

TECHNICAL SPECIAL PROVISIONS
FOR
RELOCATION OF WATER AND WASTEWATER MAINS FOR THE CAXAMBAS CT
BRIDGE REPLACEMENT

Financial Project ID: 445460-1-56-01

This item has been digitally signed and sealed by Hayden Brown, PE on the date adjacent to the seal. The signature must be verified on any electronic copies.

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Firm: Barge Design Solutions, Inc.

Address: 120 Richard Jackson Blvd, Suite 200A

City, State, Zip: Panama City Beach, FL 32407

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TABLE OF CONTENTS

SECTION	DESCRIPTION	PAGE NO.
SECTION T1	GENERAL REQUIREMENTS	3
Section 1.1	Measurement and Payment	3
Section 1.2	Summary of Work	8
Section 1.3	Mobilization and Closeout	9
Section 1.4	Submittal Requirements	13
Section 1.5	Material and Equipment	20
Section 1.6	Testing and Laboratory Services	22
SECTION T2	UTILITIES	24
Section 2.1	Bypass Pumping	24
Section 2.2	Water Distribution System	28
Section 2.3	Sanitary Force Main System	48

SECTION T1 – General Requirements

Section 1.1 – Measurement and Payment

Measurement and basis of pavement shall be made for each pay item as described below.

PART 1 – GENERAL

1.01 GENERAL

- A. The unit price or lump sum bid items shall be compensation in full for furnishing all materials, labor, equipment, and incidentals necessary to complete the item in place in every detail in accordance with the plans and specifications. There will be no direct compensation for clean-up, restoration of property, and incidentals not shown in the proposal, and such incidentals must be included in the unit price for the related item of work.

PART 2 – BID ITEMS

0425 2110 MANHOLES, REPAIR (CONNECT 4” PVC FORCE MAIN TO EXISTING MANHOLE)

- A. The unit price bid for the various sizes, types, and depths of pipe used for force mains, including plugs, caps, bends, and the necessary fittings to connect to the existing manholes shall be compensation in full for one linear foot of pipe complete in place. The length of pipe paid for will be the plan length measured from the center of the sanitary sewer main to the end of the manhole connection point. This item shall include bypass pumping and removal and disposal of existing sewer pipe where required. All pipe and fittings shall be SDR 26.

0425 5 1 MANHOLE, ADJUST, UTILITIES (RAISE 1” OR LESS TO FINISHED GRADE)

- A. The unit price bid included in this Pay Item shall be made at the applicable Contract unit price bid per each manhole to be adjusted to final grade. Pay item includes installing new manhole cover and concrete pad as shown on the Plans and listed on the Bid Form. Payment shall represent full compensation for all labor, material, excavation, including rock as necessary, bedding, backfill, compaction, testing and disinfection and equipment required to complete these Pay Items.

0460 98 2 PIPE HANGER, STAINLESS

- A. The unit price bid for 4-inch and 8-inch stainless steel bridge-mounted pipe hanger supports shall be compensation in full for the construction and materials necessary to install one stainless steel pipe hanger in place to the concrete structure.

1050 16002 UTILITY PIPE, REMOVE & DISPOSE, 2-4.9"

- A. This unit price bid for the various sizes and types of WATER/SEWER pipe shall be compensation in full for the removal and replacement of one linear foot of pipe complete in place. The length of pipe installed will be the plan length measured along the centerline of the installed pipe from center of installed pipe or junctions to center of junction or various ends with no deduction in measured length for specials, fittings, or valves. The depth of cut to be paid for will be vertical distance from ground surface on the centerline of the pipe invert. This item shall include bypass pumping and removal and disposal of existing sewer pipe. The contract unit price shall also include any clearing and grubbing, dewatering, and incidentals necessary to complete the work.

1050 16004 UTILITY PIPE, REMOVE & DISPOSE, 8-19.9"

- A. This unit price bid for the various sizes and types of WATER/SEWER pipe shall be compensation in full for the removal and replacement of one linear foot of pipe complete in place. The length of pipe installed will be the plan length measured along the centerline of the installed pipe from center of installed pipe or junctions to center of junction or various ends with no deduction in measured length for specials, fittings, or valves. The depth of cut to be paid for will be vertical distance from ground surface on the centerline of the pipe invert. This item shall include bypass pumping and removal and disposal of existing sewer pipe. The contract unit price shall also include any clearing and grubbing, dewatering, and incidentals necessary to complete the work.

1050 31204 UTILITY PIPE, POLY VINYL CHLORIDE, FURNISH & INSTALL, WATER/SEWER, 4"

- A. The unit price bid for the various sizes and types of force main shall be compensated in full for one linear foot of pipe complete in place. The length of pipe installed will be measured along the centerline of the installed pipe from center of installed pipe or junctions to center of junction or various ends with no deduction in measured length for specials, fittings, or valves.

1050 31208 UTILITY PIPE, POLY VINYL CHLORIDE, FURNISH & INSTALL, WATER/SEWER, 8"

- A. The unit price bid for the various sizes and types of potable water main shall be compensated in full for one linear foot of pipe complete in place. The length of pipe installed will be measured along the centerline of the installed pipe from center of installed pipe or junctions to center of junction or various ends with no deduction in measured length for specials, fittings, or valves.

1050 51204 UTILITY PIPE, DUCTILE IRON/CAST IRON, FURNISH & INSTALL, SEWER, 4"

- A. The unit price bid for 4-inch, ductile iron sanitary force main shall be compensation in full for one linear foot of pipe complete in place. The length of pipe installed will be measured along the centerline of the installed pipe from

center of installed pipe or junctions to center of junction or various ends with no deduction in measured length for specials, fittings, or valves.

1050 51208 UTILITY PIPE, DUCTILE IRON/CAST IRON, FURNISH & INSTALL, WATER, 8"

- A. The unit price bid for 8-inch, ductile iron potable water main shall be compensation in full for one linear foot of pipe complete in place. The length of pipe installed will be measured along the centerline of the installed pipe from center of installed pipe or junctions to center of junction or various ends with no deduction in measured length for specials, fittings, or valves.

1055 51108 UTILITY FITTINGS, DUCTILE IRON/CAST IRON, FURNISH & INSTALL, ELBOW, 8"

- A. This pay item includes furnishing and installing the elbow fittings (11 ¼ through 90-degree elbows) for potable water mains of the quantity and type as shown in the Drawings.
- B. Measurement - The quantity to be paid for will be the actual number of fittings furnished and installed, measured as "each", for pipes 8" and larger in diameter. For fittings on pipes up to 7.9" in diameter, fittings are included in the pipe cost. Work includes all labor, material, including mechanical joint restraint, and incidentals.
- C. Basis of Payment - Price and payment will be full compensation at the Contract unit price for all work and materials required to complete installation of 8" utility fittings in an acceptable manner

31208 UTILITY FITTINGS FOR PVC PIPE, FURNISH & INSTALL, TEE, 8"

- A. This pay item includes furnishing and installing the tee fittings for potable water mains of the quantity and type as shown in the Drawings. The quantity to be paid for will be the actual number of fittings furnished and installed, measured as "each", for pipes 8" and larger in diameter. For fittings on pipes up to 7.9" in diameter, fittings are included in the pipe cost. Work includes all labor, material, including mechanical joint restraint, and incidentals. Price and payment will be full compensation at the Contract unit price for all work and materials required to complete installation of 8" utility fittings in an acceptable manner.

1055 31508 UTILITY FITTINGS FOR PVC PIPE, FURNISH & INSTALL, CAP/PLUG, 8"

- A. This pay item includes furnishing and installing the cap/plug fittings for the potable water and wastewater force mains of the quantity and type as shown in the Drawings. The quantity to be paid for will be the actual number of fittings furnished and installed, measured as "each", for pipes 8" and larger in diameter. For fittings on pipes up to 7.9" in diameter, fittings are included in the pipe cost. Work includes all labor, material, including mechanical joint restraint, and incidentals. Price and payment will be full compensation at the Contract unit

price for all work and materials required to complete installation of 8" utility fittings in an acceptable manner.

1080 24108 UTILITY FIXTURE, VALVE ASSEMBLY, F&I, 8" (EA)

- A. This pay item includes furnishing and installing 8" gate valves on the associated pipelines. The quantity to be paid for will be the actual number of valves, valve boxes, and concrete valve collars, furnished and installed, measured as "each". Work includes all labor, materials, and incidentals. Price and payment will be full compensation at the Contract unit price for all work and materials required to complete installation of valves in an acceptable manner as shown in the DRAWINGS and as specified. The cost of the valves will also include all survey, testing, record data, as-builts, excavation, restraints, warranty, bedding, backfilling, compaction, borrow, labor, materials, mechanical joint restraints, and incidentals.

1080 26101 UTILITY FIXTURE, VAC/AIR ASSEMBLY, F&I, 1" (EA)

- A. This pay item includes furnishing and installing the 1-inch vac/air assembly on the associated pipelines. The quantity to be paid for will be the actual number of vac/air assemblies furnished and installed, measured as "each." Work includes all labor, materials, including mechanical joint restraints, and incidentals. Price and payment will be full compensation at the Contract unit price for all work and materials required to complete installation of vac/air assemblies in an acceptable manner as shown in the DRAWINGS and as specified herein. The cost for each vac/air assembly includes all pipe, fittings and appurtenances as detailed on the Drawings, survey, testing, record data, as-builts, warranty, bedding, restraints, backfill, compaction, labor, materials, and incidentals.

1080 26102 UTILITY FIXTURE, VAC/AIR ASSEMBLY, F&I, 2" (EA)

- A. This pay item includes furnishing and installing the 2-inch vac/air assembly on the associated pipelines. The quantity to be paid for will be the actual number of vac/air assemblies furnished and installed, measured as "each." Work includes all labor, materials, including mechanical joint restraints, and incidentals. Price and payment will be full compensation at the Contract unit price for all work and materials required to complete installation of vac/air assemblies in an acceptable manner as shown in the DRAWINGS and as specified herein. The cost for each vac/air assembly includes all pipe, fittings and appurtenances as detailed on the Drawings, survey, testing, record data, as-builts, warranty, bedding, restraints, backfill, compaction, labor, materials, and incidentals.

1080 26600 UTILITY FIXTURE, VAC/AIR ASSEMBLY, REMOVE (EA)

- A. This pay item includes removing the existing vac/air assemblies on the associated pipelines. The quantity to be paid for will be the actual number of vac/air assemblies removed, measured as “each.” Work includes all labor and incidentals. Price and payment will be full compensation at the Contract unit price for all work required to complete the removal of vac/air assemblies in an acceptable manner as shown in the DRAWINGS and as specified herein. The cost for each vac/air assembly removed includes all appurtenances as detailed on the Drawings, survey, testing, record data, labor, materials, and incidentals.

END OF SECTION 1.1

Section 1.2 – Summary of Work

PART 1 - GENERAL

1.01 SUMMARY

- A. These Technical Special Provisions (TSPs) are provided to describe the methods, materials, and equipment required for the installation of the potable water and wastewater systems for the City of Marco Island, Florida (CITY) by the FDOT Contractor under UWHCA (Utility Work by Highway Contractor Agreement) for the construction of the Caxambas Ct Bridge Replacement (Financial Project Identification (FPID) 445460-1) project. The project is generally located in Section 21, Township 52 South, Range 26 East at the Caxambas Court Bridge within the limits of the CITY.
- B. The UWHCA are described as follows: UWHCA 445460-1: Potable water and wastewater piping systems are to be constructed within the limits of existing FDOT and local right-of-way as well as CITY easements along and adjacent to Caxambas Court. The utility relocation spans approximately 650 LF for both water and sewer. This work includes the relocation of existing mains and appurtenances, the installation of new potable water mains, wastewater mains and appurtenances and the removal of existing PVC and ductile-iron potable water mains and sections of wastewater mains mounted to the Caxambas Ct Bridge.

