OLD COACHMAN/SPECTRUM FIELD RCW PIPE REPAIR PROJECT

PINELLAS COUNTY JOINT PROJECT AGREEMENT

(PROJECT No. 17-0056-UT)

TECHNICAL SPECIAL PROVISIONS

Prepared for

CLEARWATER
BRIGHT AND BEAUTIFUL · BAY TO BEACH

100% Submittal

MARCH/2020

City of Clearwater, Florida
OLD COACHMAN/SPECTRUM FIELD RCW PIPE REPAIR PROJECT

PINELLAS COUNTY JOINT PROJECT AGREEMENT

(PROJECT No. 17-0056-UT)

TABLE OF CONTENTS

DIVISION 01 – GENERAL REQUIREMENTS

01630 Measurement and Payment.....01630-1

DIVISION 02 – SITEWORK

02071 Directional Boring.....02071-1
02221 Trenching, Bedding and Backfill for Pipe.....02221-1
02610 Certa-Lock PVC Pipe.....02610-1

DIVISION 09 – FINISHES

09900 Painting and Coatings.....09900-1

DIVISION 13 – SPECIAL CONSTRUCTION

13350 Prefabricated Welded Steel Bridges.....13350-1

DIVISION 15 - MECHANICAL

15062 Ductile Iron Pipe and Fittings.....15062-1
15065 Tracer Wire.....15065-1
15100 Valves and Appurtenances.....15100-1

DEFINITIONS:

- THE OWNER IS PINELLAS COUNTY'S ENGINEER.
- THE PROJECT REPRESENTATIVE IS PINELLAS COUNTY'S ENGINEER.
-

NOTE: The definitions are for the option (City of Clearwater Technical Special Provisions) ONLY.

SECTION 01630
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 SCOPE

A. This section covers methods of measurement and payment for items of Work associated with the installation of reclaimed water (RCW) mains owned by City of Clearwater (City).

1.02 GENERAL

A. The total Bid Price shall cover all Work required by the Contract Documents. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction equipment and tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the lump sum and unit prices bid. All Work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of Contractor and all costs in connection therewith shall be included in the prices bid.

1.03 EXCAVATION

A. The price bid for each item of Work, which involves excavation or trenching, shall include all costs for such Work. No direct payment shall be made for excavation or trenching. All excavation is unclassified and there shall be no separate payment for excavation of rock or for backfill where rock is excavated below subgrade.

1.04 MEASUREMENT AND PAYMENT

A. Bid Items for the *Old Coachman/Spectrum Field RCW Pipe Repair Project (17-0056-UT)*:

1. Bid Items No. CLW-005-0700, CLW-101-0100, CLW-102-0100 – For description of these Bid Items, refer to the latest revision of the Pinellas County Standard Technical Specification for Roadway and General Construction.

2. Bid Item CLW-005-0900 - For description of this Bid Item refer to Sheet 2 of the Construction Drawings.

3. Bid Item No. CLW-1 - F&I RCW Pipe by Horizontal Directional Drill

   a. Description: This Bid Item describes measurement and payment for RCW pipe installed by directional boring. The pay quantities for the work specified under this Section shall be the number of linear feet of

the types and sizes of pipe specified in the applicable pay items, actually constructed and accepted.

b. Measurement: Measurement will be horizontally, above the centerline of the pipe, and includes the length of any valves or fittings.

c. Payment: Payment will be according to the diameter, thickness class, lining material, coating, and type of joint, as set forth on the Proposal. The unit bid price includes furnishing and installing all pipe by directional boring or by incidental open cut at launching and receiving pits, two 10-gauge high-carbon steel inner core reinforcement directional drilling tracer wires, tracer wire testing, connecting/tie-ing into existing stubbed out pipes, reconnections, materials above or below ground along pipeline alignment, joints and jointing materials, couplings, labor, machinery, construction equipment, directional boring equipment, bentonite clay slurry seal, launching and receiving pits, exploratory pits; excavation, bracing, shoring, sheeting, bedding and backfill, compaction, dewatering, adjusting/relocating, supporting, protecting or replacement of existing underground or aboveground utilities including associated utility coordination; disposal of spoil/bentonite or other materials; hydrostatic testing including water for testing, temporary plugs, taps and blow-offs; pigging and flushing (including existing pipes impacted by construction); erosion control; concrete encasement; bollard removal and replacement; signage removal and replacement; underdrain restoration and all other related and necessary materials, work and equipment required to construct a complete operable pipeline. This bid item shall include all required site restoration work.

d. Payment shall be made under:

i. Item No. CLW-1 – F&I 12” C-900/RJ CERTA-LOK DR 18 PVC RCW WM by Horizontal Directional Drill

4. Bid Item No. CLW-2 – F&I RCW Pipe by Open Cut

a. Description: These Bid Items describe measurement and payment for RCW pipe installed by open cut. The pay quantities for the work specified under this Section shall be the number of linear feet of the types and sizes of pipe specified in the applicable pay items, actually constructed and accepted.

b. Measurement: Measurement will be horizontally, above the centerline of the pipe, and includes the length of any valves or fittings. The limits of measurement shall be as shown on the plans.

c. Payment: Payment will be according to the diameter, thickness class, lining material, coating, and type of joint, as set forth on the Proposal. The unit bid price includes furnishing and installing all pipe by open cut, restraining gaskets or couplings for pipe joints, excavation, dewatering, backfill, compaction, connecting/tie-ing

into existing stubbed out pipes, reconnections, couplings, two 12-gauge solid or stranded copper locator wire, tracer wire testing, polyethylene encasement for DI pipe, materials above or below ground along the pipeline alignment, joints and jointing materials, bracing, shoring and sheeting; exploratory excavation; bedding and backfill, compaction, constructing the specified protection and adjusting of existing above ground and underground utilities and service connections; adjusting/relocating, supporting, protecting, or replacement of existing underground or aboveground utilities including associated utility coordination; bollard removal and replacement; signage removal and replacement; disposal of spoil or other materials; hydrostatic testing including water for testing, temporary plugs, taps and blow-offs; pigging and flushing (including existing pipes impacted by construction); erosion control; concrete encasement; underdrain restoration and all other related and necessary materials, work and equipment required to construct a complete operable pipeline. This bid item shall include all required site restoration.

d. Payment shall be made under:

i. Item No. CLW-2 – F&I 12” C-900/RJ CERTA-LOK DR 18 PVC RCW WM by Open Cut

5. Bid Item No. CLW-3 – F&I 12” DI RCW Pipe Installed on Steel Pipe Bridge

a. Description: This Bid Item describes measurement and payment for aerial crossing of new DI RCW pipe installed on a galvanized steel pipe bridge at the location shown on the plans. The quantity to be paid for under this item is the number of RCW aerial crossings acceptably installed where shown on the plans.

b. Measurement: Measurement will be on a lump sum basis for each pipe aerial crossing made, regardless of pipe size, type or length. Limits of the pay item are identified on the plans.

c. Payment: Payment will be made for each pipe aerial crossing and shall include designing, furnishing and installing on existing concrete bents of a galvanized steel pipe bridge including all anchoring devices and appurtenances; furnishing and installing all DI RCW pipe, fittings, pipe restraining devices and pipe supports as shown on the plans. The Bid Item shall include full compensation for all labor, materials, machinery, combination air valve assemblies, saddles, roller pipe supports, demolition, hydrostatic testing; pigging; flushing; erosion control; disposal of spoil or other materials and all other items necessary to complete this Bid Item. No additional compensation will be made for any materials or for repairs or required modifications to the existing bridge bents. This bid item shall include all required site restoration.

d. Payment shall be made under:

i. Item No. CLW-3 – F&I 12" DI RCW Pipe Installed on Steel Pipe Bridge

6. Bid Items Nos. CLW-4, CLW-5 – Remove & Dispose of Existing Pipe

a. Description: These Bid Items describe measurement and payment for removal and disposal of existing buried or above ground RCW pipe including casing pipe. The pay quantities for the work specified under this Section shall be the number of linear feet of the sizes of pipe specified in the applicable pay items, actually removed and disposed of.

b. Measurement: Measurement will be horizontally, above the centerline of the pipe, and includes the length of any fittings and valves. The limits of measurement shall be as shown on the plans. No overlap with measurement for payment for other Bid Items shall be measured for this bid item.

c. Payment: Payment will be according to the diameter of pipe as set forth in the Plans. The unit bid price includes removal and disposal of existing buried or above ground pipes including casing pipe, pipe concrete support structures and all fittings and valves as shown on the Plans including but not limited to excavation, disassembly, removal and proper disposal of pipes, joints and jointing materials; disassembly of casing pipe, grouting and capping of existing sections of pipe, dewatering, bracing, shoring and sheeting; exploratory excavation; constructing the specified protection and adjusting of existing above ground and underground utilities and service connections; adjusting/relocating, supporting, protecting, or replacement of existing underground or aboveground utilities including associated utility coordination; disposal of spoil or other materials; erosion control; and all other related and necessary materials, work and equipment required to safely and properly remove and dispose of the existing RCW pipes, fittings and appurtenances. This bid item shall include all required site restoration.

