

**TECHNICAL SPECIFICATIONS****T1.00 GENERAL REQUIREMENTS****T1.01 Summary of Work**

The Contractor shall have access to and inspect the project area prior to beginning construction and ascertain existing conditions as per Section I-2.01 of the Instructions to Bidders.

The work will include the furnishing of all services, labor, equipment and certain materials necessary for a complete installation of water lines and performed in a thorough and workmanlike manner, as outlined in Section G-1.02 of the General Provisions. All items implied, usually included, or required for the construction of a complete operating system shall be installed whether or not shown on the plans or specified herein. In general, pipe shall be provided with a minimum of 36 inches of cover.

The Contractor will preserve and protect all existing vegetation such as trees, shrubs and grass adjacent to the site, as outlined in Sections G-9.02 and G-9.03 of the General Provisions, which do not reasonably interfere with the construction, as determined by the Engineer. It will be the Contractor's responsibility to give written notification, at least 2 days prior to commencement of construction, to any owners or occupants of properties along the construction route. This notification shall be about the pending construction, in order to allow the said owners or occupants an opportunity for removing from the work site any bushes, flowers, plantings, trees etc. they wish to save that are within the limits of construction. The Contractor will be responsible for all unauthorized cutting or damaging of trees and shrubs, including damage due to careless operation of equipment, stockpiling of materials or tracking of grass by equipment. The Contractor will be liable for, or will be required to replace or restore at no additional expense to the City, all vegetation not protected or preserved as required herein that may be damaged or destroyed.

**T1.02 Coordination**

The Contractor shall provide for the complete coordination of the construction effort including the work of subcontractors, the effort of independent testing agencies and the interrelated work with the City where tie-ins to existing facilities are required.

It shall be the Contractor's responsibility to alert the Engineer at least two working days in advance of construction, to any conflicts or potential conflicts with the proposed work. Failure of the Contractor to review the job site and alert the Engineer to any conflicts shall relieve the City from compensating the Contractor for any cost arising from any remedial

action necessary to resolve the conflict with the proposed work.

All water lines, storm drains, sanitary sewers, gas or other pipe, telephone or power cables or conduits, all individual service connections and all other obstructions, whether or not shown on the plans, shall be supported where adjacent to or crossing the new utility line excavation in a manner acceptable to the Department and the respective utility owner. Wherever existing utility structures or branch connections leading to sanitary sewers or to storm drains, or other conduits, ducts, pipes, or structures present obstructions to the grade and alignment of the pipe, they shall be permanently supported, removed, relocated, or reconstructed by the Contractor through cooperation with the owner of the respective utility, structure, or obstruction involved. In those instances where their relocation or reconstruction is impractical, a deviation from line and grade will be authorized and the changes shall be made in the manner directed by the Engineer.

Approximate locations of known water, sanitary, drainage, power and telephone installations along the route of the new water mains or in the vicinity of new work are shown, but must be verified in the field by the Contractor. Any discrepancies or differences found shall be brought to the attention of the Engineer, in order that necessary changes may be made to permit installation of new pipe and actual locations recorded for the City's record drawings.

In addition, careful coordination with the work of other contractors may be required if other work is underway within the project area.

Working adjacent to and crossing other utilities can be expected to be commonplace on this project. The Contractor, as outlined in Article G- 1.03 of the General Provisions, shall coordinate his construction schedule with the various utility companies as well as affected local agencies involved prior to starting the project along with a minimum of 48 hours notice to when construction will commence in an area, in order to permit field location of utility lines prior to construction. A toll free number, 811 is available to assist in such coordination efforts. This number is for the utility notification center, a program known as Sunshine State One Call of Florida, but may not totally represent all utilities involved in the construction area. The Contractor is responsible for contacting the utility notification center and to immediately notify the Water Department's Chief Construction Engineer (259-1636) of the "Location Request Number" obtained.

The various agencies or utilities possibly affected by the work include but are not necessarily limited to the following:

City of Tampa  
Wastewater Department  
306 E. Jackson St. (390A6N)

Tampa, FL 33602

Florida Dept. Transportation  
2820 Leslie Rd.  
Tampa, FL 33619

DPW Traffic Transportation  
306 E. Jackson St., (290A4E)  
Tampa, FL 33602

Hillsborough County  
Planning & Devel. Mgmt. Dept.  
P.O. Box 1110  
Tampa, FL 33601  
276-8323

Hillsborough County Right of Way Management office  
5701 East Hillsborough Avenue  
Suite 1222  
Tampa, Florida 33610

All utilities shall be kept in operation except with the express written consent of the utility owner. It will be the Contractor's responsibility to preserve existing utilities. Any and all damage to existing utilities as a result of the Contractor's actions shall be repaired to the satisfaction of the utility owner and the City at the Contractor's expense.

Where connections are made to existing mains or other shutdowns are necessary, permission must be obtained and arrangements must be made with the Water Department for removing from service those mains that will be affected. Shutdowns must be held to a minimum in both number and duration, and accomplished at times acceptable to the Water Department. No valve or other control device on the existing system shall be operated by the Contractor except as detailed in the Specific Provisions, sections S-31.01 - Shutdowns. Additionally, any service meter that is temporarily removed, after being approved by the Water Department, shall be returned to the original service address from which it was removed.

**T1.03 Field Engineering**

Each element of the work is subject to review by the Engineer, prior to proceeding with the next element; however, this shall not relieve the Contractor of the responsibility for delivering to the City a project completed in conformance with the contract plans and specifications and guaranteed as stipulated.

**T1.04 Abbreviations and Symbols**

Various abbreviations and symbols may be used or referenced in these specifications and contract plans. Symbols are generally explained on the sheet of the plans entitled "Location Map, Legend and General Notes". Abbreviations commonly used, along with their full reference, are as follows:

- |     |               |   |   |
|-----|---------------|---|---|
| 1.  | Cu. Yds. (CY) | - | Cubic Yards   |
| 2.  | FDEP          | - | Florida Department of Environmental Protection          |
| 3.  | DIP           | - | Ductile Iron Pipe                                       |
| 4.  | DIPRA         | - | Ductile Iron Pipe Research Association (formerly CIPRA) |
| 5.  | FDOT          | - | Florida Department of Transportation                    |
| 6.  | EA            | - | Each  |
| 7.  | Lin. Ft. (LF) | - | Lineal Foot   |
| 8.  | HDPEP         | - | High Density Polyethylene Pipe                          |
| 9.  | LS            | - | Lump Sum  |
| 10. | mg/l          | - | Milligrams Per Liter                                    |
| 11. | NSF           | - | National Science Foundation                             |

12.	OSHA	-	Occupational Safety and Health Administration
13.	ppm	-	Parts Per Million
14.	psi	-	Pounds per Square Inch
15.	PVCP	-	Polyvinyl Chloride Pipe
16.	RPR	-	Resident Project Representative
17.	S.P.	-	Steam Pressure
18.	Sq. Ft. (SF)	-	Square Feet
19.	Sq. Yds. (SY)	-	Square Yards
20.	TN	-	Ton
21.	W.O.G.	-	Water, Oil, Gas
22.	HDD	-	Horizontal Directional Drilling
23.	MJ	-	Mechanical Joint
24.	FL	-	Flanged Joint
25.	CIP	-	Cast Iron Pipe
26.	NAVD88	-	North American Vertical Datum 1988

#### **T1.05 Submittals, Shop Drawings, Product Data and Samples**

The Contractor shall submit 4 copies of shop drawings as stated in Article G-3.02 of the General Provisions, plus those copies necessary for his own requirements in accordance with Section 3 of the General Provisions. The shop drawings shall have been checked and stamped approved by the Contractor and identified as the Engineer may require. This data shown in the shop drawings shall be complete with respect to dimensions, design criteria, materials of construction, and the like, to enable the Engineer to review the information required. The data shown on the shop drawings shall include, in addition to that specified in the General Provisions, reference to specification section, drawing number, item identification on catalog cuts and like information to expedite review. Incomplete

submissions will be returned without action.

Items that are on the Water Department's pre-approved material list will not be required to go through the shop drawing submittal process, provided that the list of materials is submitted to and approved by the Engineer in advance of the start of construction.

The Engineer will review and return one (1) set of the shop drawings along with those sets submitted by the Contractor over and above the quantity required by Article G-3.02 of the General Provisions. The returned sets shall bear the Engineer's comments and shall be returned with reasonable promptness. The Contractor's stamp of approval on any shop drawing shall constitute a representation to the Engineer that the Contractor has either determined and verified all field construction criteria, materials, catalog numbers and similar data or he assumes full responsibility for doing so, and that he has reviewed or coordinated each shop drawing with the requirements of the work, contract documents and technical specifications.

The Engineer's review of a shop drawing is only for general conformance with the design concept of the project, and shall not relieve the Contractor from his responsibility for and deviation from the requirements of the contract documents or technical specifications, unless the Contractor has, in writing, called the Engineer's attention to such deviation at the time of the shop drawing submission and the Engineer has given written approval to the specific deviation. Any review by the Engineer shall not relieve the Contractor from his responsibility for errors or omissions in the shop drawings.

One complete set of reviewed shop drawings, product data and samples shall be kept at the site at all times. During the work specified as shown on the shop drawings, the Contractor shall make no deviations from the reviewed drawings, and the changes made thereon by the Engineer, if any.

When required by the Engineer, shop drawings or product data shall be submitted for, but shall not be necessarily be limited to, the following:

- Electrofusion equipment and personnel certifications
- Butt fusion equipment and personnel certifications
- Horizontal directional drilling equipment and personnel certifications
- HDPE pipe, fittings and accessories
- Ductile iron pipe and fittings, including restrained joint type,
- Gate valves and butterfly valves,
- Tapping valves and sleeves
- Fire Hydrants
- Air release valves and Pedestals,
- Casing pipe and jack and bores,

Concrete mix design, reinforcing steel and pre-cast items, if used.  
All electrofusion fittings

Whenever a standard of quality is established by a reference specification, the Contractor shall submit a certificate by the manufacturer that the material supplied meets the requirements of both these technical specifications and the referenced specifications and standards.

### **T1.06 Quality Control**

In addition to the inspection and testing outlined in Section 5 of the General Provisions, compaction/density tests also shall be required.

