANING**

Water Distribution, Force Main and Low Pressure Main Systems

Flush all foreign matter from pipeline. For water mains, flush prior to disinfection. Hoses, fittings and temporary pipes in ditches shall be provided as required to dispose of flushing

water without damage to adjacent properties. Flushing velocities shall be at least 2.5 feet per second.

Prior to the actual line flushing operation, the Contractor shall properly notify the City of Stuart and the Engineer of Record of such intended water use a minimum of 24 hours prior to flushing of mains that are 8 inch diameter and smaller , and, preferably, at least 1 week prior to flushing of mains larger than 8 inch diameter. All flushing times will be limited to off peak times of water system demand and consumption. No flushing shall take place without the City of Stuart representatives and/or Engineer of Record present.

The City of Stuart will provide meter assemblies for determination of the volume of water used for flushing. The contractor shall pay for all water used.

Mains 3” diameter and larger shall be cleaned using a poly-pig cleaning system. All equipment and piping shall be provided by the contractor.

### **P.11 HYDROSTATIC AND LEAKAGE TESTING**

The Contractor shall provide all necessary equipment such as pumps, gauges and water measuring tanks and shall perform all work required for pipe pressure and leakage test. Hydrostatic and leakage tests shall be made between valves and/or connectors for each section tested using the procedure outline in ANSI/AWWA C600.

The allowable leakage rate for pressure tests is included in the specific system standard specifications. The testing procedure shall include the continued application of the specified pressure to the test system by way of a pump taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container. Any exposed pipe, fittings, valves, hydrants, and joints shall be examined during the test. Any damaged or defective pipe fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material, and all tests shall be repeated.

The pressure shall not vary by more than  $\pm 5$  psi from the required pressure for the duration of the test. If at any point during the test the pressure loss exceeds 5 psi, the test is considered failed. Should the test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until within the established limits.

### **P.12 DISINFECTION (Water System Only)**

Disinfection of mains shall comply with AWWA C651. Each unit of completed supply line and distribution system shall be thoroughly flushed and then disinfected with chlorine. The use of chlorine or other disinfectant tablets is strictly prohibited.

The Contractor shall install sampling taps required to take all necessary water samples of points designated in the Construction Drawings or by the City of Stuart representatives.

The Contractor shall make all arrangements with a certified testing laboratory to take all water samples required for bacteriological tests and shall maintain continuous running

bacteriological sample taps. Water mains being tested must remain under line pressure, and have continuous running sample taps until release of system into service by the City of Stuart and FDEP.

END OF SECTION

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**DIVISION R**  
**PIPELINE CLEANING - POLY PIG METHOD**

**R.1 SECTION DESCRIPTION**

Provide all supervision, labor, tools, transportation, material and equipment necessary to investigate the integrity and clean, as necessary, existing main pipelines, using poly pigs and an approved poly pig procedure. Install all items required, including the provision of poly pig launching and retrieval devices as required and the furnishing of poly pigs swabs and poly pigs as noted further in this specification.

It shall be the Contractor's responsibility to install the necessary equipment, and demonstrate its functioning, disassemble equipment, clean-up and store materials at the direction of the City of Stuart and Engineer.

The Contractor is required to visit the site and review the record drawings of the existing pressure mains prior to bidding of this item. He is expected to have a full understanding of the magnitude of the work to be performed. The Contractor will not be entitled to any extra payment for work that is typically expected for this type project and that result from the lack of understanding by the Contractor.

Mains required to be investigated are existing low pressure mains and force mains and as shown and described within the construction drawings.

**R.2 QUALIFICATIONS**

The materials and work specified herein shall be furnished and performed by firms who are fully experienced, reputable, and qualified in the manufacture, installation and use of the specified items. The materials specified shall be constructed and installed in accordance with the best practice and methods.

The Contractor shall provide evidence of qualification by providing copies of his/her state certification or license to perform such work as herein described. Such documentation must be provided prior to beginning construction. Failure to provide such documentation will delay the beginning of work. Any firm performing the work that is not certified or licensed will result in a stop work order.

Contractor's personnel shall comply with the safety and health requirement of OSHA 29 CFR Documentation certifying such compliance for all contractor project personnel shall be included as part of the submittal required by these specifications.

**R.3 CONTRACTOR RESPONSIBILITIES**

Supervision - There shall be on-site at all times during the work, one superintendent with a minimum of three years supervisory experience to survey, layout and supervise the construction of the work under this contract.

Proposed Method of Work - The method of cleaning shall be by use of poly pigs or swabs. The Contractor shall furnish polyurethane pipe cleaning pigs of the appropriate diameter and covering material for use in the pipe system to be cleaned.



The pigs shall be blown elastomer polyurethane with open cell type construction having a material density suitable for use with the pipe system to be cleaned. 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.

When in use, the pig must be able to undergo a reduction to a minimum of sixty-five percent of the original cross sectional area and return to shape while maintaining the sliding seal and ability to clean. Pigs shall be bi-directional and have the ability to negotiate fittings, valves and other appurtenances. The pig cover material shall be such that it effectively scours and cleans the inside of the pipe without damage to the pipe liner of the wall.