d. Payment shall be made under:

i. Item No. CLW-4 – Remove & Dispose of Existing Aboveground Bypass Pipe

ii. Item No. CLW-5 – Remove & Dispose of Existing Buried 12" RCW Pipe

7. Bid Items Nos. CLW-6 - F&I Gate Valve & Valve Box

a. Description: This Bid Item describes measurement and payment for gate valves and valve boxes, for RCW pipelines. The quantity

to be paid for under this item is the number of valves acceptably installed where shown on the drawings.

b. Measurement: Measurement will be per each valve according to the diameter, type, and joint requirements, as set forth on the Proposal.

c. Payment: The unit bid price includes furnishing and installing gate valves; valve boxes and covers; polywrap; tracer wire access; valve identification tags; concrete valve box pad with welded wire fabric, extension stems; 2-inch schedule 80 PVC pipe; brass coupling and plug; couplings; adjusting, supporting, or replacement of existing underground utilities; excavation, backfill, compaction, dewatering, bracing, sheeting, shoring, erosion control, and incidental construction associated with these Items as shown in the details. This bid item shall include all required site restoration.

d. Payment shall be made under:

i. Item No. CLW-6 – F&I 12” Gate Valve & Valve Box

8. Bid Item No. CLW-7 – F&I Thrust Restraint for New Fittings & Valves to PVC Pipe

a. Description: This bid item describes measurement and payment for retainer gland assemblies used in installing restrained joints on proposed PVC pipe and associated ductile iron fittings and valves.

b. Measurement: The quantity to be paid for under this item is the number of retainer gland assemblies acceptably furnished and installed as shown on the plans.

c. Payment will be according to the number of retainer gland assemblies for restraining new fittings and valves, acceptably furnished and installed. The unit bid price includes furnishing and installing all restraining devices along the pipeline alignment, and all other related and necessary materials, work, and equipment required to properly install the restrained joint. Contractor shall restrain proposed fittings and valves, where required, as shown in the drawings. Contractor shall use restrained joints only; no concrete thrust blocks or thrust collars shall be permitted.

d. Payment shall be made under:

i. Item No. CLW-7 – F&I 12" Thrust Restraint for New Fittings & Valves to PVC Pipe

9. Bid Item Nos. CLW-8 – F&I Thrust Restraint for Existing PVC Pipe

a. Description: This bid item shall be used only if the Contractor determines in the field that joints of existing buried PVC RCW pipe are not restrained. The bid item describes measurement and

payment for split ring retainer gland assemblies used in restraining joints on existing PVC pipe and existing DI fittings.

b. Measurement: The quantity to be paid for under this item is the number of retainer gland assemblies acceptably furnished and installed as shown on the plans.

c. Payment will be according to the number of retainer gland assemblies for restraining joints of existing pipes and fittings, acceptably furnished and installed. The unit bid price includes furnishing and installing all restraining devices along the pipeline alignment, excavation, dewatering, bracing, shoring and sheeting, exploratory excavation, bedding and backfill, compaction, constructing the specified protection and adjusting of existing above ground and underground utilities and service connections, erosion control, and all other related and necessary materials, work, and equipment required to properly install the restrained joint. Contractor shall restrain existing pipe and fittings only if the Contractor determines in the field that joints of existing buried PVC RCW pipe are not restrained. Restraining lengths shall be as shown in the plans. Contractor shall use restrained joints only; no concrete thrust blocks or thrust collars shall be permitted. This bid item shall include all required site restoration.

d. Payment shall be made under:

i. Item No. CLW-8 – F&I 12” Thrust Restraint for Existing DI Pipe

10. Bid Item No. CLW-9 – F&I Combination Air Valve & Polyethylene Cover

a. Description: This Bid Item describes measurement and payment for combination air valves for RCW pipelines. The quantity to be paid for under this item is the number of above ground combination air valves including polyethylene covers acceptably installed where shown on the Contract Drawings or where directed by the Owner or the Owner’s authorized Project Representative.

b. Measurement: Measurement will be per each based on the number of combination air valves with covers installed.

c. Payment: The unit bid price includes furnishing and installing combination air valves, valve box and cover, fittings, service saddle, joint restraints, 2-inch polyethylene tubing, ball valves and valve box, brass pipe, corp stop, concrete pad, gravel bed, excavation, backfill, compaction, dewatering and all other related and necessary materials, work, and equipment required to properly install the combination air valve.

d. Payment shall be made under:

i. Item No. CLW-9 – F&I Combination Air Valve & Polyethylene Cover

11. Bid Item No. CLW-10 – F&I Compact Ductile Iron Fittings

a. Description: This Bid Item describes measurement and payment for compact ductile iron pressure pipe fittings for the construction of the RCW piping as shown on the plans. The quantity to be paid for under this Item will be based on the theoretical weight, in pounds, of actual permanent fittings acceptably furnished and installed.

b. Measurement: The quantity to be paid for under this item is the theoretical weight, in pounds, of actual permanent furnished and installed. The theoretical weight for compact fittings shall be calculated based on the weight listed in ANSI/AWWA C153 ductile iron fittings of the 350 psi pressure.

c. Payment: Payment for pressure pipe fittings will be based on the theoretical weight, in pounds, of actual permanent fittings furnished and installed. The unit bid price includes furnishing and installing all fittings, excavation, backfill, dewatering, sheeting, shoring, erosion control, and incidental construction associated with these Items. No additional payment will be made for furnishing and installing all joint accessories, gaskets, bolts, and joint lubricant for mechanical joints. No payment shall be made for ductile iron fittings included in other bid items.

d. Payment shall be made under:

i. Item No. CLW-10 – F&I Compact DI Fittings.

13. Bid Item No. CLW-11 – Tree Barricades

a. Description: This Bid Item describes measurement and payment for protective barricades around all trees and palms within or adjacent to the work zone, including all staging or lay down areas or as directed by the Owner or the Owner's authorized Project Representative.

b. Measurement: The quantity of tree barricades to be paid for under this Item shall be measured as one lump sum quantity.

c. Payment: The quantities, as determined above, shall be paid for at the contract lump sum price set out in the Proposal, which price and payment constitutes full compensation for all the work described herein. Payment will be made by project completion. No payment will be made if tree barricades are not utilized throughout the project as deemed necessary by the Owner or the Owner's authorized Project Representative.

d. Payment shall be made under:

i. Item No. CLW-11 – Tree Barricades

12. Bid Item No. CLW-12 – Root Pruning

a. Description: This Bid Item describes measurement and payment for root pruning of trees associated with the installation of the potable or raw water transmission or distribution piping. The quantity to be paid for under this item is the linear feet of trench in which tree roots are acceptably pruned as directed by the Owner or the Owner's authorized Project Representative.

b. Measurement: Measurement will be horizontally, above the centerline of the pipe from beginning to end of root pruning activities in the trench as determined by the Owner or the Owner's authorized Project Representative.

c. Payment: Payment will be according to the linear feet of trench in which tree roots are acceptably pruned as directed by the Owner or the Owner's authorized Project Representative. The unit bid price shall include the services of a certified arborist, cutting the roots, cutting equipment, plastic barrier, and any other activity or equipment necessary to prune the tree roots until the work is accepted by the Owner or the Owner's authorized Project Representative.

d. Payment shall be made under:

i. Item No. CLW-12 – Root Pruning

13. Special Bid Item CLW-999-0000 – Unspecified Work

The work covered by this Bid Item consists of unspecified items of work not included in other bid items that is directly related to the City potable water mains relocations. For a detailed description of this Bid Item, refer to the latest revision of the Pinellas County Standard Technical Specification for Roadway and General Construction.

B. Note for: Sod, Asphalt Pavement, Driveway, Concrete Sidewalk and Concrete Curb Replacement, Unsuitable Material Excavation Below Grade, Select Backfill Below Grade and Asphalt Overlay.

1. All costs associated with sod, driveway, concrete sidewalk, and curb restoration, unsuitable material excavation below grade, and select backfill below grade shall be included in the unit prices bid for the potable water and sanitary sewer piping installed. No additional payment will be made for these items unless directed by the Owner or the Owner's authorized Project Representative.

C. Note for: Erosion Control

1. No additional payment will be made for erosion control features for raw water piping installation to protect the work areas and adjacent property. All costs associated with this item shall be included in the unit prices bid for the linear feet of potable water piping.

2. Erosion control may include sheeting, shoring, trenching boxes, artificial coverings, mowing, sandbagging, slope drains, sediment basins, cleanouts, baled hay and straw, floating silt barrier, staked silt barrier, staked silt fence and seeding.

3. Erosion control is considered a subsidiary obligation of the Contractor and shall include furnishing and installing material, routine maintenance, mowing and removal of temporary erosion control features upon completion of construction.

END OF SECTION

SECTION 02071
DIRECTIONAL BORING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this Section includes all labor, machinery, construction equipment and appliances required to perform in a good workmanlike manner all directional boring therein.

1. The overall work scope shall include, but not be limited to steerable directional boring (drilling) equipment, boring pits and equipment, sheeting, location signs as required, miscellaneous appurtenances to complete the entire Work as shown on the Contract Drawings, and restoration, including irrigation system replacement. Directional boring operations shall be performed within the right-of-way and/or easements shown on the Contract Drawings.

B. The equipment used in directional boring, also known as Horizontal Directional Drilling, shall be of adequate commercial size and satisfactory working condition for safe operation, and may be subject to approval by the County or State at the discretion of the Engineer. Such approval, however, shall not relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein. Only workmen experienced in directional boring operations shall be used in performing the Work.