1.02 “BUILD AMERICA BUY AMERICA” (BABA) PROVISION

- A. The contractor shall refer to Section 6-5.2 of FDOT Standard Specifications for the BABA Appendix.

END OF SECTION 1.2

Section 1.3 – Mobilization and Closeout

PART 1 – MOBILIZATION

1.01 SCOPE

- A. Mobilization shall consist of initiating the Contract, and may include such portions of the following as are required at the beginning of the project:
 - 1. Setting up the respective Contractor's general plant, shops, storage areas and other facilities as may be required by the Specifications, by local or State law or by regulation.
 - 2. Setting up field office for representative of Engineer and Owner.
 - 3. Providing access to the project site by the Contractor.
 - 4. The Contractor obtaining their necessary permits and licenses, and payment of fees for same.
 - 5. Protecting existing utilities by the Contractors.
 - 6. Providing required insurance and bonds by the Contractor.

1.02 MATERIALS

- A. Materials under this part of this Specification are limited to those required for mobilization for the Contractor but not intended for incorporation in the completed Contracts.

1.03 EXECUTION

- A. All equipment required to diligently start the respective Contractor's construction work shall be on the site in satisfactory operating condition. The physical construction facilities including field office, personnel and equipment shall be set up and operating at the required efficiency to diligently pursue the work.

PART 2 – CLOSE-OUT

2.01 CLEANING-UP

- A. Upon completion and before work will finally be accepted and final payment made, the Contractor, except as noted, shall perform final cleaning as follows:
 - 1. Remove all debris off site.
 - 2. Clean, sod or seed all disturbed areas.
- B. Final cleaning shall be performed after the work is completed and immediately before turning the work over to the Owner.

The Contractor shall remove all his field offices, storage facilities and any other materials or items that were used by him during the construction and not incorporated into the Project. Leave these temporary service areas in a clean condition and repair or replace any damaged areas ready to be turned over to the Owner. The Contractor shall seed, and sod as required.

2.02 FINAL RESTORATION

- A. In addition to the requirements specified in the various Sections of these Specifications the Contractor shall make final restoration of all areas disturbed by his temporary construction facilities such as, but not limited to, office and storage trailers.
- B. In general, the Contractor shall repair all walks, roadways and any other areas damaged during construction, inside or outside the Construction zone, to the satisfaction of the Owner.

2.03 RECORD DRAWINGS

- A. In addition to the prints furnished for construction and for public bodies, the Contractor will be furnished without charge, four (4) sets of White Prints for the purpose of recording as-built conditions.
- B. These prints shall be marked "Record Drawings" and maintained at the Project site. The Contractor shall record on the prints all deviations from the Contract Drawings, at the time that such deviations are made.
 - 1. All changes made in partitions, doors, or in arrangement or construction of the Project, as well as a complete record of the exact manner in which mechanical and electrical work are installed, shall be recorded on these prints. Dimensions shall be included where necessary to accurately locate piping and other items which will be concealed in the finished work and which may later be necessary to locate for service.
 - 2. Record Drawings shall show all vertical and horizontal changes to the piping as shown on the Drawings.
- C. A complete file of accepted field sketches, diagrams, and other changes as may become necessary during the progress of the work shall also be maintained and attached to the set of marked-up prints.
- D. For each progress payment submission, the respective Contractor shall provide evidence to the satisfaction of the Engineer that all changes to date have been incorporated into the Contractor's "Record Drawings".
- E. At completion of the work, the respective Contractor shall provide, for the information of the Engineer, each sheet of marked prints and all accepted field sketches and diagrams.

- F. When this data has been checked and returned by the Engineer, the respective Contractor shall record all field changes and conditions on the "Record Drawings." Record drawings must be of professional quality in AutoCAD 2015 format and submitted to the Engineer in both "hard copy" and digital format on compact disc. Each sheet shall be signed by an Officer of the Company certifying that each sheet reflects the as-built conditions.
- G. Before final payment for this close-out item, deliver "Record Drawings" in a clean and neat condition to the Engineer or final payment will be held until receipt of the Record Drawing and is to the satisfaction of the Engineer.

2.04 MAINTENANCE AND OPERATING INSTRUCTIONS (If applicable)

- A. Prior to final payment for this close-out item, the Contractor shall also provide final (up-dated) maintenance information and final (up-dated) operating instructions for all equipment provided under this Contract. These instructions shall set forth all of the information necessary for the Owner to operate and make full and efficient use of equipment and perform such maintenance and servicing as would ordinarily be done by the Owner.
- B. Information shall be given in simple, non-technical language with sufficient diagrams and explanation to be readily understandable by the average layman. Possible hazards shall be particularly pointed out with instructions cautioning against mistakes that might result in damage to equipment or building or in danger to personnel.
- C. This information shall be assembled and bound in a hard cover brochure(s) or book(s). Brochure shall contain:
 - 1. Operating instructions.
 - 2. Maintenance instructions.
 - 3. Manufacturer's literature marked to key with item numbers or code on Contract Drawings, giving manufacturer's equipment designation and list for replacement parts.
 - 4. Name, address and phone number of installing Contractor.
 - 5. Name, address and phone number of local company providing 24-hour service if different from the installer.
 - 6. Typed list of belt drives listing dimensions of sheaves, bore, keyway and manufacturer's replacement belt numbers.
 - 7. Detailed description for the care and maintenance of planting.
- D. Submit manuals and operating instructions in accordance with the provisions of Section 1.7, Submittal Requirements.

- E. One copy of operating and maintenance instructions portion of these data applying to equipment in each Mechanical, Electrical Room and similar spaces shall be suitably mounted and framed under glass, and the entire frame mounted where directed on the wall of each room.

END OF SECTION 1.3

SECTION 1.4 – Submittal Requirements

PART 1 – GENERAL

1.01 SCHEDULES

- A. The Contractor shall be responsible for preparing a Progress or Work Schedule for the entire project.

1.02 SHOP DRAWINGS, SAMPLES AND MANUALS

- A. The Contractor shall process the Shop Drawings required by his Contract to the Engineer and he shall be responsible for their timely submission in accordance with the Shop Drawing schedule which is included in the overall progress or work schedule as described in Part 2 of this Section.
- B. Any proposed deviations/substitutions from that specified shall be clearly noted on the cover letter transmitting the shop drawing. Failure to so note will be cause for rejection of equipment, materials, etc. after installation.
- C. All submissions shall be marked with the Specification Section Number containing the item submitted for review or Drawing number for items specified on Drawings only.
- D. Revised shop drawings submitted for review shall be marked "RESUBMISSION".

1.03 CONSTRUCTION PHOTOGRAPHS

- A. The Contractor shall be responsible for all construction progress photographs. Progress photographs must be submitted with each pay request.

1.04 SUBMITTAL PROCEDURES

- A. All "Hard Copy" submittals shall be delivered to the Owner's responsible party.
- B. The submittals shall have been properly certified and identified by the Contractor. If they are submitted properly, the items will be processed for review.
- C. All submittals that require certification letter(s) per the FDEP Supplemental Conditions must have all applicable letters included when submitted to the Owner's responsible party. If they are not included, the submittal will be returned without review.
- D. The processed submittals will be returned to the respective Contractor.
- E. In the event of a conflict between this Section and other Sections of the Specifications regarding the number of copies to be submitted; the requirements of this Section govern.

- F. Electronic transmittal of submittal per the Standard General Provisions is permissible. Delivery shall be by email, an FTP site, or upload to an owner approved portal.

PART 2 – SCHEDULE

2.01 PREPARATION

- A. The Contractor shall prepare a Progress or Work Schedule for the entire Project, using CPM, showing the order in which the Contractor proposes to carry on his work and salient features, including submissions of shop drawings and samples and procurement of materials, to meet date of completion.
- B. Each activity in the Progress or Work Schedule shall be identified and a time for the performance of such activity indicated. Each activity shall be preceded by all work that must be accomplished prior to that activity. All abbreviations, codes and/or symbols used shall be described on the Schedule.
- C. The Contractor, in preparing his proposed Progress or Work Schedule, shall prepare a narrative highlighting his recommended sequence of construction. Any subsequent change to the Progress or Work Schedule that alters the sequence of construction shall include a narrative from the Contractor highlighting those subsequent changes.
- D. In addition to the schedule described above, the Contractor shall submit a list of shop drawings he proposes to submit for review which shall include the following:
 - 1. Specification Section Number
 - a. Description of all items within section.
 - b. Approximate date of each submittal.
 - 2. Contract Drawing Number
 - a. Description of all items on each Contract Drawing, if not previously covered by the Specifications.
 - b. Approximate date of each submittal.

2.02 SUBMISSION

- A. Submit six (6) hard copies or one (1) electronic copy of Schedule to the Engineer for review within thirty (30) days after award of Contract. Update and resubmit Schedule monthly thereafter until completion of the work. Updated Schedule shall have completed activities removed or indicated as such. Whenever modifications are made to the Contract which add or delete activities and/or revise time of completion, Schedule shall be revised and resubmitted to the Engineer within ten (10) days after such modification is authorized.

- B. In the event that the work is behind schedule, the Schedule shall be revised, through the use of overtime work or by other means, to ensure that the work is completed within the Contract time. Under these circumstances, overtime work shall be performed at no additional cost to the Owner.

PART 3 – SHOP DRAWINGS AND MANUALS

3.01 GENERAL

- A. Shop drawings are defined as drawings, diagrams, illustrations, schedules, performance charts, brochures and other data prepared by the Contractor which illustrate how specific portions of the work shall be fabricated and/or installed.
- B. Shop drawings are not part of the Contract Documents but are a supplementary means of communications to assist in the understanding of what the Contractor proposes to provide and to establish that whatever he intends to install either does or does not conform to the Drawings and Specifications.
- C. In the instance of a request for a substituted item, the Contractor shall verify that it will fit into the space allocated to the originally required item giving due regard to all other trades' requirements. Where modifications to the Contract Documents are proposed, the Contractor must clearly indicate such deviation in writing in his transmittal letter. If the modification and/or substitutions are agreed to by the Engineer, the Contract Documents will be appropriately modified. However, when additional work is required, the Contractor is advised that he must pay the Engineer for redesign to accommodate the revised substitution as well as pay other contractors for extra work required by them for the change. No increase in Owner's construction cost will be allowed.

3.02 CATALOG SHEETS

- A. For standard manufactured items considered by the Engineer as not requiring special Shop Drawings, the Contractor shall submit six (6) hard copies or one (1) electronic copy of manufacturer's catalog sheets showing model numbers and illustrated cuts of the items to be furnished, scale details, sizes, dimensions, performance characteristics, capacities, wiring and control diagrams and all other pertinent information. This information shall be highlighted on all six (6) hard copies or electronic copy when appropriate.
- B. The Engineer will retain three hard (3) copies and return three hard (3) copies to the Contractor submitting the catalog sheets where applicable.