For tests required by the Technical Specifications regarding soil compaction, asphalt testing and concrete cylinder strength, the Department will appoint and employ services of an independent firm to perform inspection and testing. The independent firm will perform inspections, tests, and other services specified individual specification Sections and as required by the Engineer. Reports will be submitted by the independent firm to the Engineer, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents. The Contractor shall cooperate with the independent firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested; notify Engineer and independent firm a minimum of 24 hours prior to expected time for operations requiring services; and make arrangements with the independent firm and pay for additional samples and tests required for Contractor's use. Retesting required due to non-conformance with specified requirements shall be performed by the same independent firm at the direction of the Engineer. Payment for retesting will be charged to the Contractor by deducting inspection or testing charges from the Contractor's payment.

### **T1.07 Materials and Equipment**

#### **A) General**

Materials and equipment incorporated into the work shall meet the requirements of Section 4 of the General Provisions and these specifications. The Contractor shall furnish satisfactory evidence of the quality and kind of materials and equipment as well as guarantees or warranties provided by the manufacturer. It will be necessary to submit a copy of all delivery tickets for materials used on the project, regardless of the basis of payment.

Materials, supplies or equipment to be incorporated into the work shall not be purchased by the Contractor or subcontractors subject to a chattel mortgage or under

a conditional sale contract or other agreement by which an interest is retained by the seller.

All materials and equipment shall be applied, installed, connected, erected, used, cleaned, finished and conditioned in accordance with the instructions of the applicable manufacturer, fabricator or processor except as otherwise provided in the Contract Documents. At the time that any piece of equipment is placed in service or operation at the construction site, the Contractor shall arrange for a qualified representative of the manufacturer to be present for the purpose of inspecting, approving and adjusting the equipment installation. He shall remain on the job to instruct the City's personnel in proper operation and maintenance and shall remain until the equipment is operating in a satisfactory manner.

B) Quality Standards

If a standard of quality for items of equipment is established by reference on the plans or in the specifications to specific manufacturer's products, materials or construction and/or fabrication, items of equipment shall equal or exceed the standard of the referenced product as outlined in Section G-4.05 of the General Provisions.

The Engineer shall be the sole judge of material or equipment equality. The burden of proof of equality rests with the Contractor. Qualities described and shown refer to minimum criteria the Engineer will use in considering equipment proposed for the project.

It is not the intent of the Contract Documents to function as proprietary specifications. Where a particular manufacturer make and model are cited and specifically required for interchangeability of parts and to match existing equipment, this has been stated in the specifications.

C) Transportation and Handling

Materials and equipment shall be loaded and unloaded by methods affording adequate protection against damage. Every precaution shall be taken to prevent injury to the material or equipment during transportation and handling. Suitable power equipment will be used and the material or equipment shall be under control at all times. Under no condition shall the material or equipment be dropped, bumped or dragged. When a crane is used, a suitable lift sling shall be used.

The crane shall be placed so that all lifting is done in a vertical plane. Materials or equipment skid loaded, palletized or handled on skidways shall not be skidded or

rolled against material or equipment already unloaded.

Materials and equipment shall be delivered to the job site by means that will adequately support it and not subject it to undue stresses. Material and equipment damaged or injured in the process of transportation, unloading or handling shall be rejected and immediately removed from the site. They shall be replaced with materials that meet all requirements of the contract documents and are suitable to the Engineer.

D) Storage and Protection

Materials and equipment shall be stored in a manner and at a location acceptable to the Engineer to insure the preservation of their quality and fitness for the work and which precludes damage or injury and affords protection against weather staining, corrosion or vandalism. Skidded or palletized materials or equipment shall not be stacked. Electrical equipment shall be stored indoors or under cover. Sheet materials shall be stored in a manner that affords free drainage with no ponding of water. All equipment shall be stored in a secure area.

Replacement of materials or equipment damaged, destroyed or lost through improper, inadequate or careless storage shall be the Contractor's responsibility.

Stored materials and equipment shall be readily and easily accessible to facilitate inspection.

**T1.08 Cleaning and Restoring**

Prior to final acceptance, all rubbish and unused material due to or connected with the construction shall be removed and the premises left in a condition acceptable to the City. All damaged areas shall be repaired, and all excess earth and rubble removed. Payments due may be withheld due to failure to comply with these requirements.

Any and all existing facilities and/or conditions shall be restored to original condition or better before final payment and acceptance is made by the City.

**T1.09 Preconstruction Photography**

The Contractor shall furnish all labor, materials, equipment, and incidentals required to videotape as determined and approved by the Department, that all areas within the project are, as shown in the drawings and as specified herein.

A professional video photographer who is fully experienced, and qualified with the

specified equipment shall perform the photography.

The total audio-video system and the procedures employed in its use shall be such as to produce a finished product that will fulfill these technical requirements. The video portion of the recording shall produce bright, sharp, clear pictures with accurate colors and shall be free from distortion or any other form of picture imperfection. All video recordings shall, by electronic means, display on the screen the time of day, the month, day and year of the recording. This time and date information must be continuously and simultaneously generated with the actual recording. The audio portion of the recording shall produce the commentary of the camera operator with proper clarity and be free from distortion at a nominal sound level of 40-50 decibels.

The color video camera used in the recording shall be capable of producing an output viewable in industry standard DVD format. It shall be capable of being viewed utilizing a TV/DVD player and/or a PC with a DVD drive/player. The DVD provided must be capable and authorized to allow reproduction by the City of Tampa and not be copyright protected. The DVD's provided must be single sided, 4.37 computer GB capacity (DVD-5). Multiple DVD's may be provided if necessary to show complete detail of the project. Video output from camera(s) must utilize a minimum of 8:1 zoom. The DVD shall be new and shall not have been used for any previous recording.

Video recording shall be accomplished along all routes approved by the Department which have any construction performed by the Contractor with a total length greater than 100 lineal feet. Video taping shall include any approved staging and storage areas and the route between the staging and storage areas and the project site when an off-site area is used.

When viewed, the DVD shall show the entire length of construction from right-of-way line to right-of-way line. Existing conditions should be apparent to the viewer along the length of construction. Camera pan, tilt zoom-in and zoom-out rates shall be sufficiently controlled such that recorded objects shall be clearly viewed during videotape playback. In addition all other camera and recording system controls such as lens focus and aperture, video level, pedestal, chrome, white balance and electrical focus shall be properly controlled or adjusted to maximize picture quality.

The taping shall be done so as to show the proposed construction areas in an oblique view (30 degrees). The average rate of travel during a particular segment of coverage shall be directly proportional to the number and size of the surface features within the construction area's zone of influence.

Coverage shall include, but not be limited to, all existing driveways, sidewalks, curbs, ditches, streets, landscaping, trees, culverts, catch basins, headwalls, retaining walls, fences, visible utilities, and all buildings located within the zone of influence. Of particular concern are any existing faults, fractures, defects or other imperfections exhibited by the above-mentioned surface features. Close-up coverage shall be recorded in these areas. Audio descriptions shall be made simultaneously with support video coverage.

Engineering drawings shall be referenced, by stationing, in the audio on the tapes. If visible, house numbers shall also be mentioned in the audio. All videotapes shall be permanently labeled and shall be properly identified by videotape number and project title.

A record of the contents of each tape shall be supplied on a video log identifying each segment in the tape by location, i.e., street or easement, viewing side, traveling direction, engineering stationing, house or lot numbers, and all referenced by tape counter numbers.

No construction shall start until pre-construction photography is complete. Any portion of the video coverage deemed unacceptable by the Owner will be re-recorded by the Contractor at no additional charge.

## **T2.00 CONSTRUCTION OF WATER MAINS AND APPURTENANCES**

### **T2.01 Subsurface Investigation**

The Contractor shall be responsible for having determined to his satisfaction, the nature and location of the work, and the ground conformation, the character and quality of the substrata, the types and quantity of materials to be encountered, the nature of the groundwater conditions, the character of equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions and all other matters which can, in any way affect the work under this Agreement. The prices established for the work to be done will reflect all costs pertaining to that work.

The Contractor will notify the Engineer promptly in writing of any subsurface or adverse physical conditions at the site which differ materially from those that may be indicated by the Contract Documents or earlier subsurface information in accordance with Section I-2.01 of the Instructions to Bidders and Section G-2.04 of the General Provisions. The Engineer will promptly investigate the conditions and advise the Contractor in writing if further surveys or subsurface tests are necessary. If necessary, the Department will promptly obtain the necessary additional surveys and tests and furnish copies to the Contractor.

**T2.02 Site Preparation**A) General

The construction site shall be cleared of all obstructions, stumps roots, and vegetation within the limits required for proper execution of the work in accordance with Section 110, FDOT Standard Specifications, latest edition, to a minimum depth of 12 inches.

Shrubbery, trees and plants shall be protected as required by the City of Tampa Parks Department ("Parks Department") or the agency having jurisdiction, as shown on the plans, or as directed by the Engineer. Where necessary to remove plantings in order to accomplish the work, such plantings shall be replaced. Trees will be transplanted when feasible, and when a successful transplant is probable. Plantings and trees shall be replaced before the work is accepted.

Foliage, trunks, and roots of trees to remain shall be barricaded by encircling with stakes and flagging at a distance equal to the branch spread or as required by the Parks Department. Stockpiling of materials and movement of equipment shall be avoided within this area. Interfering branches shall be removed without injury to trunks.

Trees, stumps, and large roots within the construction area shall be removed, unless otherwise directed. Topsoil shall be stockpiled for future use. Unsuitable materials shall be removed from the site and properly disposed of by the Contractor. All trees shall be preserved in their natural state unless their removal is directed by the Department. Trees within 20 feet of the construction line shall be protected as indicated on the plans or as directed by the Engineer. Trees with trunk diameters in excess of five inches (measured circumference three feet above ground level and divided by 3.14) shall be preserved unless:

- A. their removal is directed;
- B. they are located within areas scheduled to be paved; or
- C. they interfere with utility or pipe trench alignment.