C. Provide all structures, safety equipment, and professional services required to provide for the health and safety of the general public and of personnel involved in directional boring work in accordance with the requirements of the regulatory agencies having jurisdiction.

D. Take all measures necessary to protect surrounding public and private property, adjacent buildings, roads, drives, sidewalks, and appurtenances from damage due to directional boring work. Responsibility and payment for correction of such damage shall be the sole responsibility of the Contractor.

E. The Directional Boring operation is to be operated in a manner to eliminate the discharge of water, drilling mud, and cuttings to the adjacent water bodies or to the land areas involved during the construction process.

1.02 REFERENCE DOCUMENTS

A. FDOT Utility Accommodation Guide

B. American Society for Testing and Materials (ASTM).

C. American Water Works Associations (AWWA).

1.03 RELATED WORK

A. Section 15064 HDPE Pipe.

1.04 QUALIFICATIONS

A. Pipe Manufacture: All pipe for an individual directional drill installation shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the items to be furnished for HDD pipeline construction.

B. The Directional Drill Contractor must have at least five years of directional drilling experience installing potable water, wastewater, or reclaimed water mains of at least 12 inches in diameter. Three references are to be provided to the Engineer during shop drawing submittal.

C. All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety. Each person must have at least five years of directional drilling experience. The Directional Bore Installer shall have a sufficient number of competent workers on the job at all times to insure the Directional Bore is made in a timely and satisfactory manner.

D. Pipe Segment Fusions: All pipe fusing equipment and methods shall be performed by specialists who are certified by the pipe manufacturer for such operations. The specialists responsible for thermal butt fusing plastic pipe shall have manufacturer certification for performing such work and a minimum of five (5) years of experience performing this type of work. Documentation of the certification and the required work experience shall be submitted for approval during shop drawing submittal.

E. Drilling Supervisor: A competent and experienced drilling supervisor representing the Directional Drill Contractor shall be present at all times during the actual drilling operations. This includes, but is not limited to, drilling equipment mobilization and set-up, drilling fluid preparation, boring, back-reaming and pulling. A responsible representative who is thoroughly familiar with the equipment and type of work to be performed must be in direct charge and control of the operation at all times. In all cases, the supervisor must be continually present at the job site during the actual Directional Bore operation.

F. Drilling Fluid Specialist: The personnel responsible for supervising the supply, mixing, monitoring fluid quality, pumping and re-circulation system proposed for the drilling fluid shall have a written certification issued by the Drilling Fluid manufacturer for performing such work and a minimum of five years experience performing this type of work. If no certification is available, written

documentation of the required work experience for the proposed personnel shall be submitted for review and approval.

G. Personnel who are unqualified, incompetent or otherwise not suitable for the performance of this project shall be removed from the job site and replaced with a suitable person.

H. A professional land surveyor registered in the State of Florida will be required for certified as-builts as per specifications.

1.05 SUBMITTALS

A. PRE-CONSTRUCTION SUBMITTALS

1. Drilling Materials: Detailed description including specifications and catalog cuts for:

a. Pipe, fittings, tanks and materials to be furnished for the drilling equipment, dewatering and local drainage including the names of the suppliers.

b. Shop drawings and catalog data for all HDD equipment.

c. Steering and tracking devices including specific tracer wire.

d. Drilling fluids: the drilling fluid submittal shall include the ratio of mixture to water, including any additives, based on the Contractor's field observations prior to construction, knowledge and experience with drilling in similar conditions, and any soil data provided in the Contract Documents, which shall be verified by the drilling fluid specialist. The Contractor is responsible for maintaining the quality of the drilling fluids during all boring work and shall engage a testing laboratory to sample and monitor the fluids at regular intervals, comparing results to the approved mixture. Field changes to the drilling fluids shall be approved by the drilling fluid specialist and reported to the Engineer.

2. Shop drawings for the specialized equipment to be used.

3. Shop drawings for the breakaway swivel, including the method of setting the swivel's break point and set point to be used, along with the product pipe manufacturers pullback force recommended setting.

4. A Bore Plan that includes the following:

a. Contact information and experience for the drilling fluid specialist.

b. The number of passes the bore will include prior to the product pipe pull-back.

c. The pilot bore and all reaming bore sizes including the final pullback with the product pipe.

d. Drilling rod length in feet.

e. The pilot bore, pre-ream bores (if any) and pullback production rate in minutes per (drilling) rod.

f. The fluid pumping rate in gallons per minute for each drilling sequence.

g. Details of the entry and exit pit locations along with entry and exit angles for the bore, and coordination with the design profile.

5. Details of the Drill Head device including types of cutters suitable for the variable subsurface soil and rock conditions at the site, drilling fluid port arrangements, connection to drill rod and devices for location tracking.

6. Details of the Back Reaming device including types of cutters suitable for the variable subsurface soil and rock conditions at the site, drilling fluid port arrangements, connection to drill rod and devices for location tracking.

7. Site layout plan for entry and exit pit locations, drawn to scale, depicting the position of all required equipment, access points, existing facilities to remain in place, existing traffic lanes to be maintained in operation, office trailers and storage sites.

8. Pipe assembly procedure, details of support devices, and staging area layout including methods to avoid interference with local streets, driveways, and sidewalks.

9. The Contractor must coordinate with Pinellas County for all traffic lane diversions or closures and obtain their permits or written approvals before performing any work in the public right of way.

10. Incident Reaction or Contingency Plan: The Contractor shall prepare and submit for review and approval to the Engineer an Incident Reaction Plan that will describe in detail the actions and materials to be used in the event that the proposed and approved construction activity or progress is stopped, deviated, delayed or obstructed, or the materials fail to perform as intended. The plan shall consider a typical range of failure scenarios and describe the required and intended reactions that will restore the work to its intended design.

a. Regarding spills, the plan shall include, as a minimum, the monitoring and response activities presented in the Bentonite Spill Prevention and Management Plan included which is a part of the FDEP Environmental Resource Permit for this project and must be followed.

11. Proposed construction schedule for all field activities.

12. An HDD schedule identifying daily work hours and working dates for each installation.

13. All test reports for tests completed as required by these Specifications.

B. DIRECTIONAL DRILLING LOGS

1. The following AS-RECORDED DATA is required from the contractor and/or fusion provider to the Owner or pipe supplier upon request:

a. The as-recorded plan and profile will reflect the actual installed alignment, and reflect the horizontal offset from the baseline and depth of cover and all utility facilities found during the installation.

b. All fittings, valves, or other appurtenances will also be referenced and shown.

c. A daily project log, along with tracking log sheets, should they be used, shall be provided. Tracking log sheet data, should it be employed, shall include any and all that apply, including inclination, depth, azimuth, and hydraulic pull-back and rotational force measured.

PART 2 – PRODUCTS

2.01 DRILLING SYSTEM EQUIPMENT

A. GENERAL

1. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pull back the pipe, a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the installation, a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be reused (if required), a magnetic guidance system or walk-over system to accurately guide boring operations, a vacuum truck of sufficient capacity to handle the drilling fluid volume, and trained and competent personnel to operate the system. All equipment shall be in good, safe condition with sufficient

supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

B. DRILLING RIG

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

C. DRILL HEAD

1. The horizontal directional drilling equipment shall produce a stable fluid lined tunnel with the use of a steer-able drill head and any subsequent pre-reaming heads.

2. The system must be able to control the depth and direction of the drilling operation.

3. Drill head shall contain all necessary cutters and fluid jets for the operation, and shall be of the appropriate design for the ground medium being drilled.

D. MUD MOTORS (If Required)

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

E. DRILL PIPE

1. Shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool~~s~~ joints should be hardened to 32-36 RC.

2.02 GUIDANCE SYSTEM

A. GENERAL

1. An electronic walkover tracking system or a Magnetic Guidance System (MGS) probe or proven gyroscopic probe and interface shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance shall be capable of tracking at all depths up to fifty feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The guidance system shall be accurate and calibrated to manufacturer‘s specifications of the vertical depth of the borehole at sensing position at depths up to fifty feet and accurate to 2 feet horizontally.

B. COMPONENTS

1. The Contractor shall supply all components and materials to install, operate, and maintain the guidance system.

C. The guidance system shall be of a proven type, and shall be set up and operated by personnel trained and experienced with the system. The operator shall be aware of any geo-magnetic anomalies and shall consider such influences in the operation of the guidance system.

2.03 DRILLING FLUID (MUD) SYSTEM

A. MIXING SYSTEM

1. A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water, and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be minimum of 1,000 gallons. Mixing system shall continually agitate the drilling fluid during drilling operations.

B. DRILLING FLUIDS

1. Drilling fluid shall be composed of clean water and bentonite clay. Water shall be from an authorized source with a pH of 8.5 œ 10. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. No additional material may be used in drilling fluid without prior approval from Engineer. The bentonite mixture used shall have the minimum viscosities as measured by a March funnel:

Rocky Clay	- 60 seconds
Hard Clay	- 40 seconds
Soft Clay	- 45 seconds
Sandy Clay	- 90 seconds
Stable Sand	- 80 seconds
Loose Sand	- 110 seconds
Wet Sand	- 110 seconds

2. These viscosities may be varied to best fit the soil conditions encountered, or as determined by the operator.

C. DELIVERY SYSTEM

1. The mud pumping system shall have a minimum capacity of 35-500 GPM and the capability of delivering the drilling fluid at a constant minimum pressure of 1200 psi. The delivery system shall have filters in-line to prevent solids from being pumped into drill pipe. Used drilling fluid and drilling fluid spilled during operations shall be contained and conveyed to the drilling fluid recycling system or shall be removed by vacuum trucks or other methods acceptable to Engineer. A berm, minimum of 12 inches high, shall be maintained around drill rigs drilling fluid mixing system, entry and exit pits and drilling fluid recycling system to prevent spills into the surrounding environment. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey drilling fluid from containment areas to storage and recycling facilities for disposal.