3.03 SHOP DRAWINGS

- A. The Contractor shall submit for review six (6) white prints or one (1) electronic copy of shop and working drawings of materials fabricated especially for his Contract, and of equipment and materials for which such drawings are specifically requested.
 - 1. The Contractor shall submit six (6) copies or one (1) electronic copy of a letter with the Shop Drawings for each piece of equipment signed and certified by an authorized representative of the Equipment Manufacturer which certifies that the subject equipment meets or exceeds the current OSHA/ANSI and local industrial codes for safety. The letter shall also specifically identify any exceptions that the Equipment Manufacturer has taken in not providing the required safety devices as they relate to the above codes.
- B. Coordinate all equipment systems with the Drawings and submit a complete and coordinated shop drawing submission of the specific equipment system. All shop drawings related to the specific equipment system shall be submitted at the same time for review. The shop drawing submission shall provide the coordination of concrete foundations, piping, relative elevations, electrical, chemical facilities, instrumentation facilities, dimensions, structural changes, etc. in sufficient detail that the Engineer can adequately review the shop drawing. Equipment systems submitted which are incomplete and uncoordinated shall be returned to the respective Contractor, unchecked. A resubmission shall be made after equipment system shop drawings have been completed and coordinated. Any required changes in the equipment system layout vs. the equipment system shown on the Drawings shall be provided by the respective Contractor at no added expense to the Owner or Engineer.
- C. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter conforms to the Drawings and Specifications in all respects. Drawings which are correct shall be marked with the date, checker's name and certification of the Contractor's approval, and then shall be submitted to the Resident Project Representative. Any Shop Drawings submitted without the Contractor's certification will be returned without review.
- D. The Engineer will retain three hard (3) copies and return three hard (3) copies to the Contractor where applicable.

Shop Drawings shall show the principal dimensions, weight, structural and operating features, performance characteristics and wiring diagrams, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawing. When it is customary to do so, when the dimensions are of particular importance or when so specified, the

drawings shall be certified by the manufacturer or fabricator as correct for this Contract.

- E. When so specified or if considered by the Engineer to be acceptable, manufacturer's specifications, catalog data, descriptive matter, illustrations, etc., may be submitted for review in place of shop and working drawings. In such case the requirements shall be as specified for shop and working drawings, insofar as applicable.
- F. The Contractor shall be responsible for the prompt submission of all shop and working drawings in accordance with the shop drawing schedule so that there shall be no delay to the work due to the absence of such drawings.
- G. No material shall be purchased or fabricated especially for this Contract until the required shop and working drawings have been submitted and reviewed as conforming to the Contract requirements. All materials and work involved in the construction shall then be as represented by said drawings.
- H. The Engineer's review of shop and working drawings will follow a general check made to ascertain conformance with the design concept and functional result of the project and compliance with the information given in the Contract Documents. The Contractor is responsible for details and accuracy, for conforming and correlating all quantities and dimensions at the job site; for information that pertains solely to the fabrication processes or to techniques of construction; and for coordination of the work of all trades.

3.04 MANUALS

- A. The Contractor shall submit for review three (3) hard copies and one (1) electronic copy of all requested operating and maintenance manuals with the shop drawing submittals.
- B. The Engineer will retain one (1) hard copy and one (1) electronic copy and return two (2) hard copies to the Contractor.
- C. Prior to final payment, provide two (2) updated operating, maintenance manuals and parts list for the Owner's use.

3.05 FIELD DISTRIBUTION

- A. The Contractor shall be responsible for the required number of processed drawings or catalog cuts for field distribution to all necessary Contractors.
- B. The Contractor shall be responsible for the prompt distribution of processed Shop Drawings to all other Contractors whose work must be coordinated with the work progress.

PART 4 – SAMPLES

4.01 SUBMISSION OF SAMPLES

- A. Unless otherwise specified, the Contractor shall provide samples in duplicate and identify each sample by an appropriate tag or label listing the names of the Project, the Owner, the Engineer and the Contractor and/or Subcontractor as well as the exact identification of the sample. Tag or label shall be large enough to provide a blank space for review stamps.
- B. Samples of items submitted for destruction tests or for use in testing mixture with other materials will not be returned. Review of these items will be given by letter.
- C. When reviewed, one sample of each item, not submitted for destruction, will be returned to the Contractor and shall be kept and maintained in good condition in the submitting Contractor's office at the project site for later use in comparison with material actually delivered for the work. When samples of large, fabricated items or of costly items are required, reviewed samples may be installed in the work if the exact location of such samples is recorded on the Engineer's Record Drawings.

PART 5 – CERTIFICATION AND TESTS

5.01 GENERAL

- A. Six (6) hard copies or one (1) electronic copy of certifications and reports of tests when required under the various sections of the Specifications shall be submitted.

PART 6 – CONSTRUCTION PHOTOGRAPHS

6.01 GENERAL

- A. The Contractor shall provide pre-construction views, submitted in duplicate of the entire construction area before any work begins. Views shall be in the form of DVDs or External Storage Devices such as non-returnable USB flash drives or hard drives.
- B. The Contractor shall provide, from commencement of Project through completion of all Work, clear, sharp, color, 8-inch by 10-inch photographs, in duplicate. Digital pictures are also acceptable. These progress photographs shall be submitted to the Engineer each month in conjunction with the current Monthly Estimate. Interior and/or exterior views shall be made as requested by the Engineer.

C. Each photograph or digital photograph shall have the following information clearly noted on the picture. The information shall be typed or neatly printed on a label and placed on the face of the picture, and not obliterate important construction features.

1. Date Photo was taken and photo number.
2. Client/Owner.
3. Project Title and Contract number.
4. Contractor.
5. Description of what is shown on the photo including direction.

6.02 NUMBER OF VIEWS

A. Provide a minimum of ten views each month from preselected locations clearly showing the progress of the Work.

END OF SECTION 1.4

SECTION 1.5 – Material and Equipment

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Material and equipment incorporated into the work:
 - 1. Conform to applicable Technical Special Provisions and standards.
 - 2. Comply with size, make, type and quality specified, or as specifically approved in writing by the engineer.
 - 3. Manufactured and Fabricated Products:
 - a. Design, fabricate and assemble in accordance with the best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
 - c. Two or more items of the same kind shall be identical and manufactured by the same manufacturer.
 - d. Products shall be suitable for service conditions.
 - e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
 - 4. Do not use material or equipment for any purpose other than that for which it is specified.
 - 5. All material and equipment incorporated into the project shall be new.

1.02 MANUFACTURERS INSTRUCTIONS

- A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to the Engineer and County. Maintain one set of complete instructions at the job site during installation and until completion.
- B. Handle, install, connect, clean, condition and adjust products in strict accordance with such instructions and in conformity with specified requirements. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer in conjunction with the County prior to proceeding. Do not proceed with work without clear instructions.

1.03 TRANSPORTATION AND HANDLING

- A. Arrange deliveries of products in accordance with construction schedules, coordinate to avoid conflict with work and conditions at the site.
 - 1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
 - 2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals and that products are properly protected and undamaged.
- B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.04 SUBSTITUTIONS AND PRODUCT OPTIONS

- A. Contractor's Options:
 - 1. For products specified only by reference standard, select any product meeting that standard.

END OF SECTION 1.5

SECTION 1.6 – Testing and Laboratory Services

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

- A. CONTRACTOR shall employ and pay for the services of an Independent Testing Laboratory to preform testing specifically indicated on the Contract Documents. (The Contractor shall include the cost of testing in each item that requires testing.) The testing laboratory selected shall be approved by the OWNER. The OWNER may at any time elect to have materials and equipment tested for conformity with the Contract Documents.
 - 1. CONTRACTOR shall cooperate with the laboratory to facilitate the execution of its required services.
 - 2. Employment of the laboratory shall in no way relieve CONTRACTOR's obligations for quality control to perform the Work of the Contract.

1.02 RELATED REQUIREMENTS

- A. The Contract Documents include, but are not limited to, the following related requirements:
 - 1. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, order or approvals of public authorities.
 - 2. Respective section of specifications: Certifications of products.
 - 3. Each specification section listed: Laboratory tests required, and standards for testing.

1.03 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

- B. Laboratory is not authorized to:
 - 1. Release, revoke alter or enlarge on requirements of Contract Documents.
 - 2. Approve or accept any portion of the Work.
 - 3. Perform any duties of the CONTRACTOR.

1.04 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with Laboratory personnel and arrange access (where required) to work to MANUFACTURER's operations.
- B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.
- C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, asphaltic concrete, soil cement, and other material mixes.

- D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacturer or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents.

The ENGINEER may require the CONTRACTOR to provide statements or certificates from the MANUFACTURERS and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the CONTRACTOR, and no extra charge to the OWNER shall be allowed on account of such testing and certification.

- E. Furnish incidental labor and facilities:

1. To provide access to work to be tested.
2. To obtain and handle samples at the Project site or at the source of the product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

- F. Notify laboratory sufficiently in advance (minimum 48 hours) of operations to allow for laboratory assignment of personnel and scheduling of tests.

- G. If the test results indicate the material or equipment complies with the Contract Documents, all associated field and laboratory costs will be paid under the testing allowance. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, all associated costs will not be paid under the testing allowance, and the CONTRACTOR shall be responsible for payment of all field and laboratory costs.

END OF SECTION 1.6

SECTION T2 - UTILITIES

SECTION 2.1 – Bypass Pumping

PART 1 – GENERAL

1.01 SUMMARY

- A. This section presents the requirements for Bypass Pumping that will be required for all sewer line and manhole replacement unless the Contractor can demonstrate to Engineer and Owner that the work can be accomplished without bypass pumping.

1.02 BYPASS PUMPING PLANS

- A. Contractor shall meet with Owner, in presence of Engineer, to establish locations of pumps and equipment needed to achieve flow stoppage of adequate time to complete the work.
- B. The Contractor shall be solely responsible for all work associated with Bypass Pumping.
- C. Contractor shall provide Engineer at the Pre-Construction Meeting a plan detailing the anticipated start date and length of time required to perform Bypass Pumping. Contractor shall provide a minimum of one full day written notice to the Owner in advance of start of Bypass Pumping. Owner shall acknowledge such notice.
- D. The Owner shall receive from the Contractor a map showing the location or locations at which flow will be stopped, as well as the locations at which pumping will occur, and the location at which the flow will be returned to the sanitary sewer system. The map shall show the location and length of hoses, location and capacities of pumps, and the method used to stop flow. The plan shall also detail the number of people required to perform the work, and the frequency with which checks of sewage levels in manholes will be made. Additionally, Contractor shall provide the names and phone numbers of Contractor employees who will be on- site, 24 hours/day to the Owner. Contractor's employees shall carry cellular telephones with them at all times.

1.03 REGULATORY REQUIREMENTS

- A. Maintenance of Traffic
 - 1. Contractor shall maintain the flow of traffic in a manner consistent with the requirements of the Owner or the Manual of Uniform Traffic Control Devices such that bypass pumping does not interfere with travel, or access to houses or businesses.

B. Sanitary Sewer Spills

1. The Contractor shall establish a procedure whereby, in the event of a sewage spill, promptly notify the Department of Environmental Protection and the Owner.
2. The Contractor shall verbally report all unauthorized releases or spills of untreated or treated wastewater to the Owner and the Florida Department of Environmental Protection as soon as practical, but no later than 12 hours from the time the Contractor becomes aware of the discharge. Spills or releases in excess of 1,000 gallons per incident, or where public health of the environment may be endangered, are to be reported to the State Warning Point at (800) 320-0519, Spills or releases of any amount are to be reported to the Owner at 850-547-4238 and FDEP at 850-872-4375. The Contractor, to the extent known, will provide the following information to the Owner, State Warning Point and DEP branch office:
 - a. Name, address and telephone number of person reporting.
 - b. Name, address and telephone number of responsible persons for the discharge.
 - c. Date and time of the discharge and status of the discharge (ongoing or ceased).
 - d. Characteristics of wastewater spilled or released (untreated or treated, industrial or domestic).
 - e. Estimated amount of the discharge.
 - f. Location or address of the discharge.
 - g. Whether the discharge was contained on-site, and cleanup actions taken.
 - h. Description of area affected by the discharge, including name of any water body.
 - i. Other persons or agencies contacted

In addition, a written report shall be provided to the Owner, FDEP and other affected agencies on forms provided by the Owner no later than 72 hours following the discharge. All notifications shall comply with the provisions of any applicable which may apply to the project and shall be in accordance with Rule 62-604.550, F.A.C.