Pigs shall be as manufactured by Knapp Polly Pig, Houston, Texas, or approved equivalent.

Cleaning - Cleaning shall restore the original flow characteristics of new pipe flow without over abrading or over cleaning the interior walls of the pipe.

Training - The Contractor shall furnish on-site and project in progress training to the City of Stuart personnel for future remedial cleaning and to implement a proper flushing program.

Equipment - The Contractor shall furnish pig launching equipment which will minimize the City of Stuart need to provide for additional valves, fittings and auxiliary water supplies. Said equipment shall be of the latest design and construction and shall include the means to maintain constant monitoring of the in-line flows and pressures of the system being cleaned and the constant location of the cleaning pigs in the system.

The Contractor shall maintain on-site for the duration of the project and have available for immediate use an electronic poly pig detector with the appropriately sized cavity poly pig for use in the system being cleaned to provide a means of tracking the passage of the pig in the system to locate, areas of potential or suspected blockage, and to find "lost" valves and other disparities within the system.

The Contractor shall also have available auxiliary centrifugal pumps for cleaning.

Testing - The Contractor shall perform pre-cleaning and post-cleaning flow testing to determine sizes, types, densities and numbers of pigs and/or swabs to be used, to establish the means and procedures to properly and safely clean the piping, to evaluate the system and to measure the effects of the cleaning operation.

Tests shall include fire flow tests, Hazen Williams "C" factor measurements, Manning "N" values, in-line velocity and volume capacity calculations and any other tests as may be required to properly and safely perform the work under this contract.

Communication - The Contractor shall provide radio communication and job site transportation between launching and retrieval points.

Report upon Completion - The Contractor shall provide a written report upon completion of line cleaning to outline and detail information acquired during the cleaning process about the system or to confirm existing information.

#### **R.4 SUBMITTAL**

In accordance with the General Conditions and as specified herein, submit to the Engineer for review, complete detailed information including shop drawings as required, literature, and other pertinent information relating to the installation and operation of low pressure main pipeline cleaning devices and appurtenances.

#### **RQ.5 POLY PIGS**

Poly pigs shall be constructed of blown elastomer polyurethane with an open cell construction and a density equal to or suitable for use in the piping system being cleaned. Poly pig configuration shall consist of a parabolic nose and a concave base, and it shall be coated with resilient surface material that will maintain a peripheral seal and will effectively clean the piping system without over abrading the interior pipe wall. Poly pig characteristics when in use shall include the ability to navigate through ninety degree and one hundred and eighty degree turns, bi-directional fittings, full port valves and comparable in-line appurtenances, reduce its cross sectional area and restore itself to its original design configuration, be propelled by applications of hydraulic and pneumatic pressure while maintaining its primary function as an internal cleaning device of conduits. When effectively and properly applied the poly pig shall clean and restore piping systems of all sizes, types, uses, and lengths to their design or maximum flow capacity.

Furnish poly pigs in sufficient numbers and sizes, of appropriate densities, coatings and configurations to properly clean the system(s) prior to the system(s) begin put into service.

Provide sufficient poly pigs to maintain an inventory of poly pigs equal to the requirements for cleaning the system for a period of one year after the initial cleaning has been completed.

Poly pigs shall be those as manufactured by Knapp Polly Pigs of Houston, Texas or an approved equal.

Provide pig signal devices as required. These devices shall be those as manufactured by Maloney Pipeline Products, Houston, Texas or an approved equal.

#### **R.6 EQUIPMENT**

Furnish and install poly pig launching and retrieval devices as required to properly clean the particular system.

Launching and retrieval device shall be fabricated, designed and manufactured according to ANSI standards and capable of withstanding working pressures of 150 P.S.I.G.

Launch and receiving tube shall be fabricated of PVC or steel pipe sized one diameter larger than the system to which it will be attached with a minimum length of 2.5 times the diameter. For poly pig launchers and receivers, twelve inch or smaller in size, steel wall thickness shall be a minimum of five sixteenths inch. For poly pig launchers and receivers, fourteen inch or larger, wall thickness shall be a minimum of three eighths inch.

#### **R.7 GENERAL**

Equipment shall be installed in accordance with manufacturer's recommendations.

Initial cleaning selection of the cleaning pigs, instruction and training of facility personnel and provision of Operations/Maintenance Manual shall be provided by personnel thoroughly trained, knowledgeable and experienced in the technology and procedures required for the proper and safe “pigging” of this system.

### **R.8 PERFORMANCE**

Contractor will establish, with assistance from the Engineer, the design of the cleaning procedure including the provision of;

- Selection of starting and ending points for the cleaning process.
- Evaluation of total volume of fluids to be used and the disposal and the source(s) of these fluids.
- Mechanical or piping adaptation to the existing piping configuration.

Coordination and scheduling of the cleaning process to include selection of the distances and sizes of the piping to be cleaned as one procedure.

Alternative procedures to be immediately applied if the cleaning of the system requires such remedial action.

**END OF SECTION**

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