All trenching performed adjacent to tree trunks shall be accomplished in such a manner as to maintain a minimum clearance of at least 10 feet between the pipe and the base of the tree trunks for trees 5 inches in diameter and larger. A minimum of 20 feet clearance shall be maintained for tree trunks classified a grand tree by the Parks Department. When trenching is to be performed closer than the above minimums, root pruning or other protective measures as directed by the Engineer may be required. Tree trimming and root pruning shall be performed by a

competent tree specialist who carries proper insurance and is licensed by the City of Tampa.

B) Tree Removal and Tree Trimming

Tree removal shall comply with the City of Tampa Tree Ordinance, City Code or ordinances, rules, or regulations of any other governmental agencies having jurisdiction. Within the limits of the water pipeline trench, all trees and roots which have been designated for removal, shall be removed and disposed of by the Contractor to allow for installation of the pipeline without hindrance. All removed trees and roots outside the trench area shall be cleared to a minimum depth of 12-inches below finished grade or as directed by the City. The Contractor shall notify the City when encountering material that is believed to qualify as Tree Removal. The Contractor shall give ample time for the City to inspect the location and make necessary measurements before removal.

After removing a tree, the Contractor shall not proceed with construction of the water pipeline without first restoring the tree removal location to an acceptable condition of repair which meets the City's approval. Satisfactory off site disposal of timber, stumps, roots or any other materials resulting from removal of trees or roots shall be the sole responsibility of the Contractor. Material shall not be burned or buried on the project site. The location of material disposal shall have the approval of the City. The method of material disposal shall be consistent with City of Tampa standards.

1. When located within the City of Tampa but outside the right-of-way, the following trees require no permit from the City based on Section 13-7, City of Tampa Code.

- |                       |                            |
|-----------------------|----------------------------|
| Australian Pine       | Brazilian Pepper           |
| Cherry Laurel         | Chinaberry                 |
| Queensland Umbrella   | Eucalyptus                 |
| Monkey Puzzle         | Male Mulberry (No Berries) |
| Mimosa/Woman's Tongue | Queen Palm                 |
| Wild Cherry           | Citrus                     |
| Chinese Tallow        | Surinam Cherry             |
| Lead                  | Carrotwood                 |
| Rosewood              | Earleaf Acacia             |
| Golden Rain Tree      | Shefflera                  |
| Silk Oak              | Punk                       |
| Ear Tree              | Eucalyptus                 |

2. All trees to be removed from City rights-of-way shall require a tree removal permit issued by the Parks Department.

C) Tree Planting

Newly planted trees and shrubs will be kept well watered and shall be alive, healthy and vigorous at the time of acceptance of the project by the City, or shall be replaced. Trees will be braced or tied to resist wind conditions until they have taken root.

**T2.03 Dewatering**

If subsurface water is encountered in trenching or structural excavation work, the Contractor shall adequately dewater the excavation at his expense. No additional payment shall be made for dewatering operations.

The contractor will be required to do any and all sampling that may be required to be in conformance with the NPDES discharge permit requirements, at no expense to the city.

Subsurface water shall be kept 2 feet or more below the working area until there is no danger of displacement of pipes or structures. All water collected and pumped shall be disposed of in a manner which will cause no health hazard, flooding or nuisance to the surrounding area and in a manner so as not to degrade the water quality of surrounding water or violate any environmental ordinances or requirements. Water containing debris, sand or heavy sediment shall not be discharged into the stormwater system. All permits for the discharge of this water shall be obtained by the Contractor from the appropriate regulatory agency.

**T2.04 Trenching, Backfilling and Compacting**

Trenching shall be conducted to the limits and grades shown on the plans or as directed by the Department.

The Contractor performing trench excavation on this Contract shall comply with the Occupational Safety and Health Administration's (OSHA) trench excavation safety standards, 29 C.F.R., s.1926.650, Subpart P, including all subsequent revisions or updates to these standards as adopted by the Department of Labor and Employment Security (DLES) as well as The Florida Trench Safety Act as delineated in Florida Statute Chapter 553, Part III.

By submission of his bid and subsequent execution of this Contract, the Contractor certifies that all trench excavation done within his control shall be accomplished in strict adherence with OSHA trench safety standards, including all revisions and updates to these standards as adopted by the Department of Labor and Employment Security, as well as to The Florida Trench Safety Act as delineated in Florida Statute Chapter 553, Part III.

The Contractor also agrees that he has obtained or will obtain identical certification from his proposed subcontractors that will perform trench excavation prior to award of the subcontracts and that he will retain such certifications in his files for a period of not less than three years following final acceptance.

The Contractor shall consider all available geotechnical information in his design of the trench excavation safety system.

Dewatering operations shall be maintained until pipelaying is complete and the trench backfilled sufficiently to prevent movement or flotation of the pipe.

The use of trench-digging machinery will be permitted except in places where its operation will cause damage to other utilities, trees, buildings, or existing structures above or below ground; in which case hand methods will be employed.

The trench width and trenching method may vary with, and depend upon the depth of the trench and the nature of the excavated material encountered; but in any case shall be of ample width to permit the pipe to be laid and jointed properly and the backfill to be placed and compacted properly. The minimum width of unsheeted trench, at the bottom where the pipe is to be laid, shall be one foot greater than the nominal diameter of the pipe, except by consent of the Department. The maximum clear width of trench and the trench support system shall be in accordance with OSHA requirements. Where sheeting and bracing are used, the trench width shall be increased accordingly. Trench sheeting shall be cut off at a level of at least 1 foot above the top of the installed pipe and shall be left in place until the pipe has been laid, tested for defects, repaired if necessary, and until the earth around the pipe has been compacted to a depth of 2 feet over the top of pipe.

Unless otherwise specified, the trench shall be AWWA C600 Type 2 as shown on the Standard Details "Typical Trench, Bedding and Backfill Detail". The trench shall have a flat bottom conforming to the depth to which the pipe is to be laid. The pipe shall be laid upon sound soil, cut true and even, so that the barrel of the pipe will have equal bearing for its full length. Bell depressions of ample dimensions shall be dug at each joint to permit proper pipe jointing.

In the event the Contractor excavates below the elevation required without approval from the Department, he shall refill with approved material and thoroughly consolidate. If, in the opinion of the Engineer, the trench bottom cannot support the pipe, a further depth and/or

width shall be excavated and refilled to pipe foundation grade or other approved means shall be adopted to assure a firm foundation for the pipe.

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street drainage. All material removed from the trench on an improved area shall be removed from the site by the Contractor at the Contractor's expense.

Material removed from an unimproved area may be reused if, in the opinion of the Engineer, it is suitable and if local conditions permit reuse. All materials suitable for reuse must be stored separate from the general excavated material. All backfill material must be approved by Engineer prior to placement. If replacement backfill is required, the Contractor must supply the material at his expense.

Backfill material shall be free from cinders, ashes, refuse, organic matter, boulders, rocks or stones, or other material that in the opinion of the Engineer is unsuitable. Rocks up to 6-inches in their greatest dimension may be used for backfill from 1 foot above the top of the pipe up to the subgrade of the pavement unless otherwise specified by the Engineer.

All trenches shall be backfilled by hand, from the bottom of the trench to the centerline of the pipe in layers of 6 inches. Compaction shall be performed by tamping. Backfill material shall be deposited in the trench for the full width on each side of the pipe.

From the centerline of the pipe to the specified grade, the pipe shall be backfilled by hand or by approved mechanical methods.

Compaction and consolidation shall be done in accordance with the requirements of the agency having jurisdiction.

In the absence of specific standards, all compaction shall conform to the following: The space between the pipe and the trench sides shall be packed full by hand shoveled earth, free from lumps, carefully deposited in layers, not exceeding 6 inches in depth. Such material shall be placed equally on each side of the pipe, and at the same time tamped in a manner acceptable to the Department, until enough fill has been so placed and compacted to provide a minimum cover of 12 inches above the pipe. All bedding placed to this elevation shall be compacted to a minimum density of 98% of the maximum modified proctor density. From this point, the backfill shall be compacted in uniform layers not exceeding 12 inches in depth to a minimum density of 98% of the maximum modified proctor density where it is to support paving, sidewalk, etc., or elsewhere as directed by the Engineer. All other backfill shall be compacted to 95% of the maximum modified proctor density or to a level matching the requirements of the regulatory agency having responsibility for that portion of the right-of-way.

**T2.05 Pipeline Installation**A) General

During shipping, delivery and installation of pipe and accessories, materials shall be handled in such a manner as to prevent any damage. Particular care shall be taken not to injure pipe coatings. All pipe, fittings, valves and other material shall be subject to inspection and acceptance by the Department after delivery and no broken, cracked, misshapen, imperfectly coated, or otherwise damaged or unsatisfactory material shall be used. When a defect is discovered, the damaged portion shall not be installed. With the Department's approval, cracked pipe shall have the defect cut off at least 12 inches from the break in the sound section of the barrel.

Installation shall be according to AWWA Standard C 600 (ductile iron pipe), AWWA C605 (PVC pipe), AWWA C906 (HDPE pipe), manufacturer's recommendations, and as described in these technical specifications.

All connections to existing piping systems shall be made as shown or indicated on the plans after consultation and cooperation with the Department. No such connection shall be made until all requirements of these specifications as to tests, cleaning, flushing and disinfection of new work have been met, and the planned cut-in to the existing line has been approved by the Department. Where connections are made between new work and existing work, the connections shall be made in a thorough and workmanlike manner using proper fittings and specials. Some such connections may have to be made during off-peak hours if required by the Department.

B) Underground Pipelines

Proper implements, tools and facilities satisfactory to the Department shall be provided and used. Pipe, fittings, valves and appurtenances shall be carefully lowered into the trench piece by piece. Under no circumstances shall piping materials be dropped or dumped into the trench. Pipe and fittings shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation in final position. If damage occurs to any pipe, fitting, valve or piping accessory in handling, the damage shall be immediately brought to the Engineer's attention. The Engineer shall prescribe corrective repairs or rejection of the damaged items.

Lumps, blisters and excess coating shall be removed from the bell- and-spigot end

of each pipe. The outside of the spigot and the inside of the bell shall be wire brushed and wiped clean, dry and free from oil and grease before the pipe is laid. Pipe joints shall be made up in accordance with manufacturer's recommendations.