2.04 OTHER EQUIPMENT

A. PIPE ROLLERS

1. Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe during handling and pullback operations.

2. A sufficient quantity of rollers and spacing, per the pipe supplier's guidelines shall be used to assure adequate support and excessive sagging of the product pipe.

B. PIPE PULL HEADS

1. Pipe pull heads shall be utilized that employ a positive through-bolt design assuring a smooth wall against the pipe cross-section at all times.

2. Pipe pull heads shall be specifically designed for use with HDPE pipe and shall be as recommended by the pipe supplier.

C. RESTRICTIONS

1. Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by the Engineer prior to commencement of the work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system shall maintain line and grade within the tolerances prescribed by the particular conditions of the project.

2.05 EROSION CONTROL

A. Provide silt fence, floating turbidity barriers and hay bales as approved under FDOT Standard Specifications for use near open water bodies, wetlands, ditches, inlets or other areas where runoff could pollute nearby water bodies.

2.06 STORAGE AND HANDLING OF MATERIALS

A. Inspect materials delivered to the site for damage. All materials found to have cracks, flaws, cuts, abrasions or other major defects shall be rejected and removed from the job site immediately.

B. Store materials under cover out of direct sunlight. Do not store directly on the ground. Keep all materials free of dirt and debris.

C. Disposal of fluids is the responsibility of the Contractor, and shall be performed in accordance with all permits and applicable federal, state or local environmental regulations. Upon completion the area shall be completely cleaned of all debris, spilled fluids and damaged plants, and restored to existing or better conditions.

PART 3 – EXECUTION

3.01 DIRECTIONAL DRILLING OPERATIONS

A. GENERAL

1. The Contractor shall provide all material, equipment, and facilities required for directional drilling. Proper alignment and elevation of the bore hole shall be consistently maintained throughout the directional drilling operation. The method used to complete the directional drill shall conform to the requirements of all applicable permits.

2. The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations. If Contractor is using a magnetic guidance system, drill path will be surveyed for any surface geo-magnetic variations or anomalies.

3. The directional boring equipment shall be operated by individuals trained by the manufacturer as experienced operators.

4. The directional boring equipment shall produce a stable, clay sealed tunnel with a minimum burial depth of 30-inch for the carrier pipe installation.

5. Locations for the drilling equipment and storage of materials shall be coordinated with the Engineer to minimized damage to existing features and property. All equipment and materials shall remain in Public Right-of-Way or Easements, unless written permission from the property owners allows the placement of equipment on private property.

6. The directional boring equipment shall employ a fluid cutting technique. The soil shall be cut by small diameter, high pressure jets of liquefied clay. The jets shall cut the soil in advance of the boring tool, impregnating and lining the tunnel wall with clay. The clay shall be totally inert and pose no environmental risk. A pilot hole shall be drilled with an appropriately sized drill pipe. The pilot hole will then be increased to the appropriate diameter by a reaming operation. The boring tool will then be connected to the pipe, and the boring tool shall pull the carrier pipe through the clay lined tunnel as it traverses under the surface being crossed. The pulling strength of the boring equipment shall not exceed pipe safety pull strength as per manufacturer's recommendations. Surface excavations shall be limited to small launching and receiving pits. Pits shall be no larger than that required for launching and receiving. Adequate "pit-tail" lengths of service connection piping shall be provided at both the launching and receiving ends to facilitate service connection assembly.

7. Readings shall be recorded after advancement of each successive drill pipe (no more than 10 feet) and the readings plotted on a scaled drawing of 1-inch = 2 feet, both vertical and horizontal. Access to all recorded readings and plan and profile information shall be made available to the Owner or the Owner's authorized Project Representative, at all times. At no time shall the deflection radius of the drill pipe exceed the deflection limits of the carrier pipe as specified herein.

B. REAMING

1. Upon approval of the pilot hole location by the Engineer, the hole opening or enlarging phase of the installation shall begin. The borehole diameter shall be increased to the size recommended by the pipe manufacturer to accommodate the pullback operation of the pipe. The type of hole opener or back reamer to be utilized in this phase shall be determined by the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation. The reamer type shall be at the Contractor's discretion.

C. PIPE PULLBACK OPERATION

1. Pipe shall be fused prior to insertion, if the site and conditions allow, into one continuous length.

2. The pipes shall be assembled in a manner that does not obstruct adjacent roads or City, County, or Public activities adjacent to the layout areas except as directed otherwise by the Owner's authorized Project Representative.

3. The Contractor shall provide adequate support/rollers along the stringing area to support the required length of the pipe for each bore. Such support/rollers shall be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback.

4. Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately prior to joining.

5. All PVC pipe mains installed by shallow directional boring shall be provided with an insulated (2) 10-gauge Copperhead Extra High Strength copper-clad steel tracer wires as manufactured by Copperhead Industries or approved equal with color coded insulation for pipe location purposes. These wires are to be continuous with splices made only by methods approved by the Engineer. Wire is to be secured to all valves, tees, and elbows. The locator wires shall be tested by voltage of at least 12 DC. Test each wire with both positive and negative charge with not more than 1 volt of loss per 1000 feet will be allowed. The wires will be pre-tested at time of pressure test of pipeline. If pretest fails for both wires, pressure test will not be done until wire is repaired. Final wire testing to be at job finish. If this test fails, the Contractor is responsible for repairing the locator wires. See Section 15065 for additional information.

6. Pulling Loads: The maximum pull (axial tension force) exerted on the pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not overstressed.

7. Torsion and Stresses: A swivel shall be used to connect the HDPE pipeline and tracer wires to the drill pipe to prevent torsional stresses from occurring in the pipe.

8. Pipeline Support: The pipelines shall be adequately supported during installation so as to prevent overstressing or buckling.

9. The Contractor shall at all times handle the pipe in a manner that does not overstress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50 percent of yield stress for flexural bending of the pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense. The contractor shall take appropriate steps during pullback to ensure that the pipe will be installed without damage.

10. During the pullback operation, the Contractor shall monitor roller operation and sidebooms if required to assist movement of the pipe. Surface damage shall be repaired by Contractor before pulling operations resume.

11. The lead end of the pipe shall be closed during the pull back operation.

12. After the carrier pipe is completely pulled through the tunnel, a sufficient relaxation period, as recommended by the specified pipe manufacturer, shall be provided prior to the final pipe tie-in.

13. The Contractor shall install, maintain, and leave in place any sheeting, underpinning, cribbing, and other related items (other than that required for the boring and receiving pits) to support any structure or facility affected by the boring operations. The Engineer, depending upon existing conditions, may require that additional sheeting for the excavation be left in place.

14. Contractor shall hydrostatically test each line according to the required test procedures in these Technical Special Provisions after installation of complete pipeline services. Pressure shall be monitored with certified instruments during the test. The requirements for testing shall be met.

D. HANDLING DRILLING FLUIDS AND CUTTINGS

1. During the drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. These fluids must not be discharged into the waterways. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.

E. RESPONSIBILITY

1. The Contractor shall be fully responsible for the steerable, clay lined directional drilling operation. Any noticeable surface defects resulting from improper operation of this boring equipment shall be repaired by the Contractor at his expense.

F. CLEANING AND SIZING PIGS

1. After the pipe is in place, cleaning pigs shall be used to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check for abnormalities in the form of buckles, dents, excessive out-of-roundness, and any other deformations. The sizing pig run shall be considered acceptable if the survey results indicate that there are no sharp anomalies (e.g. dents, buckles, gouges, and internal obstructions) greater that 2 percent of the nominal pipe diameter, or excessive ovality greater than 5 percent of the nominal pipe diameter. For gauging purposes, dent locations are those defined above which occur within a span of five feet or less. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality location are those defined above which exceed a span of five feet.

G. SUCCESSFUL COMPLETION

1. The contractor shall be considered as having completed the requirements of any directional boring when he has successfully completed the work and tested the pipe to the satisfaction of the Engineer.

2. Following drilling operations, Contractor will de-mobilize equipment and restore the work site to the original conditions or better. All excavations will be backfilled and compacted according to the specifications.

3. Surface restoration shall be completed in accordance with the requirements of the contract, to a condition as good as or better than existed prior construction.

END OF SECTION

SECTION 02221

TRENCHING, BEDDING AND BACKFILL FOR PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to perform all excavation, backfill, fill, grading, trench protection or other related work required to complete the piping work shown on the Drawings and specified herein. The work shall include, but not be limited to: vaults; duct conduit; pipe; roadways and paving; backfilling; required fill or borrow operations; grading; disposal of surplus and unsuitable materials; and all related work such as sheeting, bracing and dewatering.

B. Prior to commencing work, the Contractor shall examine the site and review test borings if available, or undertake his own subsurface investigations and take into consideration all conditions that may affect his work.