3. The Contractor shall be so solely liable for any FDEP penalties, fines or actions resulting from any unpermitted wastewater discharge and/or the failure to provide proper notice according to the above requirements.

1.04 MEASUREMENT AND PAYMENT

- A. There shall be no separate line item payments for the task. Cost of this work shall be included in the unit pricing described in Section 1.1 of these provisions.

PART 2 – PRODUCTS

2.01 EQUIPMENT

- A. Contractor shall use only materials and equipment capable of relieving the bypass pumping of raw, unscreened sewage. The material and equipment shall be in and kept in good repair throughout the work. Standby equipment as may be needed shall be ready for use in the event maintenance or repair of the equipment in service is required.
- B. The bypass system shall be of sufficient capacity to handle existing flow plus additional flow that may occur during a rainstorm. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. If pumping is required on a 24 hours basis, all engines shall be equipped to keep noise to a minimum, within local noise abatement regulation with residential-critical mufflers, sound deadening enclosures, and other means.
- C. When flow in a sewer line is plugged, blocked, or bypassed, sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Further, precaution must be taken to public or private property served by the sewers involved.

2.02 SUPPLIES

- A. The Contractor shall be responsible for supplying any and all supplies, spare parts, material, labor, incidentals and expendables required to prosecute the work in a timely manner.

2.03 REGULATION

- A. All work shall be in accordance with all Federal, State, and Local regulations.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions
 - 1. Contractor shall verify receipt of notice from Owner.
 - 2. Contractor shall verify site is ready for bypass pumping.

3.02 PREPARATION

- A. Traffic Maintenance: The Contractor shall ensure all required traffic control devices are in place.
- B. Contingency Plan: Contractor shall ensure the necessary phone numbers and procedures are posted at the bypass location to ensure rapid response.
- C. Bypass Pumping Route: Contractor shall ensure adequate space is available to accommodate pumps, piping, and thrust restraint as may be needed to perform work.
- D. Protection of Existing Property: Adequate examination and preparation shall be made by Contractor to assure existing property (public or private) remains undamaged during the work. Contractor shall be solely responsible for the protection from damaging public or private property.

3.03 CLOSEOUT

- A. Contractor shall establish all work required during the performance of Bypass Pumping is complete to the approval of the Engineer.
- B. The Contractor may then notify the Owner of the intent to stop pumping. The Contractor shall keep all equipment ready for reuse should the need arise during switch over.
- C. The Contractor may, once approval is granted, begin removing equipment from site.
- D. Contractor shall perform a thorough cleaning and restoration, in-kind of any areas disturbed or damaged, at no cost to Owner.

END OF SECTION 2.1

SECTION 2.2 – Water Distribution System

PART 1 – GENERAL

1.01 SCOPE

- A. This Section describes products to be incorporated into the water distribution system and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. It is the intent of these specifications to provide information supplemental to the contents of the construction drawings on the quality of materials, execution, measurement, etc. These specifications are general in nature and may contain products and requirements which are not applicable to the project. Discrepancies between these specifications and the construction drawings, either imagined or real, shall be brought to the attention of the Owner for clarification.

1.02 DESCRIPTION OF WORK

- A. Extent of work is shown on the drawings.
- B. Domestic water system work includes but is not limited to: Water mains, fire hydrants, valves, service connections and appurtenances.
- C. Comply with the requirements of applicable sections for excavation and backfilling required in connection with water distribution system work.
- D. Comply with requirements of Paragraph 2.12 of this section for concrete work required in connection with water distribution system work.
- E. Contractor is advised that existing water mains may be of various pipe materials, including asbestos cement. The Contractor shall be responsible for protection of existing water mains during construction and shall be responsible for repairing any pipes damaged during construction. Repair sections shall be PVC or ductile iron. The Contractor shall comply with all work site, air emission, solid waste and personal safety and protection regulations as related to the excavation, exposure, cutting, handling, containment and disposal of existing water main pipe material.
- F. The removal, encapsulation or enclosure, storage and disposal of pipe materials containing asbestos shall be in accordance with Chapter 469 of the Florida State Statutes; American Water Works Association Manual of Water Supply Practices No. M16 “Work Practices for Asbestos – Cement Pipe”; 29 CFR 1910.19; 29 CFR 1926.1101, Appendix F; Asbestos NESHAP (40 CFR 61, Subpart M); 40 CFR 763, Appendix D; and all other industry and regulatory requirements.

1.03 QUALITY ASSURANCE

- A. Codes and Standards: Perform all work in compliance with applicable requirements of governing authorities having jurisdiction and the applicable standards of the American Water Works Association (AWWA).
- B. Testing and Inspection Service
 - 1. Employ, at Contractor's expense, testing laboratory to perform bacteriological testing of water mains.
 - 2. It will be the responsibility of the Contractor to coordinate all testing and inspections. The Contractor shall notify the Owner, testing service, and applicable agency inspectors 48 hours in advance of testing and inspections.
 - 3. Hydrostatic test shall be completed by the Contractor in the presence of the Owner or Owner's representative.
 - 4. All water main taps to the existing system requires notification at least 72-hours in advance to the City of Marco Island Water and Sewer Department
- C. The manufacturer shall provide written certification to the Owner that all products furnished comply with all applicable requirements of these Specifications.

1.04 SUBMITTALS

- A. Prior to construction commencing, the Contractor shall submit for approval by the Owner manufacturer's certifications and cut sheets for the following items:
 - 1. Valves
 - 2. Water main pipe
 - 3. Fittings
 - 4. Tapping sleeves
 - 5. Other appurtenances
- B. Qualifications: If requested by the Owner, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.
- C. Test Reports: Submit Bacteriological Test Reports directly to the Owner's Engineer from the testing services with copy to Contractor.

1.05 EXISTING UTILITIES AND OBSTRUCTIONS

- A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner. The Contractor shall call the Sunshine State One Call of Florida, Inc. (1-800-432-4770), as required by Florida Law and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site, at least 72 hours (three business days) prior to construction, to verify the location of the existing utilities.
- B. Conflict with Existing Utilities
 - 1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed water main does not permit safe installation of the water main by the use of sheeting, shoring, tie-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the water main to avoid horizontal conflicts, if the new alignment remains within the available right-of-way or easement, complies with regulatory agency requirements, and after a written request to, and subsequent approval by the Owner. If, in the opinion of the Owner, the water main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the Owner will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.
 - 2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed water main does not permit the crossing without immediate or potential future damage to the utility, main, service, or the water main. The Contractor may change the proposed grade of the water main to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the Owner. If, in the opinion of the Owner, the water main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the Owner will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.
- C. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipelines or other obstructions.
- D. Water Main Separation Requirements in Accordance with F.A.C. 62-555.314
 - 1. Water mains constructed as part of this project shall be laid to provide a minimum horizontal distance of at least three feet between the outside of the water main and the outside of any existing or proposed vacuum-type

sanitary sewer, storm sewer, storm water force main, or pipeline conveying reclaimed water. A horizontal distance of at least six feet shall be provided between the outside of the water main and the outside of any existing or proposed gravity-type sanitary sewer, pressure-type sanitary sewer, wastewater force main, or pipeline conveying reclaimed water. A horizontal distance of at least ten feet shall be provided between the outside of the water main and all parts of any existing or proposed "on-site sewage treatment and disposal system".

2. Water mains constructed as part of this project, that will cross any existing or proposed gravity- or vacuum-type sanitary sewer or storm sewer will be laid so the outside of the water main is at least six inches above the other pipeline or at least 12 inches below the other pipeline. Water mains that will cross any existing or proposed pressure-type sanitary sewer, wastewater or storm water force main, or pipeline conveying reclaimed water will be laid so the outside of the water main is at least 12 inches above or below the other pipeline.
3. At the utility crossings described above, one full length of water main pipe will be centered above or below the other pipeline so the water main joints will be as far as possible from the other pipeline -or the pipes will be arranged so that all water main joints are at least three feet from all joints in vacuum-type sanitary sewers, storm sewers, or storm water force mains, and at least six feet from all joints in gravity or pressure-type sanitary sewers, wastewater force mains, or pipelines conveying reclaimed water.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All materials shall be new and unused. They shall be of standard, first grade quality and intended for the use for which they are offered. Materials or equipment which, in the opinion of the Owner, are inferior or of a lower grade than indicated, specified, or required will not be accepted.

2.02 WATER MAINS

- A. Polyvinyl Chloride (PVC) Pipe
 1. 3-inch and Larger Pipe: PVC pipe shall be manufactured in accordance with AWWA C900, latest edition. Pipe shall be pressure class 235 and must meet dimension requirements of dimension ratio (DR) 18 and shall bear the National Sanitation Foundation seal for potable water pipe. PVC pipe used for temporary phasing of construction that is above grade must be DR-14.
 2. Joints: Joints shall be "push-on" and shall meet all requirements of ASTM D3139. Each bell shall be an integral wall section joint assembly using

elastomeric gasket seals. All gaskets shall meet all requirements for performance as specified by ASTM F477. Joints for temporary PVC (DR-14) pipe above grade shall be restrained joint.

3. Bridge Mounted Pipe Brackets: Bridge-mounted water main piping shall be supported with a minimum of three (3) brackets per pipe span. One (1) bracket shall be installed on each side of each pipe joint, and one (1) bracket shall be installed at the midpoint of each pipe section. All brackets, fasteners, and anchorage hardware shall be fabricated from corrosion-resistant materials or provided with protective coatings suitable for the bridge environment and in accordance with FDOT requirements.
4. Pipe Marking: All pipe shall be marked as prescribed in ASTM D2241 (e.g., nominal pipe size, type of plastic pipe material, pipe dimension ratio, pressure rating, ASTM specification designation number, manufacturer's name and code), and the National Sanitation Foundation Seal for potable water.
5. PVC Pipe for water lines shall be blue.
6. Acceptance will be on the basis of the Owner's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSFApproved".

B. DUCTILE IRON PIPE (DIP)

1. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes shall be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

Pipe Sizes (inches)	Pressure Class (psi)
4 - 12	350
14 - 20	250
24	200
30 - 64	150

2. Flanged, or Flex-Joint pipe minimum wall thickness shall be equal to Special Class 53.
3. Pipe shall be cement lined in accordance with AWWA C104. Pipe shall be furnished with a bituminous outside coating. Seal coat over the cement lining is not required.

4. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum rated working pressure of 250 psi. Fittings shall be cement lined in accordance with AWWA C104 and shall be furnished with a bituminous outside coating. Seal coat over the cement lining is not required. In lieu of cement lining and bituminous coating, fittings may be provided with a fusion bonded coating and lining meeting the requirements of AWWA C116.
5. Bridge Mounted Pipe Brackets: Bridge-mounted water main piping shall be supported with a minimum of three (3) brackets per pipe span. One (1) bracket shall be installed on each side of each pipe joint, and one (1) bracket shall be installed at the midpoint of each pipe section. All brackets, fasteners, and anchorage hardware shall be fabricated from corrosion-resistant materials or provided with protective coatings suitable for the bridge environment and in accordance with FDOT requirements.