For DIP and PVCP, upon satisfactory excavation of the pipe trench and completion of the pipe bedding, a continuous trough for the pipe barrel and recesses for the pipe bells, or couplings, shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom. All ductile iron pipe shall be wrapped in polyethylene encasement (polywrapped) as shown in the Standard Detail. The tape shall be blue for potable water and shall be green for sanitary sewer force mains.

Pipe manufactured from materials, which are classed as flexible for purpose of pipe design shall be bedded true to line and grade with uniform and continuous support from a firm base and installed in accordance with manufacturer's recommendations. Blocking shall not be used to bring the pipe to grade. Backfill material shall be properly placed and compacted to provide lateral restraint against deflection in the pipe diameter. Care shall be exercised to avoid contact between the pipe and compaction equipment.

The interior of ductile iron or PVC pipe shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods. Pipe 12-inches in diameter and smaller may be cleaned by flushing in place under the supervision of the Engineer if in the Engineer's opinion the pipe contains dirt that can be so removed; if not, then the pipe shall be cleaned by swabbing and flushing before it is placed in the trench. All pipe 12-inches in diameter shall be thoroughly cleaned, by appropriate means, before placing it in the trench. During suspension of work for any reason at any time, including the end of each workday, a watertight plug shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe. Sufficient backfill material shall also be placed over the pipe to prevent flotation. Lines shall be laid straight and depth of cover shall be maintained uniformly with respect to finished grade, whether grading is completed or proposed at time of pipe installation. Pipelines shown on the plans to be laid at grade or with a specified slope shall be installed with the invert conforming to the required elevations, slopes and alignment shown and with the pipe bottom uniformly and continuously supported by a firm bedding and foundation. Pipe installed using horizontal directional drill will be installed within the tolerance outline herein.

The work shall at all times progress with caution so as to prevent damage to underground obstructions, both known and unknown. Should an obstruction not

shown on the plans be encountered, the Engineer shall be immediately notified so that alteration to the plans can be made should realignment be necessary. The Contractor shall notify the Engineer far enough in advance to allow the realignment to be accomplished by deflection in the pipe joints or adjustment in the drilling operation.

Ductile iron pipe and PVC pipe shall be laid with bell ends facing in the direction of pipe-laying (upstream) unless directed otherwise by the Department. Only EPDM gaskets will be used for PVC pipe and ductile iron pipe. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, the amount of deflection allowed shall not exceed 80% of that allowed under AWWA Standard C 600 (DIP) for the type of joint being installed and in accordance with the manufacturer's recommendations. Only after the pipe has been properly homed will it be allowed to be deflected. No deflection will be allowed for PVC pipe.

Water mains crossing or parallel to storm sewer, sanitary sewer and gas mains shall have a minimum of 12 inches vertical clearance and a horizontal clearance which shall comply with all State, Local and Federal regulations and requirements. A minimum 3-foot pipe wall to pipe wall clearance shall be maintained between all utilities and water main. Any exceptions to these standards must be approved in advance by the Engineer. When crossing or parallel to storm sewer and sanitary sewer mains, including gravity sewers and force mains, with less than the minimum clearances, the Contractor shall protect the water main as shown on the plans or, in a manner acceptable to the Engineer. Where ductile iron or PVC pipe water mains are crossing sewer service laterals with less than the require 12 inch minimum clearance, the Contractor shall make the necessary adjustments to center a full joint of water main (18' min.) at the conflict point, or replace 10 feet of the lateral with PVC pipe meeting AWWA C-900 Class 150 centered over the conflict point. Sewer laterals, when replaced, shall be installed in accordance with the City of Tampa Department of Sanitary Sewers technical manual, latest edition.

1. Thrust Restraint

All plugs, caps, hydrants, tees, bends and other fittings on pressure pipelines shall be provided with restrained joints as indicated on the plans, or as directed by the Engineer. Thrust blocks or reaction blocks may only be used when approved in advance by the Engineer.

2. Joints

The joints of all pipelines shall be made absolutely tight. The particular joint used shall be acceptable to the Department prior to

installation. The gasket material for all joints shall be EPDM and 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.

a) Push-on Joints

In making up the push-on type joint, the EPDM gasket shall be placed in the socket with the large round end entering first so that the groove fits over the bend in the seat. A thin film of lubricant (approved by the 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 brushed with a wire brush and placed in alignment with the bell of the pipe to which it is to be joined. The joint shall be made up by exerting sufficient force on entering pipe so that its plain end is moved past the gasket until it seats as per manufacturer's recommendations. Backhoe buckets or excavation equipment shall not be applied directly to the pipe.

b) Mechanical Joints

Where shown on the plans, or where in the opinion of the Department, settlement or vibration is likely to occur, all pipe joints of pressure pipelines shall be bolted mechanical type as specified herein.

Mechanical joints shall be made up using high-strength, low-alloy steel bolts and rubber gaskets having either plain or duck tip as recommended by the manufacturer. All types of mechanical joint pipes shall be laid and jointed in full conformance with the manufacturer's recommendations. Only especially skilled workmen shall be permitted to make up mechanical joints.

Mechanical joints shall be centered in the bells. Soapy water shall be brushed over the gasket just prior to installation. The EPDM gasket and gland shall be placed in position, the bolts inserted, and the nuts tightened finger tight. Mechanical joints shall be assembled in accordance with AWWA Standards. The joints 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:

Bolt Size (Inches)	Range of Torque
3/4" diameter	85 to 95 ft.-lbs.
1" diameter	95 to 100 ft.-lbs.

If effective sealing is not obtained at a maximum torque listed above, the joint shall be disassembled and reassembled after thorough cleaning. If the joint is defective, it shall be cut out and entirely replaced or if the Department gives permission, it may be repaired by a suitable clamp.

3. Plugs and Caps

Plugs shall be inserted into the bell ends of all open ductile iron pipe, tees or crosses. All plain ends of pipe and fittings shall be capped.

4. Completion

After the pipe has been installed, inspected by the Engineer and found to be satisfactory, sufficient backfill shall be placed along the exposed areas of pipe to hold it securely in place while conducting the preliminary hydrostatic test. No backfill shall be placed over the ductile iron pipe joints until the preliminary test is satisfactorily completed, leaving them exposed to view for the detection of visible leaks.

Upon satisfactory completion of the preliminary hydrostatic test, backfilling shall be completed.

C) Underground Pipelines-Horizontal Directional Drilling

The work specified in this section consists of furnishing all labor, equipment and certain materials and services necessary to install water lines using the horizontal directional drilling (HDD) method of installation, also known as directional boring. Fittings, valves and appurtenances shall be carefully lowered into the trench piece by piece. Proper implements, tools and facilities satisfactory to the Department shall be provided. Under no circumstances shall piping materials be dropped or dumped into the trench or on the ground. Pipe and fittings shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation in final position. The dragging of HDPE pipe along asphalt or concrete will not be allowed. The Contractor will use above ground rollers or may suspend it to move into position. If damage occurs to any pipe, fitting, valve or piping accessory in handling, the damage shall be immediately

brought to the Engineer's attention. Sections of HDPE pipe with cuts or gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be cut out and the ends rejoined at no additional cost to the Water Department. The Engineer shall prescribe corrective repairs or rejection of the damaged items.

1. Preconstruction Responsibilities

- a) The minimum ground cover over directionally bored water utility lines shall be 36 inches unless otherwise shown on the plans or directed by the Engineer. There shall be at least 12 inches vertical clearance when any water main crosses under a storm sewer or sanitary sewer .
- b) The Contractor shall limit curvature in any direction to reduce force on the pipe during pullback. Ideally, the directional bore should lie in a vertical plane. The minimum radius of curvature shall be no less than that specified by the pipe manufacturer.
- c) The Contractor shall submit design calculations indicating predicted/permissible (maximum safe) pull force, pipe pull rating, and minimum permissible pipe bend radius. Maximum safe pull force shall be included in the submittal. The Contractor assumes all responsibility for proper design of the directional bore. Some factors to be considered in calculating the safe pull force follow:
  - (1) The pullback force will be calculated at the leading end of the pipe behind the pulling head.
  - (2) The frictional resistance is highest just prior to movement and decreases with movement. When pullback ceases, frictional forces and drag forces increase due to the thixotropic nature of drilling mud. The mud starts to gel when it is undisturbed.
  - (3) Buoyant force pushes the pipe up against the top of the borehole, creating frictional drag between the pipe and the borehole.
  - (4) Minimum radius of curvature at the entry and exit pits and throughout the directional drill is limited by the steering capabilities of the boring equipment and the pipe manufacturer's requirements.

- (5) When the bending radius is too small, the safe pulling strength of HDPE pipe may be significantly reduced by the additional tensile stresses due to curvature.
- (6) All bending stresses due to various curvatures in the boring path are additive and should be subtracted from the safe pull force.
- (7) The “safe” pull-load is time dependent.

2. Contractor Responsibilities

- a) Contractor shall supply all labor, supervision, tools and equipment, and materials necessary to install pipe by directional bore method for potable water. Installation of the pipe system includes the installation of water mains, services and/or any other devices or materials deemed necessary for the respective systems **and as directed on the plans.**
- b) The Contractor shall provide experienced operators to perform directional boring. The Contractor shall have a minimum of four years experience with similar construction including pipelines. The Contractor shall have performed at least three successful, directional drills in each of the tube and pipe diameters specified (2-inch, 4-inch, 6-inch, 8-inch and 12-inch). Each bore shall have been a minimum of 150 feet in length and shall involve the use of HDPE pipe. In addition, the Contractor shall have at least 2 years' experience installing potable water lines. References, project scope and owners contact information for each of the aforementioned projects for both directional drill and potable water work shall be furnished prior to the award of this contract.
- c) The Contractor shall be fully responsible for placement of the pipe per the contract documents.
  - (1) The Contractor shall supply experienced persons who have received proper training in the use of the butt fusion equipment according to the recommendations of the pipe manufacturer and butt fusion equipment supplier to perform thermal fusion of the specific HDPE pipe to be used.

- (2) Contractor shall supply experienced persons who have received proper training in the use of the electrofusion equipment according to the recommendations of the pipe and fittings manufacturer and electrofusion equipment supplier to perform thermal fusion of the specific HDPE pipe and fittings to be used.
- (3) The as-built variance from the specified bore path shall not exceed plus or minus one (1) foot in the vertical plane and plus or minus one (1) foot in the horizontal plane. The Contractor shall notify the Engineer prior to start of the boring operation if these tolerances cannot be met.