C. The Contractor is responsible for the protection of every tree which is scheduled to remain in the project area. This includes trees which may or may not be shown on the plans. Every tree shall be adequately protected in place at no additional cost to the City. This includes, but is not limited to protecting the root systems and adjusting grades as necessary for tree/root protection.

1.02 PROTECTION

A. Sheeting and Bracing in Excavations:

1. In connection with construction of underground structures, the Contractor shall properly construct and maintain cofferdams. These shall consist of: sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures, existing yard pipe and/or foundation material from disturbance, undermining, or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.
2. Trench sheeting for pipes: no sheeting is to be withdrawn if driven below, mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot above the top of any pipe unless otherwise directed by the Engineer. During the progress of the work, the Engineer may direct the Contractor in writing to leave additional wood sheeting in place. If steel sheeting is used for trench sheeting, removal shall be as specified

above, unless written approval is given for an alternate method of removal.

3. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. Unless otherwise approved or indicated on the Drawings or in the Specification, all sheeting and bracing shall be removed after completion of the piping or structure, care being taken not to disturb or otherwise injure the pipeline or finished masonry. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools specifically made for that purpose, by watering, or as may otherwise be directed.
4. The Contractor shall construct, to the extent he deems it desirable for his method of operation, the cofferdams and sheeting outside the neat lines of the pipeline trench or foundation unless otherwise indicated on the Drawings or directed by the Owner/Engineer. Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing and cofferdams shall be adequate to withstand all pressures to which the pipeline or structure will be subjected. Pumping, bracing and other work within the cofferdam shall be done in a manner to avoid disturbing any construction of the pipeline or the enclosed masonry. Any movement or bulging which may occur shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.
5. Drawings of the cofferdams and design computations shall be submitted to the Engineer and approved prior to any construction. However, approval of these drawings shall not relieve the Contractor of the responsibility for the cofferdams. The drawings and computations shall be prepared and stamped by a Registered Professional Engineer in the State of Florida and shall be in sufficient detail to disclose the method of operation for each of the various stages of construction, if required, for the completion of the pipeline and substructures.

B. Dewatering, Drainage and Flotation

1. The Contractor shall construct and place all pipelines, concrete work, structural fill, bedding rock and limerock base course, in-the-dry. In addition, the Contractor shall make the final 24" of excavation for this work in-the-dry and not until the water level is a minimum of 6" below proposed bottom of excavation.
2. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavation and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.

3. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
4. Wellpoints may be required for dewatering the soil prior to final excavation for deeper in-ground structures or piping and for maintaining the lowered groundwater level until construction has been completed to avoid the structure, pipeline, or fill from becoming floated or otherwise damaged. Wellpoints shall be surrounded by suitable filter sand and no fines shall be removed by pumping. Pumping from wellpoints shall be continuous and standby pumps shall be provided.
5. The Contractor shall furnish all materials and equipment to perform all work required to install and maintain the proposed drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.
6. Where required, the Contractor shall provide a minimum of two operating groundwater observation wells at each structure to determine the water level during construction of the pipeline or structure. Locations of the observation wells shall be at structures and along pipelines as approved by the Engineer prior to their installation. The observation wells shall be extended to 6 inches above finished grade, capped with screw-on caps protected by 24" x 24" wide concrete base and left in place at the completion of this Project.
7. Prior to excavation, the Contractor shall submit his proposed method of dewatering and maintaining dry conditions to the Engineer for approval. Such approval shall not relieve the Contractor of the responsibility for the satisfactory performance of the system. The Contractor shall be responsible for correcting any disturbance of natural bearing soils for damage to pipeline or structures caused by an inadequate dewatering system or by interruption of the continuous operation of the system as specified.
8. As part of his request for approval of a dewatering system, the Contractor shall demonstrate the adequacy of the proposed system and wellpoint filter sand by means of a test installation. Discharge water shall be clear, with no visible soil particles in a one quart sample. Discharge water shall not flow directly into wetlands or Waters of the State as defined by FDEP and SWFWMD.
9. During backfilling and construction, water levels shall be measured in observation wells located as directed by the Engineer.
10. Continuous pumping will be required as long as water levels are required to be below natural levels.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials for use as fill and backfill shall be described below. For each material, the Contractor shall notify the Engineer of the source of the material and shall furnish the Engineer, for approval, a representative sample weighing approximately 50 pounds, at least ten calendar days prior to the date of anticipated use of such material.
2. Additional materials shall be furnished as required from off-site sources and hauled to the site.

B. Structural Fill

1. Structural fill shall be used below spread footing foundations, slab-on-grade floors and other structures as backfill within three feet of the below grade portions of structures.
2. Structural fill material shall be a minimum of 60 percent clean sand, free of organic, deleterious and/or compressible material. Minimum acceptable density shall be 98 percent of the maximum density as determined by AASHTO T-180. Rock in excess of 2-1/2" in diameter shall not be used in the fill material. If the moisture content is improper for attaining the specified density, either water shall be added or material shall be permitted to dry until the proper moisture content for compaction is reached.

C. Base Course

1. Asphalt, crushed concrete, soil cement or approved equal, shall be used as base course for bituminous paved roads and parking areas.

D. Common Fill

1. Common fill material shall be free from organic matter, muck or marl and rock exceeding 2-1/2" in diameter. Common fill shall not contain broken concrete, masonry, rubble or other similar materials. Existing soil may be used to adjust grades over the site with the exception of the construction area.
2. Material falling within the above specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the Engineer, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials by the Contractor.

E. Crushed Stone

1. Crushed stone may be used for pipe bedding, manhole bases, as a drainage layer below structures with underdrains and at other locations indicated on the Drawings.
2. Crushed stone shall be size No. 57 with gradation as noted in Table 1 of Section 901 of Florida Department of Transportation, Construction of Roads and Bridges.

PART 3 EXECUTION

3.01 FILL PLACEMENT

A. General

1. Material placed in fill areas under and around pipelines and structures shall be deposited within the lines and to the grades shown on the Drawings or as directed by the Engineer, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by the Engineer. If sufficient common fill material is not available from excavation on site, the Contractor shall provide borrows as may be required.
2. Limerock base course material, structural fill and screened limerock, may be provided as borrow.
3. Fill shall be brought up in substantially level lifts throughout the site, starting in the deepest portion of the fill. The entire surface of the work shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section. Fill shall not be placed against concrete structures until they have attained sufficient strength.
4. Fill shall be dumped and spread in layers by a bulldozer or other approved method. During the process of dumping and spreading, all roots, debris and stones greater in size than specified under Materials, shall be removed from the fill areas. The Contractor shall assign a sufficient number of men to this work to insure satisfactory compliance with these requirements.
5. If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by another approved method before the succeeding layer is placed.
6. All fill materials shall be placed and compacted "in-the-dry". The Contractor shall dewater excavated areas and is required to perform the work in such manner as to preserve the undisturbed state of the natural inorganic soil.

3.02 COMPACTION

A. Structural fill, limerock base course and screened limerock in open areas, shall be placed in layers not to exceed nine inches in depth as measured before compaction. Each layer shall be compacted by a minimum of six coverages (3 passes each way) with the equipment described below, to at least 98 percent of the maximum density, as determined by AASHTO T-180. Incidental compaction due to traffic by construction equipment will not be credited toward the required minimum six coverages.

B. Common fill shall be placed and compacted in a manner similar to that described above for structural fill, with the following exceptions: layer thickness prior to compaction may be increased to 12-inches in open areas; and common fill except dike fill, required below water level in peat excavation areas may be placed as one lift, in-the-wet, to an elevation one foot above the water level at the time of filling.

C. Compaction equipment in open areas shall consist of a medium-heavy vibrator roller (minimum static weight of 10 tons) operated at resonant frequency and at a speed of 2 fps or less or other compaction equipment approved by the Engineer.

D. Areas adjacent to pipelines, structures and other confined areas inaccessible to the vibrator roller shall be compacted with a manually operated sled-type vibratory compactor. The Contractor shall also conform to additional backfill requirements at pipelines and structures as specified in the Contract Documents. Compaction of the fill by such means shall be to the same degree of compaction as obtained by the rubber-tired equipment, and the Engineer may make the necessary tests to determine the amount of compactive effort necessary to obtain equal compaction. Unless such tests indicate that modifications may be made, the fill compacted by mechanical compactors shall be placed in 6-inch layers and thoroughly tamped over the entire surface.

Compaction equipment is subject to approval by the Engineer.

E. It is the intention that the fill materials with respect to moisture be used in the condition they are excavated insofar as this is practicable. Material which is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits.

F. If the Engineer shall determine that added moisture is required, water shall be applied by sprinkler tanks or other sprinkler systems, which will insure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued.

G. The Contractor shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment and all other materials and equipment necessary to place the water in the fill in the manner specified.

3.03 TRENCH EXCAVATION AND BACKFILLING

A. Excavation for all trenches required for the installation of pipes and electrical ducts shall be made to the depths indicated on the Drawings and in such manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches.

B. Rock shall be removed to a minimum 6" clearance around the bottom and sides of all the pipe or ducts being laid.

C. Where pipes or ducts are to be laid in limerock bedding or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

D. Where the pipes or ducts are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated manually, shall be done in such a manner that will give a flat bottom true to grade so that pipe or duct can be evenly supported on undisturbed material. Bell holes shall be made as required.