2.03 FITTINGS (3-inch and Larger)

- A. General: Fittings three inches and larger shall be ductile iron manufactured in accordance with ANSI/ AWWA C110/ A21.10 or C153/ A21.53. The minimum pressure rating for fittings shall be 250 psi.
- B. Coating: All fittings furnished with bituminous outside coating and shall be cement mortar lined and coated in accordance with AWWA C104.
- C. Anchoring Devices
 1. All anchoring devices shall be suitable for use with mechanical joint fittings meeting AWWA C110 and/ or AWWA C111.
 2. All anchoring devices shall be constructed of ductile iron (at least ASTM A536 Grade 70-50-05) and manufactured in accordance with AWWA C110 and/ or C111.
 3. All anchoring devices shall have a sufficient number of set screws so as to properly restrain various fittings or pipes at the rated pressure without the need for additional thrust restraint.
- D. Retainer Glands
 1. Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Glands shall be manufactured of ductile iron conforming to ASTM A536. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI A21.11 and ANSI/AWWA C153/ A21.53, latest revision. Twist-off nuts shall be used to insure proper actuating of the restraining devices.

2. Retainer glands for ductile iron pipe shall be Megalug Series 1100, as manufactured by EBAA Iron, Uni-Flange Series 1400, as manufactured by Ford Meter Box Company, or Star Pipe Products Star-Grip Series 3000.
3. Retainer glands for polyvinyl chloride pipe shall be Megalug Series 2000 PV, as manufactured by EBAA Iron, Inc.

E. Push-on Restraints

1. Push-on joint restraints shall be Fast-Grip Gasket by American Ductile Iron Pipe Co., or equal.
2. Bell harness restraints shall be Megalug Series 2500 by EBBA Iron or equal.

2.04 GATE AND TAPPING VALVES

- A. Smaller than 2-Inches in Diameter: Gate valves shall be bronze, heavy duty, rising stem, wedge type with screwed or union bonnet. Valve ends shall be threaded type. Valves shall have a minimum 200 psi working pressure for water (125 psi working pressure for steam). Valves shall be made in the U.S.A. Gate valves shall be Crane No. 428 (threaded).
- B. 2-Inches through 36-Inches in Diameter: Gate valves shall be resilient seat wedge encapsulated with EPDM rubber type conforming to the requirements of AWWA C509 or AWWA C515 rated for 200 psi working pressure.
 1. Valves shall be provided with two O-ring stem seals with one O-ring located above and one O-ring below the stem collar. The area between the O-rings shall be filled with lubricant to provide lubrication to the thrust collar bearing surfaces each time the valve is operated. At least one anti-friction washer shall be utilized to further minimize operating torque. All seals between valve parts, such as body and bonnet, bonnet and bonnet cover, shall be flat gaskets or O-rings.
 2. The valve gate shall be made of cast or ductile iron having a vulcanized, synthetic rubber coating, or a seat ring attached to the disc with retaining screws. Sliding of the rubber on the seating surfaces to compress the rubber will not be allowed. The design shall be such that compression-set of the rubber shall not affect the ability of the valve to seal when pressure is applied to either side of the gate. The sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.
 3. All internal ferrous surfaces shall be coated with epoxy to a minimum thickness of 4 mils. The epoxy shall be non-toxic, impart no taste to the water and shall conform to AWWA C550.
 4. Stem nuts shall be independent of wedge and shall be of solid bronze conforming to ASTM B62.

5. All valves shall open by turning a two-inch square operating nut counterclockwise.
6. Gate Valve: Joints shall be mechanical joints and shall conform to AWWA C111, and all bolts and nuts for mechanical joints shall be high-strength, low- alloy steel in accordance with AWWA C111. All gaskets shall be for a standard mechanical joint of BUNA-S (SBR Buna) in accordance with ANSI/ AWWA C111/ A21.4. All mechanical joint accessories shall be furnished with the valves.
7. All tapping valves shall have flange-by-mechanical joint ends.
8. All valves shall be furnished with operating nuts.
9. One operating wrench will be provided for each five valves furnished; at least one wrench shall be supplied.
10. All tapping valves shall be interchangeable with other makes of tapping sleeves.
11. Approved models are:
 - a. American Flow Control Series 2500 Resilient Wedge Valve
 - b. Mueller Company A-2362-78 Resilient Wedge Gate Valve with Aqua Grip
 - c. Kennedy
 - d. Clow

2.05 VALVE BOXES AND EXTENSION STEMS

- A. Valve boxes shall be provided for all buried valves. Valve boxes shall be one complete assembled unit composed of the valve box and extension stem. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. Valve box assembly shall be adjustable to accommodate variable trench depths.
- B. Covers shall have "WATER VALVE" or "WATER" cast into them. Valve boxes shall be manufactured in the United States.
- C. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The material shall be galvanized square steel tubing. The stem assembly shall have a built-in device that prevents the stem assembly from disengaging at its fully extended length. The extension stem must be capable of surviving a torque test to 1000 ft-lb without failure. Valve box shall be equal to American's trench adapter.
- D. Valve box collars shall be poured in place concrete.

2.06 VALVE MARKERS

- A. The Contractor shall provide a Carsonite Utility Markers or approved equivalent with U.V. resistant decal for each valve installed. Valve decal shall be stamped "CAUTION WATER VALVE".

2.07 CONCRETE

- A. Concrete shall have a compressive strength of not less than 3,000 psi, with fiber mesh and a slump between 3 and 5--inches.
 - 1. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60. The thrust box shall not be poured over bolts or in such a way to prevent bolt removal.

2.08 DETECTION TAPE/TRACER WIRE

- A. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket.
- B. Tapes shall be color coded in accordance with APWA color codes with the following legends: Water Systems, Safety Precaution Blue, "Caution: Water Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed.
- C. Tape width shall be minimum 2--inches when buried less than 10--inches below the surface. Tape width shall be minimum 3--inches when buried greater than 10--inches and less than 20--inches.
- D. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.
- E. In addition, the Contractor shall furnish and install 10-gauge coated copper tracing wire.

PART 3 – EXECUTION

3.01 HANDLING PIPE

- A. General
 - 1. All material, unless otherwise directed, shall be unloaded at the job site and distributed at the site of the project by the Contractor.
 - 2. Materials shall be handled with care to avoid damage. In loading and unloading, pipe shall be lifted by hoists or slid or rolled on skids in such a manner as to avoid shock. Under no circumstances shall pipe be dropped.
 - 3. Pipe handled on skids must not be allowed to roll against pipe already on the ground.

4. The Contractor shall be responsible for the safe handling of all materials. Damaged materials will be rejected by the Owner.
- B. Pipe shall be handled so as to avoid damage to the coating and lining. If, however, any part of the coating or lining is damaged by the Contractor, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Owner before installation.
- C. Pipe shall be distributed on the site of the work parallel with and opposite or near the place it is to be laid in the trench, and with bell ends facing the directions in which the installation will proceed unless otherwise directed.
- D. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.
- E. No pipe shall be strung further along the route than 1,000 feet beyond the area in which the Contractor is actually working without written permission from the Owner. The Owner reserves the right to reduce this distance to a maximum distance of 400 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.
- F. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.
- G. No distributed pipe shall be placed inside drainage ditches.
- H. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge--to--edge.

3.02 INSTALLATION OF PIPE

- A. General
 1. Upon satisfactory installation of the pipe bedding, as specified in the "Earthwork for Utilities" section of these specifications, a continuous trough for the pipe barrel and recesses for the pipe joints shall be excavated by hand digging so that, when the pipe is laid in the trench true to line and grade, the pipe barrel will receive continuous, uniform support, and the joint will receive no pressure from the trench bottom.
- B. The interior of all pipe shall be thoroughly cleaned of all foreign material before being lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods.
- C. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench, piece by piece, by means of hoisting apparatus, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to pipe, pipe coating, and pipe lining. Under no circumstances shall pipe or accessories be dropped,

dumped or rolled into the trench from finished ground level.

- D. The gasket material for each joint shall be properly positioned before the pipe is lowered into the trench. The joining of the pipe shall proceed in accordance with the manufacturer's requirements.
- E. Watertight plugs shall be installed in the open ends of the pipe at all times when pipe laying is not in progress. At no time shall trench water be permitted to enter pipe.
- F. Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe. Wherever it is necessary to cut gray or ductile cast iron pipe which is equipped with a push-on joint type bell end, the cut end of the pipe shall be adequately beveled so as to prevent the edge of the cut pipe from cutting or tearing the gasket as the plain end is inserted into the bell of the adjoining pipe or fitting. All field-cut pipe shall be beveled by the Contractor, and the pipe "short" shall be used as part of the pipeline construction.
- G. Whenever necessary to deflect pipe after proper homing from a straight line, either in the vertical or horizontal plane to avoid obstructions, the maximum allowable deflection shall be in accordance with 75% of manufacturers recommendation.
 - 1. Only after the pipe has been properly homed will it be allowed to deflect.
- H. No pipe shall be laid in water or when the trench conditions or the weather is unsuitable for such work.
- I. All water lines and services shall be located a minimum of 36 inches below grade unless noted otherwise on the drawings.
- J. Any pipe which is disturbed or found to be defective after laying shall be removed and re-laid or replaced.
- K. Prior to connecting new work to existing lines or appurtenances, the Contractor shall verify location and elevation of existing connection point and notify Owner of any conflicts or discrepancies.
- L. Joints
 - 1. Before laying the pipe, all lumps, blisters, and excess coal tar coating shall be removed from the bell and plain ends of each length of pipe. The pipe ends shall then be wire brushed and wiped until clean and dry. Where mechanical joints or push-on joints are specified, oil and grease also shall be removed. Pipe ends shall be kept clean until joints are made. The plain end of pipe for mechanical joints shall be lubricated with a soapy solution before installing the gaskets.

2. In making up the push-on type joint, the gasket shall be placed in the socket per manufacturer's recommendation. A thin film of lubricant (approved by the pipe manufacturer) shall then be applied to the inside surface of the gasket that will come in contact with the entering pipe. The plain end of the pipe to be entered shall be thoroughly cleaned and placed in alignment with the bell of the pipe to which it is to be joined. The joint shall be made by exerting sufficient force on the entering pipe so that the plain end is moved past the gasket until it seats as per manufacturer's recommendation.
 - a. Pipe lubricant shall be Ease-On Pipe Joint Lubricant or equivalent.
 - b. Shall be brushed over the gasket and the plain end of the pipe for push on joints and mechanical joints, where needed.
3. Backhoe buckets or excavation equipment are not to be applied directly to the pipe.
4. Mechanical joints shall be assembled in accordance with AWWA Standards. Mechanical joints shall be centered in the bells. Soapy water shall be brushed over the gasket just prior to installation. The gasket and gland shall be placed in position, the bolts inserted, and the nuts tightened by hand.
5. The bolts shall be tightened on opposite sides of the pipes by means of a torque wrench in such a manner that the gland shall be brought up evenly into the joint. The following range of bolt torques shall be applied:

<u>Bolt Size (Inches)</u>	<u>Range of Torque</u>
3/4" Diameter	85 to 95 ft.-lbs.
1" Diameter	95 to 100 ft.-lbs.
6. If effective seal is not obtained at a maximum torque listed above, the joint shall be disassembled and reassembled after thorough cleaning.
7. If a joint is defective, it shall be cut out and entirely replaced or, if permission is given by the Owner, it may be repaired by a suitable clamp.

M. Expediting of Work

1. Excavate, lay the pipe, and backfill as closely together as possible.
2. Do not leave un-joined pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress.
3. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the Owner.

N. Polyethylene Encasement

1. Installation shall be in accordance with AWWA C105 and the manufacturer's instructions.
2. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the Owner.
3. Installation shall be at locations shown on the Drawings.