### 3. Equipment

- a) The directional drilling equipment shall consist of directional-drilling machines capable of handling 1-inch, 2-inch, 4-inch, 6-inch, 8-inch and 12-inch HDPE pipe or tubing. It will be of sufficient capacity to perform the bore, pull back the pipe and shall have a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the project, a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be reused, a guidance system to accurately guide the boring operations and a vacuum truck of sufficient capacity to handle the drilling fluid volume. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.
  - (1) The steerable, horizontal directional drilling equipment shall produce a stable fluid lined tunnel with a minimum burial depth of cover of 36-inches for the carrier pipe installation. The system must be able to control the depth and direction of the pipe and must be accurate to a window of  $\pm 2$  inches.
  - (2) The tunneling equipment shall employ drilling fluid that is inert and shall pose no environmental risk and shall be material such as bentonite or a polymer-surfactant mixture producing a slurry of proper consistency.
  - (3) The hydraulic power system shall be self-contained and free

of leaks, with sufficient pressure and volume to power the drilling operation.

- (4) Calibration of the electronic detection system shall be verified by either uncovering the tool (head) within the first ten (10) foot of the bore or by verification above ground prior to the start of the bore.
  - (5) The boring tool (head) shall be remotely steerable by means of an electronic or magnetic detection system. The tool (head) location shall be monitored in three dimensions (offset from the baseline, distance along the baseline and depth of cover) and logged every 50 feet from the drilling machine. This log will be used to produce an as-built which will be submitted to the Water Department at the conclusion of the project. The boring tool shall pull the carrier pipe through the fluid lined tunnel as it traverses the surface being crossed.
  - (6) The machine shall have means to monitor and record the maximum pullback force during the pullback operation. The pulling strength of the boring equipment shall not exceed the HDPE pipe safety pull strength as per the manufacturer's recommendation.
- b) The butt fusion machine used to join sections of HDPE pipe shall have controls and gauges for setting pressures and temperatures used for facing, heating, and fusing.
- (1) Facing shall be conducted at a pressure that produces properly faced (squared and true) pipe ends.
  - (2) Heating pressure should be set so that the pipe ends maintain contact against the heater, but are not forced against the heater (no "contact pressure").
  - (3) Fusing pressure shall be as recommended by the pipe manufacturer and fusion equipment supplier.
  - (4) Heater surfaces must be clean and free of contaminants such as dirt, oil, grease, and melted or charred plastic. To clean the heater, only wooden implements and clean, dry,

lint-free non-synthetic cloths may be used.

- (5) The heater shall be checked periodically for uniform surface temperature using a surface pyrometer.
- c) An electrofusion machine shall be used to fuse fittings and accessories to pipe. The machine shall be approved for use by the manufacturer of the pipe and the fittings.

4. Directional Bore Pipe and Fittings

HDPE tubing and pipe for 2", 4", 6", 8", 10", 12", and 14" directional bores and all associated HDPE fittings (MJ adapters, solid couplings, tapping tees, corporations, flange adapters, etc.) will be furnished by the Contractor as part of the appropriate unit priced pay item.

- a) Pipe and fittings shall be High Density Polyethylene (HDPE) as per AWWA C906. All pipe shall be pressure class 160 psi, DR 11 and PE code 3408. All tubing shall be 200 psi, DR-9 and PE code of 3408.
- b. Pipe shall be color-coded blue to provide identification. Color-coding shall be made by co-extrusion or impregnation and shall consist of stripes running along the entire outside length of the pipe, not more than 120 degrees apart or fully colored co-extruded.

Markings shall include but not necessarily be limited to the following:

- Nominal size and OD base.
- Standard material code designation.
- Dimension.
- Pressure class.
- AWWA designation (AWWA C906).
- Material test category of pipe.

5. Tracer Wire

- a) All piping shall be installed with two continuous, insulated, blue coated, solid #10 gauge UF (Underground Feeder per National Electric Code Article 339) copper tracer wires for water main location purposes by means of an electronic line tracer. The wires must be installed along the entire length of the pipe. The insulation

shall be blue in color. Sections of wire shall be spliced together using Buchanon connectors or other approved method for splicing. Twisting the wires together is not acceptable.

- b) Upon completion of the directional bore, the Contractor shall demonstrate to the Water Department that the wire is continuous and unbroken through the entire run of the pipe by providing full signal conductivity (including splices) when energizing for the entire run in the presence of the Engineer. If the wire is broken, the Contractor shall repair or replace it. No payment will be made for pipe installed until the wire passes a continuity test.

6. Fittings and Restrainers

- a) Pipe flange joints shall be made using a flanged adapter, which is butt fused to the HDPE pipe.
  - (1) A back-up ring shall be fitted behind the flange adapter sealing surface flange for bolting to the mating flange. Standard back-up rings shall be AWWA C207 Class D for 160 psi and lower pressure ratings.
  - (2) One edge of the back-up ring shall be chamfered to fit up against the back of the sealing surface flange.
- b) Connections between polyethylene pipe and mechanical joints shall be made using an MJ adapter. The MJ adapter shall be fused to the HDPE pipe on one end. The other end of the adapter will be inserted into the MJ fitting. The fitting shall be fully restrained by the installation of an MJ gland or back-up ring behind the adapter flange as the MJ gland or back-up ring is tightened in place.
  - (1) Properly installed, the joint shall be a watertight and restrained joint.
- c) Electrofusion Couplings may be used to join two sections of HDPE pipe together when there is a space constraint that precludes butt fusion.
  - (1) The electrofusion coupling will be made of HDPE and will incorporate a constant 40-volt fusion coil for purpose of joining the ends of the pipe.

(2) The electrofusion coupling will be installed in conformance with the manufacturer's requirements and recommendations.

d) When connecting HDPE pipe with ductile iron fittings, the angle of entry into the fitting shall not exceed four degrees or 80% of the allowable deflection angle as determined by AWWA C-600. In the event that the entry angle at the point of connection exceeds four degrees of deflection, additional bends shall be installed.

7. Maintenance of Traffic

Erection or installation of appropriate safety and warning devices in conformance with the governing right-of-way authority shall be the responsibility of the Contractor.

8. Construction Requirements

a) General

All directional bore operations shall be contained within rights-of-way and/or easements shown on the plans. Bores may not start after 1:00 PM unless approved in advance by the Engineer.

b) Contractor Responsibilities

(1) The Contractor shall provide the following materials and services for horizontal directional drill unless otherwise specified by the Engineer.

- Traffic control.
- Tracer wire for carrier pipe (#10 gauge or larger, solid), per Standard Detail.
- Site preparation and excavation.
- Dewatering – Groundwater Pump or Well Point System as needed.
- Sheeting and shoring, as necessary.
- HDPE pipe sized in accordance with the plan drawings.
- All butt fusion welding and electrofusion welding.
- Tie-in to existing pipelines with HDPE,

as called for in the plans.

- Preliminary site restoration (fill open pits, grading).
- Site clean up including removal and proper disposal of all waste materials and drilling fluid.
- All HDPE fittings, HDPE couplings, and HDPE carrier pipe and all ductile iron pipe, fittings, appurtenances and valves.
- Final site restoration (sod, seed, mulch, concrete/asphalt repair).

(2) The Contractor shall ensure that the following items are properly monitored and controlled:

- Calibrate locator/tracking system.
- Ensure that the flow of lubricating fluid (i.e. "Bentonite", etc.) is continuous.
- Ensure pulling pressure does not exceed pipe manufacturer's specifications.
- Fusing of pipe is within pipe manufacturer's specifications.
- Post fusion cool down time is calculated and complied with.
- Pipe is fused prior to the start of any bore longer than 100 feet.

(3) The Contractor shall record horizontal offset from the plan baseline and depth measurements every fifty (50) feet over the course of the bore and provide that data to the City along with a complete as-built. All valves, fittings, points of connection and horizontal or vertical changes from the plans shall also be referenced and shown on the as-built. Data collected by the Engineer does not relieve the Contractor from the responsibility of recording his own data. The Contractor shall log all necessary data from the locator/tracking system:

- Position.
- Roll Angle.
- Tilt Angle.
- Depth.
- Temperature of Data Transmitter.
- Remaining Battery Life.

- Pull Back Force (Maximum pull back force shall be recorded).
- (4) The Contractor shall call “Sunshine State One-Call” (phone number: 800-432-4770) at least 48 prior to performing any excavation. The Contractor shall confirm the location of utilities before starting the directional bore.
  - (5) The Contractor shall perform the horizontal directional drill in accordance with the approved project plans. In no case shall the bore extend into private property unless an easement is provided prior to start of construction or the Contractor has obtained a temporary construction easement from the property owner. Vertical tolerances shall be within plus or minus 1 foot of elevations shown on drawings. Horizontal tolerances shall be plus or minus 1 foot of alignment shown in drawings. These tolerances shall be met unless required separations for other utilities must be met and puts the bore in conflict. Failure to meet tolerances, if not pre-approved by Engineer, may be grounds for rejecting the bore. The Contractor may, at the discretion of the Engineer, be required to abandon the bore and re-drill a new one at Contractor’s own expense.
  - (6) The Contractor shall provide all structures, safety equipment, and professional services required for the health and safety of the general public and of personnel involved in directional boring work in accordance with the requirements of the Federal, State, and Local Authorities. This includes proof of construction personnel certificates of trench safety training at the time of construction.
  - (7) The Contractor shall take all measures necessary to protect surrounding public and private property, adjacent buildings, roads, drives, sidewalks, drains, sewers, utilities, trees, structures, and appurtenances from damage due to directional bore work.
  - (8) The Contractor shall exercise due care at all times and shall not apply more than the safe pull force to the carrier pipe recommended by the manufacturer.