E. Backfilling over pipes shall begin as soon as practicable after the pipe has been laid, jointed and inspected and the trench filled with suitable compacted material to the mid-diameter of the pipe.

F. Backfilling over ducts shall begin not less than three days after placing concrete encasement.

G. All backfilling shall be prosecuted expeditiously and as detailed on the Drawings.

H. Any space remaining between the pipe and sides of the trench shall be packed full by hand shovel with selected earth, free from stones having a diameter greater than 2" and thoroughly compacted with a tamper as fast as placed, up to a level of one foot above the top of the pipe.

I. The filling shall be carried up evenly on both sides with at least one man tamping for each man shoveling material into the trench.

J. The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted by rolling, ramming, or puddling, as the Engineer may direct, sufficiently to prevent subsequent settling.

3.04 GRADING

A. Grading shall be performed at such places as are indicated on the Drawings, to the lines, grades and elevations shown or as directed by the Engineer and shall be made in such a manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.

B. If at the time of excavation it is not possible to place any material in its proper section of the permanent pipeline structure, it shall be stockpiled in approved areas for later use.

C. Minute adjustments in lines or grades may be made if found necessary as the work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction.

D. Stones or rock fragments larger than 2-1/2" in their greatest dimensions shall not be permitted in the top 6" of the subgrade line of all dikes, fills or embankments.

E. All fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings, or as directed by the Engineer.

F. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All fill slopes shall be uniformly dressed to the slope, cross section and alignment shown on the Drawings or as directed by the Engineer.

G. No grading is to be done in areas where there are existing pipelines that may be uncovered or damaged until such lines which must be maintained are relocated, or where lines are to be abandoned and removed, all required valves are closed and drains plugged at manholes.

END OF SECTION

SECTION 02610
CERTA-LOCK PVC PIPE

PART 1 – GENERAL

1.01 WORK INCLUDED

A. This section specifies Certa-Lok polyvinylchloride pipe, including standards for dimensionality, testing, quality, safe handling, and storage.

B. Furnish all labor, materials and equipment required to install 12 inch Certa-Lok C900/RJ reclaimed water (RCW) pipe in accordance with the requirements of the Contract Documents. The pipe size, type and length shall be as specified herein and as shown on the Drawings. Work shall include and not be limited to proper installation, testing, restoration of underground utilities and environmental protection and restoration.

1.02 SCOPE

A. This specification covers thrust-restrained Poly-Vinyl Chloride (PVC) pipe, in nominal sizes 4 to12 inches with cast iron outside diameters. Pipe is included for use as a pressure-rated water delivery system, reclaim water system, as well as in sewer force main and fire protection piping applications.

B. Contractor shall be responsible for all installation processes and procedures associated with the installation by horizontal directional drilling in accordance with Specification Section 02071, or by open-cut in accordance with Specification Section 02221.

1.03 REFERENCE DOCUMENTS

A. American Society for Testing Materials (ASTM)

1. ASTM D1784: Standard for Rigid PVC Compounds and Chlorinated PVC Compounds ASTM D2837: Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials

2. ASTM D3139: Standard Specification for Joints for Plastic Pipes Using Flexible Elastomeric Seals

3. ASTM F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

B. American Water Works Association (AWWA)

1. AWWA C900: Standard for PVC Pressure Pipe Fabricated Fittings, 4 Through 12 inches, for Water Distribution

1.04 REQUIREMENTS

A. GENERAL

1. Products delivered under this specification shall be manufactured only from water distribution pipe and couplings conforming to AWWA C900/C905. The restrained joint pipe shall also meet all short and long term pressure test requirements AWWA C900/C905. Pipe, couplings, and all locking spline components used thereon shall be completely non-metallic to eliminate corrosion problems.

B. MATERIALS

1. Pipe and couplings shall be made from unplasticized PVC compounds having a minimum cell classification of 12454, as defined in ASTM D1784. The compound shall qualify for a Hydrostatic Design Basis (HDB) of 4000 psi for water at 73.4 Degrees F, in accordance with the requirements of ASTM D2837.

C. APPROVALS

1. Restrained joint pipe products shall been tested and approved by an independent third-party laboratory for continuous use at rated pressure. Copies of Agency approval reports or product listing shall be provided to the Engineer. Products intended for contact with potable water shall be evaluated, tested, and certified for conformance with NSF Standard 61 by an acceptable certifying organization.

D. DIMENSIONS

1. Nominal outside diameters and wall thicknesses of thrust-restrained pipe shall conform to the requirements of AWWA C900. Thrust-restrained pipe shall be furnished in sizes 4, 6, 8 and 12 inches Class 150 and Class 200. Pipe shall be furnished in standard lengths of 20 feet.

2. Dimensions of the pipe thrust restraint grooves shall be in accordance with manufacturer‘s specifications.

E. JOINTS

1. The pipe shall be joined using non-metallic couplings which, together, have been designed as an integral system for maximum reliability and interchangeability. High-strength flexible thermoplastic splines shall be inserted into matting precision-machined groves in the pipe and coupling to provide full 360 degree restraint with evenly distributed loading.

2. Couplings shall be designed for use at the rated pressure of the pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F477. Joints shall be designed to meet the leakage test requirements of ASTM D3139.

F. QUALITY CONTROL

1. Every pipe and machined coupling shall pass AWWA C605 hydrostatic proof test requirements.

G. MARKING

1. Pipe shall be legibly and permanently marked in ink with the following information.

   a. Manufacturer and Trade Name
   b. Nominal Size & DR Rating/Pressure Class
   c. Hydrostatic Proof Test Pressure
   d. (NSF-61)
   e. Manufacturing Date Code

2. Pipe and couplings shall also bear the mark of the certifying agency(s) which have tested and approved the product for use in fire protection applications.

H. WORKMANSHIP

1. As defined in AWWA C900, pipe and couplings shall be homogeneous throughout and free from voids, cracks, inclusions, and other defects, and shall be as uniform as commercially practicable in color, density, and other physical characteristics.

I. No cross connection between the reclaimed water system and the potable water system shall be allowed. At all locations where reclaimed water service is provided, the public potable water supply shall be protected by installation of an approved backflow prevention device.

J. WARRANTY

1. The pipe shall be warranted for one year after substantial completion per the pipe supplier's standard terms.

1.05 SUGGESTED SOURCE OF SUPPLY

A. Restrained Joint PVC Pipe shall be CertainTeed's Certa-Lok C900/RJ System, or approved equal.

1.06 SUBMITTALS

A. In general, shop drawings and related manufacturer's product certification shall be made in accordance with Paragraph 6.11.1 of Section III - General Conditions of the Contract Documents for approval prior to construction or fabrication of the material by the manufacturer.

B. The following PRODUCT DATA is required from the pipe/fittings supplier:

1. Pipe Size
2. Dimensionality
3. Pressure Class per applicable standard
4. Color
5. Recommended Minimum Bending Radius
6. Recommended Maximum Safe Pull Force
7. Pipe and installation services warranty information.
8. Written procedural documentation for piping products including proper handling and storage, installation, tapping, and testing.

1.07 SEPARATION OF RECLAIMED WATER, POTABLE WATER, AND WASTEWATER LINES

A. Wherever practical, reclaimed water mains should be installed on the opposite side of the street from potable water mains. A minimum horizontal separation of 5 feet (center to center) or 3 feet (outside to outside) shall be maintained between reclaimed water mains and potable water mains, sanitary sewers, or sanitary force mains. Where a reclaimed water main crosses a potable water main, sanitary sewer, or sanitary force main, a minimum of 18 inches vertical clearance shall be maintained. Where 18 inches of vertical clearance cannot be maintained, the crossing shall be arranged so that the joints of the two pipes are equidistant from the point of crossing with no less than 10 feet between any two joints. Alternatively, the reclaimed water main may be placed in a casing to obtain the equivalent of the required 10 feet separation.

1.08 SYSTEM IDENTIFICATION

A. All reclaimed water piping and appurtenances shall be clearly identified to inform the public and employees that the water is not intended for drinking.

B. The following features shall be included in the design of reclaimed water facilities:

1. All buried reclaimed water transmission and distribution piping shall be color coded purple. For PVC mains, color shall be an integral part of the pipe material.
2. All above ground valves, meters, and other devices, and other appurtenances shall be painted purple. The color standard for paint shall be Pantone color 522C with light color stableant or approved equal.
3. Tracer Wire: See Section 15065.
4. Covers for all valve boxes, meter boxes, and other below ground devices on the reclaimed water system shall be painted purple. Covers shall be permanently embossed with the wording "Reclaimed Water". Valve boxes shall be square, U.S. Foundry or approved equal.

PART 2 – PRODUCTS

2.01 CERTA-LOK POLYVINYL CHLORIDE (PVC) PIPE

A. The pipe material to be used shall meet AWWA C900 standards for Polyvinyl Chloride pressure pipe and fittings with a dimension ratio DR18 or DR14. All other pipe shall have the written approval of the ENGINEER and meet all submittal review as an optional approved product. The pipe shall be designated as Certa-Lok C900/RJ as manufactured by NAPCO Pipe and Fittings.

B. The pipe shall be joined using separate PVC coupling with beveled edges, built-in sealing gaskets and restraining grooves. The restraining splines shall be square or rectangular, and made from Nylon 101.