3.03 INSTALLATION OF FITTINGS, VALVES AND TAPS

- A. Fittings shall be handled with care to avoid damage. All fittings shall be loaded and unloaded by lifting, and under no circumstances shall fittings be dropped, skidded, or rolled. Under no circumstances shall fittings be placed against pipe or other fittings in such a manner that damage could result. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surface or interior lining of fittings. If any part of the fittings' coating or lining is damaged by the Contractor, the repair or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the Owner before installing. Fittings shall also be stored at all times in a safe manner to prevent damage and kept free of dirt, mud, or other foreign matter. All fitting gaskets shall be stored and placed in a cool location out of direct sunlight and out of contact with petroleum products. All gaskets shall be used on a first-in, first-out basis.
- B. Fittings shall be set and joined to the pipe in a manner specified previously for joint assembly. When conditions warrant, fittings should be provided with special support trussing and blocking. Valves that are 12 inches and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. Valves shall be installed in the closed position.
- C. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves shall be corrected or held for inspection by the Owner.
- D. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 60-inches beneath finished grade so as to set the top of the operating nut 30-inches below

finished grade. The valve box cover shall be flush with the surface of the finished area, or such other level as directed by the Owner.

- E. All valve boxes set in non-paved areas shall have concrete pads poured around the top section of the valve box. The pad shall be a 36-inch square and shall be centered on the valve box. All water valve covers shall be painted safety blue as prescribed by the American Public Works Association (APWA) uniform color code for utility systems. All valve covers shall be cast with the word WATER. A 2" brass monument will be set on the Northeast corner of each 36-inch poured pad of the valve box indicating the valve size, type, and number of turns required.
- F. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.
- G. A valve marker shall be provided for each valve. Unless otherwise detailed on the Drawings or directed by the Owner, valve markers shall be installed 6 inches inside the right of way or easement. Raised pavement markers (RPM's) shall be provided and installed along the appropriate roadway centerline for each in-line valve installed. RPM's for in-line valves shall be Type I, two-way, and white in color.
- H. Blow-Offs: Blow-offs shall not be connected to any sewer or submerged in any stream or be installed in any other manner that will permit back-siphoning of contaminated water.
- I. The valve and valve box shall be installed so water department personnel can insert a valve key through the valve box and completely open and close the valve.

3.04 CONNECTIONS TO WATER MAINS

- A. Make connections to existing pipelines with tapping sleeves and valves, unless specifically shown otherwise on the Drawings.
- B. Location
 - 1. Before laying pipe, locate the points of connection to existing water mains and uncover as necessary for the Owner to confirm the nature of the connection to be made.
- C. Interruption of Services
 - 1. Make connections to existing water mains only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the Owner.
- D. Testing
 - 1. The Owner or their Representative must be present for the pressure test of the tapping saddle and tapping valve before the tap is allowed.

2. Test shall be done through the saddle and the test machine or the saddle and tap valve.

E. Tapping Saddles and Tapping sleeves

1. Holes in the new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be permitted. The coupon shall be delivered to the Owner or their Representative.
2. Prior to attaching the saddle or sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.
3. Before performing field machine cut, the water tightness of the saddle or sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with water. Then using a hydro-static hand pump, pump to a pressure of 150 psi to ensure all air is expelled. No leakage shall be permitted for a period of thirty minutes.
4. After attaching the saddle or sleeve to an existing main, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to potable water shall be swabbed or sprayed with a one percent hypochlorite solution.

F. Connections and Repairs

1. Where connections or repairs are required, Contractor shall only use solid sleeves and provide all materials and labor necessary to make the connection or repair to the existing pipeline, excluding service lines 2" or smaller.

3.05 THRUST RESTRAINT

A. Retainer Glands

1. Provide retainer glands at all points where hydraulic thrust may develop and on fire hydrants and all associated fittings, valves and related piping.
2. Retainer glands shall be installed in accordance with the manufacturer's recommendations, particularly, the required torque of the set screws.
3. The Contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.

B. Thrust Collars (Requires Engineer's Approval)

1. Concrete collars shall be constructed as shown on the Drawings.
2. The welded-on collar shall be attached to the pipe by the pipe manufacturer.
3. Filter fabric shall be installed between the thrust collar and the adjacent soil.
4. Thrust collars require Engineer's approval.

C. Concrete Blocking for Hot Taps (Requires Engineer's Approval)

1. Provide concrete blocking for all bends, tees, valves, and other points where thrust may develop, except where other exclusive means of thrust restraint are specifically shown on the Drawings. Filter fabric shall be installed between the concrete blocking and the adjacent soil.
2. Form and pour concrete blocking at fittings as shown on the Drawings and as directed by the Owner. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation
3. Concrete blocking requires Engineer's approval.

D. Bell Restraints

1. Bell restraints shall be installed where required to meet restrained joint length requirements.

3.06 TESTING AND INSPECTION REQUIREMENTS

- A. It will be the responsibility of the Contractor to coordinate all testing and inspections. The Contractor shall notify the Owner and applicable agency inspectors 48 hours in advance of testing and inspections.

3.07 HYDROSTATIC TEST

- A. All sections of the water main subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of main will be considered ready for testing after completion of all thrust restraint and backfilling.
- B. All tests shall be in the presence of the Owner or their Representative.
- C. Each segment of water main between main valves shall be tested individually.
- D. Test Preparation
1. Flush sections thoroughly at flow velocities, greater than 2.5 feet per second, adequate to remove debris from pipe and valve seats. See the Table below for flushing diameters required for all new pipe sizes. The Flushing volume shall be 10 times the pipe volume being flushed.

New Pipe Dia. (in.)	Minimum Pipe Dia. (in.) for 2.5 FPS Flushing
2	1
4	2
6	3
8	4
10	6
12	6
14	8
16	8
18	10
24	12

2. Partially operate valves and hydrants to clean out seats.
3. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipes, valves and appurtenances will be pressure tested.
4. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Insert corporation cocks at high points to expel air as main is filled with water as necessary to supplement automatic air valves. Corporation stops shall be constructed as detailed on the Drawings with a meter box.
5. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure.
6. The differential pressure across a valve or hydrant shall equal the maximum possible, but not exceed the rated working pressure. Where necessary, provide temporary backpressure to meet the differential pressure restrictions.
7. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure.

E. Test Pressure

1. Test the pipeline at 150 psi or 1.5 times the operating pressure, whichever is greater, measured at the lowest point for at least two hours.
2. Maintain the test pressure within 5 psi of the specified test pressure for the test duration (at least two hours).
3. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure.
4. Provide an accurate pressure gauge with graduation not greater than 5 psi.

F. Leakage

1. Leakage shall be defined as the sum of the quantity of water that must be pumped into the test section, to maintain pressure within 5 psi of the specified test pressure for the test duration. Leakage shall be the total cumulative amount measured on a water meter.
2. The Owner assumes no responsibility for leakage occurring through existing valves.

G. Test Results

1. No test section shall be accepted if the leakage exceeds the limits determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133,200}$$

Where: L = allowable leakage, in gallons per hour
S = Length of pipe tested, in feet
D = nominal diameter of the pipe, in inches
P = average test pressure during the leakage test in pounds per square inch (gauge)

As determined under Section 4 of AWWA C600.

* If the water main section being tested contains lengths of various pipe diameters, the allowable leakage shall be the sum of the computed leakage for each diameter. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.

H. Completion

1. After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.

I. Re-Testing

1. Any alterations made to pipeline performed after initial testing shall be re-tested and passed again, regardless of initial test results.

J. Notification

1. Owner shall be notified 24-hours in advance prior to Contractor performing pressure and leakage testing.

3.08 DISINFECTING PIPELINE

- A. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous -feed method and these Specifications.

B. Specialty Contractor

1. Before disinfection is performed, the Contractor shall submit a written procedure for approval before being permitted to proceed with the disinfection. This plan shall also include the steps to be taken for the neutralization of the chlorinated water.

C. Chlorination

1. Apply chlorine solution to achieve a concentration of at least 25 milligrams per liter free chlorine in new line. Retain chlorinated water for 24 hours.
2. Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the 24-hour period.
3. After 24 hours, all samples of water shall contain at least 10 milligrams per liter free chlorine. Re-chlorinate if required results are not obtained on all samples.

D. Disposal of Chlorinated Water

1. Reduce chlorine residual of disinfection water to less than one milligram per liter if discharged directly to a body of water or to less than two milligrams per liter if discharged onto the ground prior to disposal.
2. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual.
3. Flush all lines until residual is equal to existing system.
4. The Flushing volume shall be 10 times the pipe volume being flushed.

E. Bacteriological Testing

1. After final flushing and prior to DEP approval and the water main being placed into service, the Contractor shall collect samples from the line and have tested for bacteriological quality in accordance with the rules of the Florida Department of Environmental Protection.
2. The Contractor shall give Owner Utilities 48-hour written notice of the planned bacteriological testing. The Owner's Engineer representative must be present when samples are taken. Immediately after samples are taken, the Contractor shall be responsible for delivering the samples to the laboratory for testing. The bacteriological samples shall be analyzed for both coliform and non-coliform growth. Testing shall be performed by a laboratory certified by the State of Florida and approved by the Owner.
3. All sampling and testing costs shall be paid for by the Contractor prior to final acceptance.
4. Re-chlorinate lines until required results are obtained.

5. Contractor shall provide a map of all testing sample points which correspond to the testing results labeled appropriately by station numbers, intersection, etc.

END OF SECTION 2.2

SECTION 2.3 – Sanitary Force Main System

PART 1 – GENERAL

1.01 SCOPE

- A. This Section describes products to be incorporated into sewers and accessories and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.

1.02 DESCRIPTION OF WORK

- A. Extent of sewer collection system work is shown on the drawings.
- B. Sewer collection system work includes but is not limited to sanitary sewer mains, sewer laterals (services), manholes, frames, and covers.

1.03 QUALITY ASSURANCE

- A. Codes and Standards
 - 1. Perform all work in compliance with applicable requirements of governing authorities having jurisdiction and the applicable standards of the American Water Works Association (AWWA), American National Standards Institute (ANSI), and the American Society for Testing and Materials (ASTM), latest editions.
- B. Testing and Inspection
 - 1. Leakage testing and deflection shall be performed by the Contractor. General inspection and flashing lines shall be performed by the Owner.
 - 2. It will be the responsibility of the Contractor to coordinate all testing and inspections.
 - 3. The Contractor shall notify the Owner, testing service, and applicable agency inspectors 48 hours in advance of testing and inspections

1.04 SUBMITTALS

- A. Prior to beginning construction, the Contractor shall submit manufacturer's certifications and cut sheets for approval by the Owner for the following applicable items:
 - 1. Sanitary Sewer Pipe
 - 2. Fittings
 - 3. Service Laterals
 - 4. Clean Outs

- 5. Manhole Frames and
- 6. Cover

PART 2 – PRODUCTS

2.01 GENERAL

- A. All materials shall be in accordance with the Material Standard and shall, in no event, be less than that necessary to conform to the requirements of any applicable laws, ordinances, and codes.
- B. All materials shall be new, unused, and correctly designed. They shall be of standard, first grade quality and intended for the use for which they are offered. Materials or equipment which, in the opinion of the Owner, are inferior or of a lower grade than indicated, specified, or required will not be accepted.
- C. Sewer pipe construction shall be as shown on the drawings. Furnish ells, tees, reducing tees, wyes, couplings, increasers, crosses, transitions, and end caps of same type and class of material as conduit, or of material having equal or superior physical and chemical properties as acceptable to the Engineer.