- (9) The Contractor shall furnish and install two, insulated, blue coated #10 gauge solid strand copper tracer wires as previously specified herein.
- (10) The Contractor shall give 48-hour (two working days) advance notice to the Water Department prior to start of work. The Engineer is required to inspect materials prior to the start of the boring operation and to be on site during the boring operation and installation of the pipe.
- (11) The Contractor shall be fully responsible for all steerable, fluid lined directional-boring operations. Any noticeable surface defects resulting from operation of this boring equipment shall be repaired by the Contractor at his own expense. The Contractor is reminded that he is required to take preconstruction videos of the construction site to avoid unwarranted claims for damages resulting from the construction.
- (12) The Contractor shall meet all City insurance requirements, as outlined in this document, when working in a City right-of-way or using a City right-of-way use permit.

c) The Water Department shall supply the following materials:

- Large meters.
- Small meter for large meter by-pass lines.
- Small meters.
- Double detector check valve assemblies

d) The Engineer shall witness and verify the Contractor's logging of pertinent data. The Engineer may log his own data in the Department's own Directional Bore Log sheet for the Department's use.

e) Drilling Requirements

- (1) The horizontal alignment shall be as shown on the drawings, plus or minus 1 foot. The vertical alignment shall be as shown on the drawings, plus or minus 1 foot. If the Contractor cannot meet these tolerances for whatever

## Addendum 2

reason, he shall confer with the Engineer prior to the start of the bore. The Engineer may approve or disapprove variance requests at his discretion.

- (2) All 2", 4", 6", 8", 10", 12" and 14" HDPE tubing and pipe shall have a minimum of 36 inches cover unless otherwise indicated on the plans or directed by the Engineer.
- (3) Compound curvatures shall be minimized limited by the maximum deflection as set forth by the HDPE pipe manufacturer or AWWA Standards, whichever is more stringent.
- (4) The entry angle shall be 12° to 14° (not to exceed 15°). Exit angle shall be 6° to 12° to facilitate the pullback operation. Entry and exit angles are defined as angles from the horizontal. Connection angles between HDPE pipe and ductile iron fittings shall not exceed 4 degrees.
- (5) Erosion and sedimentation control measures and on-site containers shall be installed to prevent drilling mud from spilling out of entry and/or exit pits. Drilling mud will be disposed of off-site in accordance with local, state and federal requirements and/or permit conditions. No other chemicals or polymer surfactant shall be added to the drilling fluid without written consent of the Engineer or until a determination is made by the Engineer that the chemicals to be added are not harmful or corrosive to the facility and are environmentally safe.
- (6) Pilot holes shall be drilled on bore path with no deviation greater than plus or minus 1 foot from the design depth over a length of 100 feet. In the event that the allowable deviation is exceeded, the Contractor shall notify the Engineer, and the Engineer may require the Contractor to pull back and re-drill from a location along the bore path before the deviation.
- (7) After successfully completing the pilot hole, the borehole shall be reamed to a diameter, which is, at minimum, 25 percent greater than the outside diameter of the pipe being installed.

- (8) The Contractor shall not attempt to ream at a rate greater than the drilling equipment and mud system are designed to safely handle.
- (9) In the event of a drilling hole blowout or other loss of drilling fluid, the Contractor shall be responsible for restoring any damaged property to original condition and cleaning up the area in the vicinity of the blowout or loss.

f) Pipe Installation

- (1) After reaming the borehole to the required diameter, the pipe shall be pulled through the hole. There shall be a swivel and barrel reamer to compact the bore hole walls at the front of the pipe.
- (2) Once pullback operations have commenced, the operation shall continue without interruption until the pipe is completely pulled into the borehole. **EXCEPT FOR DRILLING ROD REMOVAL, PULLBACK SHALL NOT CEASE, UNTIL THE PIPE IS COMPLETELY PULLED INTO ITS PERMANENT POSITION.** During the pullback operations, the Contractor shall apply no more than the maximum safe pipe pull pressure as detailed in the approved submittals.
- (3) After pullback, the pipe may take several hours or days to recover from the axial strain. When pulled from the reamed bore hole, the pull-nose shall be pulled out a distance longer than the total length of the pull to avoid having the pull-nose retract back below the bore hole exit level due to stretch recovery and thermal contraction to equilibrium temperature. No connections shall be made until the stretch recovery and thermal contraction cycles are complete.
- (4) The pipe entry area shall be graded as needed to provide support for the pipe and to allow free movement into the borehole. The pipe shall be guided into the borehole to avoid deformation of, or damage to, the pipe. Under no circumstances shall the pipe be dragged over an asphalt or concrete surface; above ground rollers or other similar

devices shall be used to support the pipe while it is being moved across such surfaces.

- (5) The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, and movement or distortion of surface features. Any damages caused by the Contractor's operations shall be corrected by the Contractor at no cost to the Water Department.
  - (6) In the event that unexpected subsurface conditions impeding drilling operations are encountered, the procedure shall be stopped and not continued until the Engineer has been consulted. The pipe may be installed full of water.
  - (7) If the final grade of the finished bore is not satisfactory to the Engineer or any other jurisdictional entity, the pipe shall be abandoned, full pressure grouted in place in accordance with the jurisdictional authority, and an alternate installation shall be made. The abandoned pipe shall be properly shown on "as-built" drawings to be submitted following conclusion of the construction work.
  - (8) The Engineer shall inspect the installed pipe ends for roundness and/or damage. Evidence of over-pulling or significant surface scratching shall be brought to the attention of the Engineer. Deformations of more than 10 percent may be grounds to abandon the bore and have the Contractor re-drill another line at no additional cost to the Water Department.
- g) Butt Fusion Procedure
- (1) Fusion welds shall be performed by an experienced technician who has been properly trained to meet the pipe manufacturer's procedures. All welds shall meet the pipe manufacturer's recommendations.
  - (2) As the pipe ends are melted against the heater during the heating period, the molten plastic will swell and form melt beads around the pipe ends. The melt beads shall be the same size on both pipe ends, and uniformly sized all the way around.

- (3) After melting has been completed, the ends shall be separated just enough to remove the heater, observed for uniformity of the beads and quickly (within three seconds) brought together with the recommended pressure.
  - (a) If melted plastic sticks to heater, the two ends may not be joined. The ends shall be allowed to cool and the procedure started over.
  - (b) Excess pressures shall not be used as this will squeeze too much melt out of the fusion area and result in a weakened joint.
  
- h) Connecting Two Adjoining Sections of Directionally Bored Pipe
  - (1) If the overall length of the required utility installation can not be safely pulled using one directional bore, then the Contractor shall be required to make more than one pull to accomplish the installation.
  - (2) Where two adjacent pulls meet, the Contractor shall dig a pit and join the two sections together at the elevation of the two segments as if it were a continuous pull-in. Space permitting, the Contractor may butt fuse the sections of pipe together. If space is not adequate to permit butt fusion, the two sections of HDPE shall be joined together using an electrofusion solid coupling. This coupling shall be installed in conformance with the coupling manufacturer's recommendations and these documents.
  
- i) The Contractor may perform a preliminary pressure test on the completed string of pipe prior to installation. A pressure test shall be required on the completed directional bore prior to final acceptance.

9. Post-Construction

The Contractor shall be considered as having completed the requirements of the directional bore when he has successfully completed the work to the satisfaction of the Engineer.

## 10. As-Builts

When the directional bore is completed, the Contractor shall interpret the information from the data log sheets and produce marked-up as built drawings. The as-built will reflect horizontal offset from the baseline and depth of cover, every 50 feet and at all changes in direction, whichever is less. All fittings, valves, hydrants, meters meter services will also be referenced and shown. This document, along with the tracking log sheets, will be provided to the Engineer for his review and approval.

**T2.06 Casing Installation**

Casing installation shall be performed by jacking and boring under highways and railroads where shown on the plans. The casing pipe size, thickness, length, location and detail shall be as indicated and specified hereinafter. The work shall be performed by a qualified contractor experienced and regularly engaged in this type of work. All necessary materials, equipment, labor and traffic protection devices shall be on the job site before starting the work.

The Contractor shall strictly adhere to Florida Department of Transportation Utility Accommodation Manual, Hillsborough County Utility Accommodation Guide, CSX Transportation, Inc./Seaboard System Railroad Standard Specifications for Pipelines, AASHTO Standards and requirements of any other agency, whether public or private, having jurisdiction over the highway/railroad property concerned. The Contractor is advised that the requirements of the jurisdictional authority may limit start and stop days of the week as well as times of the day. Requirements may be established either verbally from an on-site representative, may be in the form of a written notice or permit, or may be transmitted through the Department. No construction or mobilization shall be started until the necessary permits have been obtained, a copy of the permit is at the job site, and proper notice and approval for construction have been obtained from the Department.

Casing pipe shall be welded steel pipe having minimum sizes and thickness as shown in the Standard Details contained within this document. The steel shall meet the requirements of ASTM A139, Grade A. The Contractor may use a welded steel casing pipe of a larger diameter if approved by the Department.

Only new pipe shall be used and all surfaces shall be smooth and uniform without bulges, dents, or warping. Finished lengths of pipe shall have beveled cut ends to facilitate proper, full depth welding of transverse joints. The casing may require bituminous coating if so dictated by the agency having jurisdiction over the jacking and boring site.

Prior to ordering equipment and materials for the jacking and boring operation, the

Contractor shall get approval from the Department of his jacking equipment. Hydraulic jacks shall be used in the jacking operation and extreme care shall be taken to hold to exact line and grade. Excavation at the heading shall be advanced not more than one foot ahead of the casing pipe and may be done manually with an auger. Reaction blocks shall be utilized and adequately designed to carry the thrust of the jacks to the soil without excessive soil deflection and in such a manner as to avoid any disturbance of adjacent structures or utilities. Adequate protection railings shall be provided at the top of the pit at all times.

The jacking pit shall be of adequate length to provide room for the jacking frame, the jacking head, the reaction blocks, the jacking auger rig, and the jacking pipe. The pit shall be sufficiently wide to allow ample working space on each side of the jacking frame. The depth of the pit shall be such that the invert of the pipe when placed on the guide frame will be at the elevation desired for the completed line. The pit shall be tightly sheeted where necessary and kept dry at all times. The jacking frame shall be designed so that it applies a uniform pressure over the entire pipe wall area of the pipe to be jacked.

Extreme care shall be taken to insure that the casing is installed to accurate line and grade; maximum acceptable error in any direction from the design grade and alignment shall be 1/8-inch per foot or as directed by the Department.

Upon completion, the Contractor shall obtain and furnish to the Department, a written release from the governing agency indicating satisfactory completion of the crossing.