B. Exposed splines shall be cut flush to coupling to reduce soil drag.

D. Couplings shall be beveled on leading edges to minimize soil friction.

E. CONTRACTOR shall adhere to the pipe manufacturer‘s most current calculations regarding tensile load limitations for trenchless application. This calculation shall be part of the required submittal (see chart below).

Size (inch)	SDR	Class	Pipe O.D. (inch)	Coupling O.D. (inch)	Maximum Pull-In Force Tightest Bending	Maximum Pull-In Force Straight Pull (No Bending)
4	18	150psi	4.80	5.964	6,700 lbs.	8,200 lbs.
6	18	150psi	6.90	8.366	9,000 lbs.	12,800 lbs.
8	18	150psi	9.05	10.947	18,000 lbs.	25,200 lbs.
12	18	150psi	13.20	15.836	26,440 lbs.	41,100 lbs.

F. CONTRACTOR shall adhere to the pipe manufacturer‘s most current recommendations regarding radius of curvature for Certa-Lok C900/RJ pipe used for trenchless application. This calculation of each bore shall be part of the required submittal prior to work.

Pipe Diameter (inch)	Min. Radius of Curvature (ft.)	Offset per 20. Length (ft.)	Deflection per 20. Length
4	100	24	11.5 Degrees
6	150	16	7.6 Degrees
8	200	12	5.7 Degrees
12	300	8	3.8 Degrees

2.02 LOCATOR WIRE

A. Pipe installed by directional drilling or by open cut shall be laid with two (2) tracer wires for location purposes. Refer to Section 15065 for additional requirements for tracer wires.

PART 3 – EXECUTION

3.01 DELIVERY AND OFF-LOADING

A. All pipes shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Owner or Engineer.

B. Each pipe shipment should be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify Owner or Engineer immediately if more than immaterial damage is found. Each pipe shipment should be checked for quantity and proper pipe size, color and type.

C. Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA M23, and all of the pipe supplier’s guidelines shall be followed.

D. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.

E. During removal and handling, be sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.

F. If appropriate unloading equipment is not available, pipe may be unloaded by removing individual pieces. Care should be taken to insure that pipe is not dropped or damaged. Pipe should be carefully lowered, not dropped, from trucks.

3.02 HANDLING AND STORAGE

A. Any length of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. Damaged areas, or possible areas of damage may be removed by cutting out and removing the suspected incident fracture area. Limits of the acceptable length of pipe shall be determined by the Owner or Engineer.

B. Any scratch or gouge greater than 10 percent of the wall thickness will be considered significant and can be rejected unless determined acceptable by the Owner or Engineer.

C. Pipe lengths should be stored and placed on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer. Caution should be exercised to avoid compression, damage, or deformation to the ends of the pipe. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.

D. Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal. Care shall be exercised when handling the pipe to not cut, gouge, scratch or otherwise abrade the piping in any way.

E. If pipe is to be stored for periods of 1 year or longer, the pipe should be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.

F. Pipe shall be stored and stacked per the pipe supplier's guidelines.

3.03 PREPARATION PRIOR TO MAKING CONNECTIONS INTO EXISTING PIPING SYSTEMS

A. Approximate locations for existing piping systems are shown in the construction documents. Prior to making connections into existing piping systems, the Contractor shall:

1. Field verify location, size, piping material and piping system of the existing pipe.

2. Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or others as shown in the construction documents.

3. Have installed all temporary pumps and/or pipes in accordance with established connection plans.

B. Unless otherwise approved, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.

3.04 PIPE SYSTEM CONNECTIONS

A. Pipe connections shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines and as indicated in the Construction Documents. Pipe connections to structures shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines.

3.05 TAPPING FOR POTABLE AND NON-POTABLE WATER APPLICATIONS

A. Tapping shall be performed using standard tapping saddles designed for use on PVC piping in accordance with AWWA C605. Tapping shall be performed only with use of tap saddles or sleeves. NO DIRECT TAPPING WILL BE PERMITTED. Tapping shall be performed in accordance with the applicable sections for Saddle Tapping per Uni-Pub-8.

B. All connections requiring a larger diameter than that recommended by the pipe supplier, shall be made with a pipe connection as specified and indicated on the drawings.

C. Equipment used for tapping shall be made specifically for tapping PVC pipe:

1. Tapping bits shall be slotted "shell" style cutters, specifically made for PVC pipe. 'Hole saws' made for cutting wood, steel, ductile iron, or other materials are strictly prohibited. Shell cutter tapping bits for 1-inch services shall be 7/8-inch diameter. Shell cutter tapping bits for 2-inch services shall be 1-3/4 inch diameter.

2. Manually operated or power operated drilling machines may be used.

D. Taps may be performed while the pipeline is filled with water and under pressure ('wet' tap), or when the pipeline is not filled with water and not under pressure ('dry' tap).

3.06 PIGGING, FLUSHING AND CLEANING

A. All mains shall be pigged, cleaned and flushed to remove all sand and other foreign matter after the service lines have been installed. The Contractor shall be responsible for developing a pigging and flushing plan to be submitted to the Engineer for approval prior to pigging and flushing. The Contractor shall dispose of all water used pigging and for flushing without causing a nuisance or property damage. Any permits required for the disposal of flushing water shall be the responsibility of the Contractor.

B. Pigs shall be of sufficient size to clear the pipelines of any sand, debris and construction materials.

3.07 TESTING

A. Testing shall comply with all applicable jurisdictional building codes, statutes, standards, regulations and laws.

B. Pressure Testing

1. The Contractor shall backfill all pipe and thrust blocking before pressure testing unless the Project Representative directs certain joints or connections left uncovered. Where thrust blocking is provided the pressure test shall not be made until at least five (5) days after the thrust blocking has been installed. A high early strength concrete may be used to reduce this time.

2. All newly laid pipe, including fitting and valves shall be pressure tested in accordance with AWWA C-605. The duration of each such test will be at least two hours.

3. Each valved section of pipe shall be slowly filled with water and a pump shall be hooked to the pipe in a manner satisfactory to the Project Representative to supply the test pressure of 150 psi. The pump, pipe connection and all necessary apparatus shall be furnished by the Contractor. The gauges used shall be furnished by the Contractor. The Contractor shall, upon request of the Project Representative, furnish to the Utilities Department certified test data for pressure gauges used for pressure testing.

4. Before applying the specified test pressure, all air shall be expelled from the pipe. Permanent air relief valves shall be located as shown on the plans. If air relief valves are not furnished the Contractor shall install corporation cocks for this purpose.

5. All exposed pipe, fittings, valves, joints and appurtenances shall be carefully examined during the open-trench test. Any cracked or defective pipe, fittings, valves or appurtenances discovered in consequence of this test shall be removed and replaced with acceptable material and the test shall be repeated to the satisfaction of the Project Representative.

C. Leakage Test

1. A leakage test shall be conducted after the pressure test has been satisfactorily completed. The Contractor shall, as before, furnish all pumps, pipe, connections and other items required to satisfactorily complete the leakage test. The leakage test shall have duration of two hours at the pressure specified for the pressure test. No pipe installation will be accepted if the leakage is greater than that determined by the formula for mechanical and push-on joints:

$$L = \frac{SDP^{1/2}}{148{,}000}$$

L= Allowable leakage [gph]
S= Length of pipe tested [feet]
D= Nominal diameter of pipe [inches]
P= Average pressure during test [psig]

2. The Owner, or his duly authorized Project Representative, shall witness these tests. The Contractor shall be responsible for finding and repairing leaks. No additional cost may be incurred by the Owner due to repairs because of failure of either test. The Project Representative has the authority to determine the number of repairs that will be made within a given length of pipe and has the right to request the Contractor to remove and relay a section of pipe if such does not comply with the established leakage rates as shown in the following table:

ALLOWABLE LEAKAGE IN GALLONS PER HOUR
(Test Pressure = 150 psi)

Pipe diameter	Leakage per 1,000 feet
2	0.18
4	0.33
6	0.50
8	0.66
10	0.83
12	0.99
16	1.32

D. The manufacturer‘s recommendations on bend radius and tensile strength shall be observed.

E. All service lines on the new mains shall also be tested along with the new mains.

F. Notice of Test: The Contractor shall give the Owner 48 hours advance notice of the time when the installation is ready for hydrostatic testing.

END OF SECTION

SECTION 09900
PAINTINGS AND COATINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all materials, labor equipment, and incidentals required to provide a protective coating system for the surfaces listed herein and not otherwise excluded.

B. The work includes painting and finishing of exterior exposed items and surfaces such as bollards, pipes, fittings, valves and all other work obviously required to be painted unless otherwise specified herein or on the Drawings. The omission of minor items in the schedule of work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of the Specifications as stated herein.

C. "Paint" as used herein means all coating systems, materials, including primers, emulsions, enamels, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

D. The following items shall not be painted:

1. Stainless steel

2. Products with polished chrome, aluminum, nickel or stainless steel finish.

3. Flexible couplings lubricated bearing surfaces, insulation and metal and plastic pipe interiors.

7. Signs and nameplates.

5. Any packing glands, unless otherwise indicated.

6. Surfaces coated with cementitious coating.

1.02 REFERENCE STANDARDS

A. NACE, National Association of Corrosion Engineers

B. ASTM, American Society of Testing and Materials

C. SSPC, Steel Structures Painting Council

1.03 QUALITY ASSURANCE

A. Provide the best quality grade of the various types of coatings as regularly manufactured by approved paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product shall not be acceptable. Brand identification is keyed to products of Tnemec Co., Inc., Kansas City, MO, to establish standard of quality or approved equal.