2.02 POLYVINYL CHLORIDE (PVC) PIPE

- A. Pipe: PVC pipe shall be manufactured in accordance with ASTM D3034 and ASTM D1784.
- B. 4" to 15" Pipe and depths up to 10 feet: Shall be ASTM D2241, with a standard dimension ration (SDR) of 35.
- C. 4" to 15" Pipe above grade shall be ASTM D2241, with a standard dimension ration (SDR) of 14.
- D. 4" to 15" Pipe and depths greater than 10 feet: Shall be ASTM D2241, with a standard dimension ration (SDR) of 26.
- E. Joints: Joints for PVC sewer pipe shall be of the bell and spigot type conforming to ASTM D3212 using factory installed flexible elastomeric seals. The elastomeric seals shall conform to ASTM F477.
- F. Pipe Marking: All pipe shall be marked as prescribed in ASTM D2241 (e.g., nominal pipe size, type of plastic pipe material, pipe dimension ratio, pressure rating, ASTM specification designation number manufacturer's name and code).
- G. Coatings: Not required
- H. Cutting: PVC sewer pipe may be field cut using hand or power saws in accordance with the manufacturer's recommendations. The raw spigot end thus formed shall be filed to remove gasket damaging burrs and to form a standard bevel.

- I. Fittings: PVC sewer pipe fittings shall comply with ASTM D3034, ASTM 3212, and have elastomeric seals conforming to ASTM F477.
- J. Bridge Mounted Pipe Brackets: Bridge-mounted water main piping shall be supported with a minimum of three (3) brackets per pipe span. One (1) bracket shall be installed on each side of each pipe joint, and one (1) bracket shall be installed at the midpoint of each pipe section. All brackets, fasteners, and anchorage hardware shall be fabricated from corrosion-resistant materials or provided with protective coatings suitable for the bridge environment and in accordance with FDOT requirements.
- K. All PVC pipe for sewer shall be green, which shall be throughout the pipe wall.

2.03 DUCTILE IRON PIPE

- A. Pipe: All ductile iron pipe shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 42,000 psi, and a minimum elongation of 10% as specified by AWWA C151/ANSI A21.51.
- B. Joints: Joints for ductile iron pipe shall be either of the slip-on type using a single rubber gasket, or mechanical joints in accordance with AWWA C110/ANSI A 21.10.
- C. Bridge Mounted Pipe Brackets: Bridge-mounted water main piping shall be supported with a minimum of three (3) brackets per pipe span. One (1) bracket shall be installed on each side of each pipe joint, and one (1) bracket shall be installed at the midpoint of each pipe section. All brackets, fasteners, and anchorage hardware shall be fabricated from corrosion-resistant materials or provided with protective coatings suitable for the bridge environment and in accordance with FDOT requirements.
- D. Coatings: The interior of all pipes and fittings shall be lined with Protecto 401 ceramic epoxy to a dry thickness of 40 mils, Permox CTF to a dry thickness of 40 mils, or Series 431 Perma-Shield to a dry thickness of 40 mils. All pipe shall receive an exterior bituminous coating in accordance with AWWA C151 and AWWAC110.
- E. All ductile iron pipe for sewer shall have a green stripe at third points around the pipe for its full length.
- F. All ductile iron pipe above grade shall be flex-joint by American Pipe.

2.04 SOLID SLEEVES

- A. Solid sleeves shall permit the connection of plain end ductile iron pipe and plain end PVC pipe. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for long pattern and have a minimum pressure rating of 250 psi. Solid sleeves shall have a mechanical or restrained joint as specified in this Section and as shown on the Drawings. Solid sleeves shall be provided with gaskets suitable for

the type of pipe to be connected. Solid sleeves shall be used only in locations shown on the Drawings or at the direction of the Owner. Solid sleeves shall be coated with Protecto 401 Epoxy, Permox CTF, or PermaShield Series 431, all to a minimum DFT of 40 mils. Solid sleeves shall be manufactured by ACIPCO or U.S. Pipe.

PART 3 – EXECUTION

3.01 EXISTING UTILITIES AND OBSTRUCTIONS

- A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner. The Contractor shall call the Sunshine State One Call of Florida, Inc. (1-800-432-4770) or (811), as required by Florida Law and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site, at least 72 hours (three business days) prior to construction, to verify the location of the existing utilities.
- B. Conflict with Existing Utilities
 - 1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed sewer line does not permit safe installation of the sewer line by the use of sheeting, shoring, tie-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Owner will determine if the alignment can be changed to avoid the conflict. If, in the opinion of the Owner, the sewer line's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the Owner will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.
 - 2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed sewer line does not permit the crossing without immediate or potential future damage to the utility, main, service, or the sewer line. The Owner will determine if the grade can be adjusted to avoid the conflict. If, in the opinion of the Owner, the sewer line's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the Owner will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.
- C. Electronic Locator: The Contractor shall have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipelines or other obstructions.
- D. Sewer Collection System Separation Requirements
 - 1. Newly constructed sewers and force mains shall adhere to the separation requirements as listed in F.A.C. 62-604.

3.02 PIPE DISTRIBUTION

- A. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.
- B. No pipe shall be strung further along the route than 1,000 feet beyond the area in which the Contractor is actually working without written permission from the Owner. The Owner reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.
- C. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.
- D. No sewer pipes shall be placed inside drainage ditches.
- E. Sewer pipes shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured inside edge to inside edge.

3.03 INSTALLATION OF PIPE

- A. General: Upon satisfactory installation of the pipe bedding, as specified in the "Earthwork for Utilities" section of these specifications, a continuous trough for the pipe barrel and recesses for the pipe joints shall be excavated by hand digging so that, when the pipe is laid in the trench true to line and grade, the pipe barrel will receive continuous, uniform support, and the joint will receive no pressure from the trench bottom.
- B. Polyvinyl Chloride Pipe: Installation shall be in accordance with the recommended practices in ASTM D2321.
- C. Ductile Iron Pipe: Installation shall be in accordance with the latest technical literature provided by the Ductile Iron Pipe Research Association.
- D. Transportation: Care shall be taken during transportation of the pipe so that it is not cut, kinked, or otherwise damaged.
- E. Handling Pipe Lengths: Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipes.
- F. Special Precautions: Polyvinyl chloride pipe connected to heavy fittings, manholes, and rigid structures shall be supported in such a manner that no subsequent relative movement between the pipe and the joint with the rigid structures is possible.

- G. The interior of all pipe shall be thoroughly cleaned of all foreign material before being lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods.
- H. Pipe laying shall proceed upgrade with spigot ends pointing in the direction of flow. Before pipe is joined, gaskets shall be cleaned of all dirt, stones and other foreign material. The spigot ends of the pipe shall be lubricated lightly with a lubricant specified by the pipe manufacturer and approved by the Owner. Sufficient pressure shall be applied to the pipe so as to properly seat the socket in the bell of the pipe. All pipe shall be laid straight, true to the lines and grades shown on the drawings in each manhole section.
- I. Under no circumstances shall pipe be laid in water or when trench conditions or the weather is unsuitable for such work, except by permission of the Owner. At all times when work is not in progress, the exposed ends of all pipes shall be fully protected by a board or other approved stopper to prevent earth or other substances from entering the pipe.
- J. Lowering Pipe into Trench: Care shall be exercised when lowering pipe into the trench to prevent damage to, or twisting of, the pipe.
- K. Except as modified hereinafter, embedment material for PVC gravity sewer pipe shall be either Class I, II, or III material as described in ASTM D2321. The “embedment detail for PVC gravity sewer pipe” shown in the project plans illustrates the meaning and limits of the terms “haunching, foundation or bedding”, and “initial backfill”.
 - 1. The table below shall be used in determining the material required for embedment of PVC gravity sewer pipe.

EMBEDMENT FOR PVC GRAVITY SEWER PIPES			
Pipe Depth	Bedding or Foundation	Haunching	Initial Backfill
16' or less	CL. I, II or III	CL. I, II or III	CL. I, II or III
Greater than 16'	CL. I or II	CL. I	CL. I, II or III

- 2. In areas where the existing material is other than as described above, and is not acceptable for use as embedment material, refer to City’s Standard Pipe Embedment Detail. Separate payment will be made for gravel used for foundation or bedding and haunching under the items of “Gravel Foundation” and “Haunching for PVC Pipe”, respectively. There will be no payment for embedment material when existing material is utilized.
- 3. In areas where the pipe is below the water table or expected to be below the water table in the future, and the foundation or bedding material is Class I material, whether existing or as installed, gravel shall be used for

haunching of the pipe. Separate payment will be made for gravel used for haunching of the pipe under the item of "Haunching for PVC Pipe".

- L. Embedment materials listed here include a number of processed material plus the soil types listed under the USGS Soil Classification System *FHA Bulletin No. 373). These materials are grouped into 5 broad categories according to the suitability for this application:
1. Class I – Angular, 6 to 40 mm (1/4 to 1-1/2 inch), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone and crushed shells.
 2. Class II – Coarse sands and gravels with maximum particle size of 40 mm (1- 1/2 inch), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Type GW, GP, SW, and SP are included in this class.
 3. Class III – Fine sand and clayey gravels, including fine sands, sand-clay mixtures and gravel-clay mixtures. Soil Types GM, GC, SM and SC are included in this class.
 4. Class IV – Silt, silty clays and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH and CL are included in haunching, or initial backfill.
 5. Class V – This class includes the organic soils OL, OH, and PT as well as soils containing frozen earth, debris, rocks larger than 40 mm (1-1/2 inch) in diameter, and other foreign materials. These materials are not acceptable for bedding, haunching, or initial backfill.
- M. All sewer lines and laterals shall be located a minimum of 36 inches below grade and at greater depths as required to provide service.
- N. After each pipe is laid, it shall be partly backfilled and made secure before the next joint is laid.
- O. Any pipe which is disturbed or found to be defective after laying shall be removed and relayed or replaced at the Contractor's expense. Sun bleached PVC Pipe is considered defective.
- P. Whenever pipe laying is stopped for the night or for any other cause, the end of the pipe shall be securely closed with a stopper to prevent the entrance of water, mud, or other obstructing matter, and shall be secured in such a manner as to prevent the end pipe from being dislodged by sliding or other movement from the backfilling.

Q. Interior Inspection

1. The Contractor shall inspect pipe to determine whether line displacement or other damage has occurred. The Contractor shall pull a 12" long mandrel through the pipe to make sure the pipe has not been damaged during compaction or has a belly in it. The Contractor shall make inspections after lines between manholes, or manhole locations have been installed and approximately two feet of backfill is in place and at completion of project. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects to satisfaction of the Owner.
 2. All Gravity Sewer lines must be videoed after system is completed and reviewed and approved by the City. Videos must be digital format with system location map and include identification for each manhole and segment of pipe. Each joint should be able to be visibly inspected the entire 360 degrees perimeter, and all lateral connections should be drawn.
 3. Make inspections after lines between manholes, or manhole locations, have been installed and approximately two feet of backfill is in place and at completion of project.
 4. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects to satisfaction of Engineer.
- R. Prior to connecting new work to existing lines or appurtenances, the Contractor shall verify location and elevations of existing connection points and notify the Owner of any conflicts or discrepancies.
- S. Wyes or tees of specified diameter shall be inserted in the sewer lines wherever designated.
- T. All sewer laterals shall be located a minimum of 36 inches below grade and at greater depths as required to provide service.
- U. Long radius wyes or tees of specified diameter shall be inserted in the sewer lines to provide service to each lot or wherever designated by the Owner.
- V. Where new laterals are specified on the plans, or instructed to be installed by the Owner, they shall be laid to the edge of the right-of-way or as the Owner may direct. The location of the lateral at the right-of-way shall be recorded on the record drawings. In sewers over eight feet in depth, or where directed, stacks shall be carried up from the wye connections at a maximum angle of 45 degrees. The ends of the laterals shall be closed with plugs or covers. Materials for stacks and laterals shall be as shown on the details or designated in the proposal.