### **T2.07 Fittings**

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. Fittings shall not be placed, under any circumstances, 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 or 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 in a manner satisfactory to the Engineer 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. Adequate precautions shall be taken to prevent the separation of joints at bends, tees, and plugged ends.

Details of design, construction, applications, installations, and number of joints necessary for the restraint of a given thrust shall be as specified herein, as shown on the Standard

Details or as indicated on the plans. Under no circumstances shall gray iron pipe be used at restrained joints. Ductile iron pipe will be used unless otherwise specified by the Department.

Where reaction or thrust blocking is required, it shall be of concrete meeting the following design criteria:

- Compressive Strength - 3,000 PSI  
90% after 7 days  
110% after 28 days
- % Air Entrainment - 5.0%
- Water/Cement Ratio - 265 lb Water/1 CY Concrete
- Maximum Aggregate Size - 1½"
- Slump - 3" - 4"

Blocking shall be placed between undisturbed earth and the fitting to be anchored where firm support can be obtained. The area of bearing on the pipe and on the ground in each instance shall be that shown on the plans, the Standard Detail or as directed by the Engineer.

The fittings shall be polyethylene encased in a manner acceptable to the Engineer prior to blocking. The blocking shall, unless otherwise shown or directed, be so placed that the pipe and fitting joints will be accessible for repair. If the soil does not provide firm support, then suitable tie rods, bridles, clamps and accessories as specified by the pipe manufacturer to brace the fitting properly shall be provided.

Pre-cast thrust blocks may be used in lieu of poured-in-place blocks on 8 inch and smaller ductile iron water mains only. This type of block must be manufactured in accordance with these Technical Specifications. Size and bearing area of blocks will be as shown in the standard details or as determined by the Department. The Department has the authority to reject any damaged block or any block considered to be of questionable quality. Placement will be in accordance with standard procedures for restraining thrust. Earth behind such blocks will be either undisturbed or compacted to a minimum of 95% (Modified Proctor) density.

Tie rods and pipe clamps when allowed by the Department must be of adequate strength to prevent movement or other suitable means may be used as allowed by the Department. Steel rods, clamps, and washers shall be rustproof treated with bituminous material and polyethylene encased.

### **T2.08 Valves**

Valves shall be handled with care to avoid damage. All valves shall be loaded and unloaded by lifting, and under no circumstances shall valves be dropped, skidded, or rolled. Valves shall not be placed, under any circumstances, against pipe, other valves 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. If any part of the valves' coating and lining is damaged by the Contractor, the repair and replacement shall be made by the Contractor at his expense in manner satisfactory to the Engineer before installing. Valves 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 valve 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.

Valves shall be set and joined to new pipe in a manner heretofore specified for cleaning, laying, and joining pipe. Valves shall be installed such that the operating nut is plumb.

Cast iron valve boxes shall be firmly supported and maintained centered and plumb over the operating nut of the valve by the Contractor with box cover flush with the surface of the finished pavement or at such other levels as may be directed. Valve boxes shall have 6-inch thick wire mesh reinforced concrete pads poured around the top section of the valve box when in pavement or when directed by the Department. The pad shall be 24 inches square and shall be centered on the valve box. All Department valve covers shall be painted safety blue as prescribed by the American Public Works Association (APWA) uniform color code for utility systems.

The valve and valve box shall be installed so Department personnel can insert a valve key through the valve box and completely open and close the valve. This test will be accomplished before final acceptance of the valve and box into the water system.

### **T2.09 Taps**

All material supplied shall be disinfected in accordance with Department standards.

After the tapping sleeve and valve have been installed and before the tap is made, the sleeve shall be tested to ensure a watertight joint. A test plug shall be provided in the sleeve and after the sleeve has been installed, it will be filled with water and the pressure increased to between 150 psi and 190 psi. All leaking joints shall be repaired to the satisfaction of the Engineer at the Contractor's expense.

All tapping sleeves shall be wrapped and sealed with polyethylene encasement material in a manner acceptable to the Engineer.

### **T2.10 Hydrants**

Fire hydrants shall be handled so as to avoid any damage at all times. Hydrants shall be located in a manner to provide complete accessibility and in such a manner that the

possibility of damage from vehicles or injury to pedestrians will be minimized. Fire hydrants in FDOT rights-of-way shall conform to FDOT clear zone requirements. Unless otherwise directed, the setting of any hydrant shall be as described in these Technical Specifications. All fire hydrants shall be thoroughly cleaned of dirt or foreign material before installation. All hydrants shall stand plumb and shall have their pumper nozzle perpendicular to the curb. The top of flange elevation shall be finished grade plus 4 inches.

Standard depth of bury shall be 3 to 5 feet. Each hydrant shall be connected to the water main with a 6-inch branch controlled by an independent 6-inch resilient seat gate valve hydrant shut-off valve. Per the Florida Fire Prevention Code, NFPA 1:18.3.4.1, clearances of seven and one-half feet in front of and to the sides of the fire hydrant are required, with four feet clearance required to the rear of the hydrant.

All fire hydrant leads shall be made of ductile iron pipe. All fire hydrant tees shall be made of ductile iron.

All hydrants shall be anchored by restrained fittings as specified in these Technical Specifications and as shown in the Standard Details.

All fire hydrants shall be painted with a high-grade enamel, Federal Safety Yellow (OSHA approved), above the ground line.

All hydrant sets shall include the installation of a concrete thrust collar around the barrel of the hydrant 8 inches below the ground line.

Upon completion of installation and passing all required tests, the Contractor shall paint the bonnet of the hydrant OSHA green.

### **T2.11 Meter and Fire Service Connections**

Any water meter and fire service connection made to new water distribution mains shall be at locations called for in the plans, in meter set cards, or as otherwise directed by the Department. No meter or fire service connections are to be installed outside right-of-way limits unless easements have been provided or as directed by the Engineer. Any trenching, excavation, backfilling, cutting, tapping necessary to install meter and fire service connections and such incidental work associated with the installation of meter and fire service system shall be performed in strict accordance with these specifications or as directed by the Engineer. Meters and double detector check valves shall be handled so as to avoid any damage at all times.

### **T3.00 TESTING**

The Department will require the Contractor to perform the required tests to ensure that all

pipe installed including service lines meets the Department's standards. The required tests are as follows:

### **T3.01 Hydrostatic Testing**

#### 1. Pressure Testing

All newly laid pipe, including fittings, valves and service lines shall be pressure tested in accordance with AWWA Standard C600 and these documents where applicable.

The Contractor shall provide all necessary equipment and instrumentation (pressure gauges, volume gauges, hoses pumps, test pipe, test fittings, etc.) required for flushing and testing of the piping systems. Pressure gauges shall be marked in graduated increments that do not exceed 2 pounds per square inch. Gauges used to measure the volume of water necessary to raise post-test line pressure back to the highest pressure achieved during the test duration will be marked in graduated increments which do not exceed 5 ounces. If requested by the Engineer, the Contractor shall furnish to the Engineer certified test data for the pressure gauges and recorders used on hydrostatic equipment. Water for test purposes will be supplied by the Department. At the option of the Engineer, flow meters and/or pressure gauges used on hydrostatic testing equipped with approved strip or round chart recorders shall be supplied by the Contractor. Tests shall be made in sections not to exceed 1/2 mile. Testing shall be conducted in the presence of and to the satisfaction of the Engineer as a condition precedent to the approval and acceptance of the system. Not less than 3 days notice shall be given prior to start of such tests, and such testing shall not be scheduled until preliminary testing by the Contractor has indicated that the test section is ready for testing. The schedule and procedures for testing shall be determined by the Contractor and reviewed with the Engineer prior to testing.

The duration of each pressure test shall be at least 2 hours with a minimum test pressure in excess of 150 psi. At no time shall the test or line pressure exceed 190 psi. If required by the Engineer, pump test equipment will be equipped with pressure relief valves pre-set to 190 psi. Each valved section of pipe shall be slowly filled with water and a pump shall be connected to the low point of the section being tested.

Before conducting the test, the Contractor shall backfill all pipe and reaction blocking unless the Engineer directs certain joints or connections to be left

uncovered. When reaction blocking is provided, the pressure test shall not be made until adequate curing time for the blocking has been allowed.

Before application of the test pressure, all air shall be expelled from the pipe. To accomplish this, taps will be made, if necessary, at points of highest elevation and afterward tightly stopped with tapered brass plugs, all at the Contractor's expense.

At the end of the 2-hour test period, the Contractor will be required to pump the lines back up to the highest pressure obtained during the duration of the test period.

Pressure tests shall be made between valves to demonstrate the ability of the valve to sustain pressure. All piping systems shall be tested in accordance with these test methods in addition to any other tests required by local plumbing codes or building authorities.

Throughout the duration of the test, the Contractor is required to maintain a minimum pressure in excess of 150 psi. The Contractor is advised that, should the test pressure fall to or below 150 psi any time during the 2-hour test, the test will be considered invalid and a retest will be required. Therefore, it is advised that the Contractor should pump water into the line as the test pressure approaches 150-psi.

The Contractor is warned that pressure testing against existing valves is done at his own risk. Failure of these valves to hold test pressure will not relieve the Contractor of the pressure testing.

All exposed pipe, fittings, valves and joints shall be carefully examined for leaks. Any cracked or defective pipe, fittings, valves or other appurtenances discovered as a consequence of the pressure test shall be removed and replaced with acceptable material. All leaking or defective joints shall be repaired, corrected or replaced. After all necessary replacements and corrections have been made, the test shall be repeated to the satisfaction of the Engineer.

If the pipeline fails the pressure test twice, then the Contractor shall be required to retest the pipeline and provide to the Department certification by a Professional Engineer registered in the State of Florida, that the pipeline has passed the test in accordance with these standards prior to the Water Department scheduling and witnessing the pressure test.

## 2. Leakage Tests for Pipelines

Concurrently with pressure testing, pipelines shall be subjected to leakage tests.

Leakage measurements shall not be started until a constant test pressure has been established in excess of 150 psi.

The duration of each leakage test shall be at least 2 hours and the test pressure shall be as specified for the pressure tests. Leakage is defined as the quantity of water that must be supplied into the pipeline or section thereof to maintain the established test pressure after the air in the pipeline has been expelled and the pipe filled with water plus that volume of water required at the conclusion of the test to bring the line pressure back up to the highest pressure obtained during the duration of the test period.