- W. Whenever pipe laying is stopped for the night or for any other cause, the end of the pipe shall be securely closed with a stopper to prevent the entrance of water, mud, or other obstructing matter, and shall be secured in such a manner as to prevent the end pipe from being dislodged by sliding or other movement from the backfilling.
- X. Wherever existing house laterals are encountered or identified by the Owner to be installed, they shall be replaced and connected to the existing lateral at the edge of right-of-way. A new PVC cleanout as shown on typical wye and lateral installation shall be installed. If necessary, the new lateral could be plugged with a pneumatic plug for pressure testing the sewer main; however, under no circumstances should the lateral be plugged for more than one hour. Additionally, it shall be the Contractor's responsibility to notify the resident 24 hours prior to such outage. House laterals are not to be shared between houses. When lateral construction is before or concurrent with curb construction, a mark shall be scribed permanently in concrete curbs, gutters, or valley gutters to represent the location of the laterals.
- Y. Wherever house laterals are intercepted by the excavation for the new sewer, connection shall be maintained temporarily to the old sewer until the particular section of new sewer is completed, tested, and approved. The house lateral shall then be broken and reconnected to the new sewer through a wye which shall have been placed in the new sewer for that purpose.
- Z. The dead end of the house lateral shall be capped with a cover or plug as specified on the drawings. The covers or plugs shall have a factory-molded joint of the same type as used for the lateral pipe and shall be of the same material. Record the location of all laterals at the right-of-way and place the information on the record drawings.
- AA. Joint Adaptors: Make joints between ductile iron pipe and other types of pipe with standard manufactured ductile iron adapters and fittings.
- BB. After each pipe is laid, it shall be partly backfilled and made secure before the next joint is laid.
- CC. Ductile Iron Pipe: Installation shall be in accordance with the manufacturer's recommendations and the ductile iron pipe research association publication "A Guide for the Installation of Ductile Iron Pipe".
- DD. Polyvinyl Chloride Pipe: Installation shall be in accordance with the recommended practices in ASTM D2321.

3.04 STORAGE AND HANDLING PIPE

- A. Storage: Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe.
- B. Stacking of polyvinyl chloride pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary, due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with sleeper or between supports.
- C. Handling Pipe: The handling of pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Sections of the pipe with deep cuts and gouges shall be removed.

3.05 CLOSING OUT OF SERVICE UTILITIES

- A. Close open ends of out of service underground utilities which are indicated to remain in place. Provide sufficiently strong closures to withstand hydrostatic or earth pressure which may result after ends of out of service utilities have been closed.
- B. Close open ends of concrete or masonry utilities with not less than eight-inch-thick brick masonry bulkheads.
- C. Close open ends of conduit with plastic plugs, or other acceptable methods suitable for size and type material being closed. Wood plugs are not acceptable.
- D. If required, fill the out of service line(s) with flowable fill as shown in the plans and as directed by the Owner.

3.06 CONNECTION TO AN EXISTING MANHOLE

- A. Connection to an existing manhole shall be made by mechanically coring into the wall structure of the manhole. The cored opening shall be sized to properly accommodate a rubber boot seal as required by specification Section 02510. The manhole is to be lined if it is going to be used for a force main or a grinder station discharge connection. The liner shall be per the Sanitary Sewer Manhole Rehabilitation specification. No house lateral shall be terminated in a manhole unless it goes into a dead-end manhole.

3.07 TESTING REQUIREMENTS

- A. General
 - 1. The Contractor shall perform a leakage test and shall carry out a mandrel test. The Contractor shall furnish all apparatus and materials needed for these tests, the cost of which shall be included in the appropriate bid item.

2. After backfilling has been completed, the pipes cleaned and before permanent paving has been installed, the Contractor shall complete the required testing to ascertain that there are no broken pipes, leaking joints or deflected pipe sections. Pipes failing these tests shall be repaired or replaced by the Contractor to meet the requirements of project documents.
3. The sewer lines and laterals shall be tested for leakage between manholes as the work progresses by one of the following methods as determined by the Owner. The low-pressure air test per ASTM F1417 will be used unless directed otherwise.
 - a. Low Pressure Air Test
 - b. Infiltration Test
4. A deflection test, using a mandrel, will be required for PVC pipe in addition to the above leakage tests.
5. The Contractor shall check alignment by “flashing” the lines.
6. For sewer pipe 8” or greater, a video of the pipe shall be provided to Owner.
7. All tests will be witnessed by the Owner. The Contractor shall notify the Owner at least 24 hours in advance of testing.

B. Infiltration Method

1. General
 - a. Infiltration tests of sewers and laterals shall be as specified hereinafter. Each manhole run will be tested separately as the construction progresses, before surface restoration, and preferably with not more than four (4) manhole runs constructed ahead of testing.
2. Infiltration Test
 - a. Infiltration tests will be acceptable only when the ground water can be established as imposing a minimum 6-foot head at the pipe invert.
 - b. Plug the upstream manhole and make measurement of the flow at the downstream manhole. Amount of leakage from any section of the sewer shall not exceed the allowable gallons as stated hereinafter per inch diameter of pipe per mile per 24 hours.

3. Leakage Allowance

- a. Maximum allowable leakage for infiltration shall be:

Pipe Material	Leakage per inch dia. of pipe per mile per 24 hrs
PVC	50 gallons
DI	50 gallons

C. Low Pressure air test Method

1. Testing shall be in accordance with UNI-B-6-98, Unibell PVC pipe Corporation. Constant pressure of 4.0PSIG (Greater than the Groundwater backpressure)
2. Low pressure air test of sewers and laterals shall be as specified hereinafter. Each manhole run will be tested separately as the construction progresses, before trench surface restoration, and preferably with not more than four manhole runs constructed ahead of testing.
3. Equipment shall be as manufactured by Cherne Industries, Inc., of Minneapolis, MN; or equal. Equipment used shall meet the following minimum requirements:
 - a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested.
 - b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
 - c. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be used. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized, as noted below. The plugs must hold against this pressure without having to be braced.
 - d. All air used shall pass through a single control panel.
 - e. Three individual hoses shall be used for the following connections:
 - 1) One hose from control panel to pneumatic plugs for inflation.
 - 2) One hose from control panel to sealed line for introducing the low- pressure air.
 - 3) One hose from sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

4. Procedures

- a. After a manhole reach of pipe including laterals has been backfilled in accordance with the specifications, the pipe cleaned, and the pneumatic plugs have been checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low-pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average ground water back pressure. At least two minutes shall be allowed for the air pressure to stabilize.

After the stabilization period the pressure can be reduced to 3.5 psig prior to starting the test., the air hose from the control panel to the air supply shall be disconnected. The portion of the sanitary sewer (line) being tested shall be termed "Acceptable," if the time required in minutes is greater than the times indicated in the following table for the pressure to decrease from 3.5 psig (greater than the average ground water back pressure) to 2.5 psig (greater than the average ground water back pressure) or drop 1 psig if the start pressure is greater than 3.5 psig.

Table 1 (from ASTM F1417)

Minimum Specified Time Required for a 1.0 psig Pressure Drop for Size and Length of
Pipe Indicated for Q=0.0015

Pipe Diam eter In.	Minimu m Time Min:s	Leng th For Min. Time , ft.	Time for Longer Lengths; s	Specification Time for Length (L) Shown, min:s							
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

- b. In areas where a high groundwater table (groundwater back pressure) is known to exist, the Contractor shall install a 1/2-inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the groundwater shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The plastic tube shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. The height of water in the plastic tube in feet shall be divided by 2.31 to establish the pounds of groundwater back pressure that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added groundwater back pressure shall be 5 psig. This increases the 3.5 psig to 8.5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same as defined in Table 1.) Should the Contractor desire to use an alternate method for establishing back pressure due to high water, details may be provided to the Owner for review and consideration of approval.
- c. If the ground water level is 2 ft or more above the top of the pipe at the upstream end, or if the air pressure required for the test is greater than 9-psi gage, the air test method should not be used. Before the air test method is used, the ground water level should be lowered by pumping or dewatering.
- d. The Contractor shall keep records of all tests made. Copy of such records will be given to the Owner. Such records shall show date, line number and stations, operator, and such other pertinent information as required by the Owner.

D. Deflection Test – PVC only

1. General

- a. Deflection testing shall be performed on all portions of the PVC sewer system. This test shall be performed in sections between manholes at least 30 days after final backfilling has been completed.
- b. Deflection testing shall be performed in accordance with the procedure outlined below.

2. Maximum Deflection

- a. The maximum allowable deflection for all installed PVC sewer pipe shall not exceed 5% of the pipe's original internal diameter.

3. Test Apparatus

Nominal Size	Average I.D.	Base I.D.	Minimum Mandrel Diameter
ASTM D3034 - SDR 35			
8	7.920	7.665	7.28
10	9.900	9.563	9.08
12	11.780	11.361	10.79
15	14.426	13.898	13.20
ASTM F679			
18	17.629	16.976	16.13
21	20.783	20.004	19.00
24	23.381	22.480	21.36
27	26.351	25.327	24.06

- a. All PVC sewer pipe shall be tested by the Contractor and at his expense for diametric deflection using a GO-NO-GO type mandrel or other approved method. The mandrel shall have an outside diameter of no less than 95% of the PVC pipe inside diameter. No allowances will be made for standard pipe deflections noted in the manufacturer's specifications. The size of mandrel shall be determined by the following: Pipe inside diameter x 0.95. Any section not allowing passage of said mandrel shall be deemed unacceptable. The Contractor shall, at his expense, determine the location and extent of the problem and make repairs or re- lay the line segment as determined by the Owner. This test procedure, in accordance with these Specifications, will be repeated after a problem has been corrected. This testing shall be accomplished prior to final acceptance.

4. Deflection Testing Procedure

- a. Completely flush the line making sure the pipe is clean of any mud or debris that would hinder the passage of the mandrel.
- b. During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line. (A braded nylon rope is recommended).
- c. After the rope is threaded through the line, connect the pull rope to the mandrel and place the mandrel in the entrance of the pipe.

- d. Connect a retrieval rope to the back of the mandrel to pull it back if necessary.
- e. Remove all the slack in the pull rope and place a tape marker on the rope at the ends of the pipe.
- f. Draw mandrel through the sewer line. If any irregularities or obstructions are encountered in the line, corrective action shall be taken as required.
- g. If a section with excessive deflection is found, it shall be located and excavated. The pipe shall be inspected for damage; if any damaged pipe is found, it shall be replaced at the Contractor's expense; if pipe is not damaged, replace and thoroughly tamp the haunching and initial backfill; replace remainder of backfill.
- h. Re-test this section for deflection.

E. Flashing Lines

- 1. Upon completion, and in the presence of the Owner, the sewer lines shall be flashed between manholes. In each section of the sewer, a round circle of light, full diameter, shall remain constantly in plain view throughout the entire length. The test shall be applied for each section after the sewer is completed in all respects and before it is accepted.

F. Test Failures

- 1. If the installation fails to meet the stated test requirements, the Contractor at his own expense shall determine the source of leakage, repair or replace all defective materials and/ or workmanship failing to meet tests and shall retest same until it is proven that installation meets requirements of project documents as determined by the Owner.
- 2. In the event the test results are not within the allowable range of acceptance, the Contractor shall take whatever corrective action is necessary including replacement of the said pipe, etc., to bring the test results within the allowable range of acceptance.

END OF SECTION 2.3