The maximum allowable leakage shall not exceed the number of gallons per hour (gph) as determined by the following formula:

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

where,

L - allowable leakage, gph

S - length of pipeline tested, feet

D - nominal diameter of the pipe, inches

P - average test pressure during the leakage test, psi gage

When leakage exceeds the allowable limit, the defective pipe or joints shall be located and repaired. All visible leaks are to be repaired regardless of the amount of leakage. If the defective portions cannot be located, the Contractor shall remove and reconstruct as much of the work as is necessary until the leakage is within the allowable limits. Such corrective work or damages to other parts of the work as a result of such work shall be at the Contractor's expense.

Leakage detection at mechanical joints shall be stopped by tightening the gland (not to exceed required torque) and leaking slip joints shall be cut out and entirely replaced or if permission is given by the Engineer, it may be repaired by a suitable clamp. Any split, cracked or defective pipe, fittings, valves, or hydrants discovered as a result of this test shall be removed and replaced by the Contractor with sound material and then test shall be repeated.

If the pipeline fails the test twice, the Contractor shall be required to retest the pipeline and provide the Department certification by a Professional Engineer registered in the State of Florida that the pipeline has passed the test in accordance with these standards.

**T3.02 Disinfection**

The Contractor shall disinfect the water mains in accordance with the applicable section of the latest AWWA Specification C651, as summarized below. The Contractor, if directed, shall use the method specified by the Engineer.

Method of Chlorination

1. Slug Method

The slug method consists of: a) Completely filling the main in order to remove air pockets, b) flushing the main with a velocity of not less than 2.5 feet per second (fps) in order to remove particles, c) at a point not more than 10 feet downstream of the water source flushing the new main; chlorine is to be continuously injected for a sufficient period to develop a solid column or "slug" of chlorinated water, d) the slug of chlorinated water is to move through the main exposing all interior surfaces to a chlorine concentration of approximately 100 mg/L for at least a 3 hour period.

2. Continuous Feed Method

The continuous feed method consists of a) completely filling the main to remove air pockets, b) flushing the main with a velocity not less than 2.5 fps, c) at a point not more than 10 feet downstream of the water source flushing the new main; chlorine is to be injected in the new main at a constant rate sufficient to establish a 25 mg/L chlorine concentration throughout the main, d) Note table for amount of sufficient chlorine required for each 100 foot section of pipe of various diameters.

<u>Pipe Diameter</u>	<u>100% Chlorine (lb)</u>	<u>1% Chlorine Solution (gal)</u>
4	0.013	0.16
6	0.030	0.36
8	0.054	0.65

The chlorinated water shall be retained in the main for at least 24 hours and have a residual of not less than 10 mg/L free chlorine prior to flushing.

3. Testing

Upon completion of the hydrostatic test and disinfection, the Contractor shall contact the Department's Construction Section requesting a bacteria test. The Contractor shall install sample taps on the new main and at the end of each new branch of the piping system. The Contractor shall flush the chlorinated disinfection water from the piping system until a free chlorine residual of 1 to 1.5 mg/L is maintained. The Engineer will pull a water sample on 2 consecutive days allowing 24 hours for each sample to be processed.

The contractor shall coordinate the scheduling of the sampling procedure a minimum of one-week in advance of wanting the sample to be pulled. Due to the varying workload, the sample will be scheduled and pulled as the schedule permits. All failed samples, or samples that are not ready at the time of collection, will be charged to the contractor at the current rate it costs the Department per sample.

Due to the requirements from the FDEP, the contractor may be required to remobilize to the job site thirty to forty-five days after the samples have been cleared to perform necessary meter transfers and/or cut and plugs.

Samples for bacterial analysis will be taken and analyzed by the Department. The sampling process may only begin on Mondays or Wednesdays. Two consecutive approved samples, taken 24 hours apart, will be required. Those samples will be pulled by the Water Department 24 hours apart. If the first sample is taken on Monday, the second sample must be taken on Tuesday. If the first sample is taken on Wednesday, the second sample will be taken on Thursday. No samples will be taken on Friday and the sampling process will not begin on Tuesday or Thursday. All drilling and tapping equipment shall be sterilized as directed by the Engineer.

After completing the testing and sterilizing and regardless of ground conditions, all sample taps and corporation stops shall be removed from the pipe and replaced with tapered brass plugs.

## **T4.00 RESTORATION**

### **T4.01 Waste Material Disposal**

The Contractor shall remove and dispose of all debris and excess spoil resulting from clearing, demolition and excavation operations. Natural waterways or bodies of water shall not be used for disposal or debris.

All debris shall be disposed of at a site approved and permitted by the State for such disposal. Clean spoil may be disposed on private property only with written authorization of the property owner.

Burning of brush or debris may be permitted, if allowed by the City, subject to the Contractor's securing permits and providing such fire watch and notification of local fire companies as may be required by local law or ordinance. Such permits, however, shall not relieve the Contractor of his responsibilities or liabilities with regard to protecting public health or properties.

#### **T4.02 Repair and Resurfacing**

Where street paving, driveways, sidewalks or curb and gutter is disturbed, restoration shall be made to a condition at least equal to the original. All materials used for restoration shall conform to standard requirements of that particular agency responsible for roadway maintenance where construction takes place. All restoration work shall also meet the requirements of both the permitting agency as well as the City. The Contractor shall determine, to his own satisfaction, any requirements and procedures, other than those set forth herein, which may affect the type, quality and method of carrying out the restoration to the satisfaction of the Department of areas to be restored.

Base material shall be of the type removed or of equal or greater structural strength as determined by the Engineer. Existing base material from the excavation shall not be reused as base material, but may be used as a stabilizer, or for trench backfill after removal of existing asphalt, unless it is determined by the Engineer to be unsuitable.

Edges of pavement shall be mechanically sawed to provide a neat, straight edge to the width shown on the plans, or greater if necessary, prior to replacement. Base material shall be placed to the depths required by permitting agency and thoroughly compacted to the density required by the Department or to the standard of the governing permitting agency.

The Contractor shall pay careful attention to the proper reconstruction of the pavement adjacent to the gutters and at street intersections to obtain satisfactory drainage to inlets from the intersecting streets.

Pavement replacement shall be with the same materials as removed and installation methods and procedures shall comply with the appropriate procedures established by the FDOT Standards Specifications or the appropriate permitting agency.

In the absence of governing agency requirements, where asphaltic concrete overlays are performed, the overlays shall be 1 inch thick over the pipe trench area as directed by the Department so as to provide a smooth transition between the existing pavement and the overlay pavement. In the event that the contractor maintains his disturbed area within the maximum pay limits but the jurisdictional authority requires milling and overlaying in excess of the maximum pay limits, the contractor will be paid for the additional milling and overlaying at the appropriate contract unit prices.

Permanent pavement replacement shall not commence until acceptable to the Engineer. Until such replacement is completed, the Contractor shall maintain all trenches and disturbed areas, providing additional base materials as is necessary to maintain smooth transition of the areas by vehicular traffic and providing dust control as necessary.

#### **T4.03 Pavement Marking**

Where shown or required for repaired/replaced pavement, pavement marking shall be painted with thermoplastic markings.

Thermoplastic compound sealing primer and glass spheres shall meet the requirements of FDOT Standard Specifications, Sections 711 and 971, or the requirements of the governing permitting agency.

Pavement marking of repairs/replacements shall match the previously existing pavement where applicable. Where markings are required other than replacement of previously existing markings, the Contractor shall follow the requirements of the U.S. Department of Transportation, Manual of Uniform Traffic Control devices for streets and Highways. Application of thermoplastic markings shall comply with FDOT Standard Specifications, Section 711, or the requirements of the governing permitting agency. Reflective pavement markers (RPMs) shall be installed to match the pattern in place prior to the start of construction.

#### **T4.04 Street Signs, Traffic Signs and Informational Signs**

Removal and relocation of all street or traffic signs shall be approved through the appropriate permitting agency.

The Contractor will furnish and install project informational signs as indicated in the contract documents and as directed by the Engineer. The Contractor will remove the sign at the conclusion of the project. Compensation will be in conformance with the appropriate pay item(s).

#### **T4.05 Seeding**

All areas designated to be seeded by the Engineer shall be according to installation procedures and materials outlined herein.

Materials for topsoiling and seeding, including fertilization, shall comply with the applicable requirements of FDOT Standard Specifications, Sections 570 and 981, or the governing permitting agency.

Areas designed to be seeded shall first be fine graded to match the surrounding areas and shall be sown only where the soil is moist and in proper conditions to induce growth. Seeding operations shall not be undertaken when wind velocities exceed 15 mph or the soil is unduly wet or otherwise not in a tillable condition. Grass seed shall be in accordance with FDOT Standard Specifications, Section 570 or shall be of a quality acceptable to the Department. The Contractor shall properly water and otherwise maintain all seeded and mulched areas until final acceptance by the Engineer. Any areas that fail to show a "catch" or uniform stand shall be reseeded and such reseeding shall be repeated, at no additional cost to the Department, until final acceptance. Procedures for topsoiling and seeding, including fertilization, shall comply with the applicable requirements of FDOT Standard Specifications, Section 570, or the governing permitting agency.

#### **T4.06 Sodding**

All areas designated by the Engineer to be sodded shall be sodded according to installation procedures and materials outlined herein.

Sod shall be of the same type as the surrounding grassed areas (unless specified otherwise by the Department), be free of weeds, and have well matted roots. The sod shall be live, fresh, and uninjured at the time of placing. Materials for sodding shall meet the applicable requirements of Sections 575 and 981 of the FDOT Standard Specifications, or the requirements of the governing permitting agency. Except as required to match surrounding grassed areas, sod may be St. Augustine, Bahia, or other varieties as selected by the Department.

Areas designated to be sodded shall first be fine graded to match surrounding areas and scarified or loosen to a suitable depth. Sod shall be placed as soon as possible

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after being dug and shall be shaded and kept moist from the time it is dug until it is planted. Methods for sodding shall meet the applicable requirements of Section 575 of the FDOT Standard Specifications, or the governing permitting agency.