B. Provide an undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only within recommended limits.

C. Undercoat and finish coat paints shall be compatible.

D. Painting shall be accomplished by experienced painters specializing in industrial painting familiar with all aspects of surface preparations and applications required for this project.

1.04 SYSTEM DESCRIPTION - NOT USED

PART 2 - PRODUCTS

2.01 MATERIALS

A. All paint shall be manufactured by one of the following and shall be their highest grade of paint: Tnemec, Koppers, Ameron, Porter, or Rustoleum. Requests to use other paint manufacturers and materials other than specified shall be submitted to the Engineer for approval.

B. The following coating systems list a product by name to establish a standard of quality; other products of the same generic types may be submitted to the Engineer for approval. When other than the specified coating system is proposed, the Contractor shall submit a typewritten list giving the proposed coatings, brand, trade name, generic type and catalog number of the proposed system for the Engineer's approval.

C. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to underlying paint.

D. Emulsion and alkyd paints shall contain a mildewcide and both the paint and mildewcide shall conform to OSHA and Federal requirements, including Federal Specification TT-P-19.

E. Finish coats containing lead shall not be allowed. Oil shall be pure boiled linseed oil.

F. Rags shall be clean painters' rags, completing sterilized.

2.02 SHOP COATINGS

A. Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with the finish paints to be used. The Contractor shall coordinate and ascertain such compatibility with his subcontractors and suppliers.

B. No paint containing lead shall be allowed.

2.03 COATING SYSTEMS

A. Metal (Non-submerged Exterior)
Exterior surfaces and shall include the following:

1. Surfaces to Be Coated

   a. Bollards

   b. Aboveground piping

   c. Miscellaneous steel shapes, angles, etc.

2. Coating System

   a. Surface Preparation - Sandblast clean (SSPC-SP6). Hand or power tool clean items are not suitable for sandblast cleaning. All metal surfaces shall be completely degreased by solvent cleaning in compliance with SSPC-SP1. Ductile iron pipe surface prep – NAPF 500-03-04.

   b. Prime Coat
      Epoxy (3 mils dry) Tnemec Series 66-1211 Epoxoline
      New Galvanized Surfaces - SSPC-SP1 Solvent Cleaning
      Tnemec Series 66-1211 Epoxoline Primer

   c. Intermediate Coat
      66-color Hibuild EP
      (3 mils)

   d. Finish Coat
      Aliphatic Polyurethane - Tnemec Series 73 Color Endura Shield (2.5 mils dry)
      Exposed reclaimed water ductile iron pipe shall be painted purple (Pantone 522C).
      Bollards shall be painted OSHA safety yellow.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. In addition to the aforementioned preparations, all dirt, rust, scale, splinters, loose particles, disintegrated paint, grease, oil, and other deleterious substances shall be removed from all surfaces, which are to be coated.

B. Before commencing work, the painter must make certain that surfaces to be covered are in perfect condition. Should the painter find such surfaces impossible of acceptance, he shall report such fact to the Engineer. The application of paint shall be held as an acceptance of the surfaces and working conditions and the painter shall be held responsible for the results reasonably expected from the materials and processes specified.

C. Clean ferrous substances, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale, and other foreign substances by solvent or mechanical cleaning. All welds, blisters, etc., shall be ground and sanded smooth. All pits and dents shall be filled and all imperfections shall be corrected so as to provide a smooth surface for painting.

D. Surface profile as obtained from sandblasting shall be as recommended by the coating manufacturer.

3.02 MATERIALS PREPARATION

A. Mix and prepare painting materials in strict accordance with manufacturer's recommendations and directions, stirring materials before and during application to maintain a mixture of uniform density, free of film, dirt and other foreign materials.

B. No thinners shall be used except those specifically mentioned and only in such quantity as directed by the manufacturer in his instructions. If thinning is used, sufficient additional coats shall be applied to assure the required dry film thickness is achieved. The manufacturer's recommended thinner or cleanup solvent shall be used for all clean up. Application by brush, spray, airless spray or roller shall be as recommended by the manufacturer for optimum performance and appearance.

3.03 APPLICATIONS

A. All painting shall be done by skilled and experienced craftsmen and shall be of highest quality workmanship.

B. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied.

C. All paint shall be at room temperature and the surface to be painted shall be dry and clean.

D. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint is of uniform finish, color and appearance.

E. Paint shall be applied in a neat manner with finished surfaces free of runs, sags, ridges, laps and brush marks. Each coat shall be applied in a manner that shall produce an even film of uniform and proper thickness.

3.04 APPLICATION RESTRICTIONS

A. Application of materials shall be done only on properly prepared surfaces as herein specified, and all exterior painting shall be done only in dry weather. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the Engineer.

B. In no case shall paint by applied to surfaces that show a moisture content greater than 15 percent.

3.05 CLEANING

A. Cleaning - All paint brushed, splattered, spilled or splashed on any surface not specified to be painted shall be removed.

END OF SECTION

SECTION 13350
PREFABRICATED WELDED STEEL BRIDGES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes materials and installation of fully engineered clear span prefabricated of welded steel construction and shall be regarded as minimum standards for design and construction.

1.02 QUALIFIED SUPPLIERS

A. Prefabricated metal bridge shall be manufactured by Bridge Brothers Inc., or Engineer accepted equal.

B. Other proposed suppliers not listed above must be pre-approved prior to submittal of bids. They must have at least five (5) years experience designing and fabricating these type structures and a minimum of five (5) successful bridge projects, of similar construction, each of which has been in service at least three (3) years. List the location, bridge size, owner, and a contact for reference for each project.

C. The Contractor must also provide the following documentation, for any proposed supplier prior to submittal of bid:

1. Product Literature.

2. AISC certified intermediate bridge with Fracture critical endorsement.

3. AWS Welder Qualifications.

1.03 APPLICABLE CODES AND STANDARDS

A. Governing Codes and Standards

1. Bridges shall be designed in accordance with the AASHTO Guide Specification for the Design of Pedestrian Bridges, 2009 edition, with 2015 Interim Revisions where applicable and unless otherwise stated in the document.

B. Reference Codes and Standards

1. AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges, 2009, with 2015 Interim Revisions

2. AASHTO LRFD Bridge Design Specifications, latest edition

3. AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, latest edition

4. AASHTO Guide Specifications for LRFD Seismic Bridge Design, latest edition

5. AASHTO M 133 Standard Specification for Preservatives and Pressure Treatment Processes for Timber, latest edition

6. Steel Deck Institute (SDI), C-2017 Standard for Composite Steel Floor Deck-Slabs

7. AISC Part 16.1-2010 Specification for Structural Steel Buildings

8. AWS D1.1 Structural Welding Code – Steel, latest edition

9. Guide to Stability Design Criteria for Metal Structures, latest edition

10. National Design Specification for Wood Construction, ANSI NDS, latest edition

11. American Wood Preservers Association Standards, latest edition

1.04 SUBMITTALS

A. Submit manufacturer's catalog data describing the bridge construction and components. Submit design and erection drawings, shop painting and finishing specifications, instruction manuals, and other data to describe the design, materials, sizes, layouts, construction details, fasteners, and erection.

B. For metal bridge design, submit engineering design calculations for structural components, bracing, equipment supports, and anchor bolts. Design calculations shall be signed by a professional engineer licensed in the state of Florida. For computer-programmed designs, submit the stress values utilized in the analysis and a certificate, signed by a professional engineer licensed in the state of Florida, stating the design criteria and procedures used and attesting to the adequacy and accuracy of design.

C. Submit information on bridge support reactions and anchor bolt location and placement for connection to the supporting foundations.

D. Submit erection drawings and diagrams. Show base anchor details, anchor bolt sizes, and embedment. Show girder and/or truss bracing.

E. Manufacturer's Schematic Drawings and Diagrams: Shop drawings shall be unique drawings, prepared to illustrate the specific portion of the work to be done. Manufacturer's standard forms requiring only filling in of blank spaces will not be acceptable unless all nonapplicable information is deleted and such standard forms are modified to reflect exact requirements and conditions unique to the project. Relevant design information such as member sizes, reactions, and general notes shall be clearly specified in the drawings. Shop drawings shall be accurately prepared to be complete in every respect. Drawings shall have cross-referenced details and sheet numbers. Drawings shall be signed and sealed by a professional engineer licensed in the state of Florida.

F. Warranty information.

1.05 GUARANTEE

Bridges shall be guaranteed against detrimental weathering or structural defects caused by ordinary wear and tear by the elements for a period of five years. Such guarantee is in addition to the guarantee required in the General Conditions and shall start upon final acceptance of the work by the Owner.

1.06 STANDARD SPECIFICATIONS

Wherever reference is made to the State Specifications, such reference shall mean the State of Florida, Department of Transportation (FDOT) Standard Specifications, latest edition.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Galvanized Steel

1. Bridges which are to be galvanized shall be fabricated from ASTM A36 or A572 and tubular sections from ASTM A500 GR B.

B. Bolts

1. Field splices shall be fully bolted with ASTM A325 high strength bolts in accordance with the AASHTO Specifications for Structural Joints. Type 3 hardware shall be used for weathering steel bridge. Galvanized hardware shall be used for painted or galvanized finishes.

C. Deck

1. Decking is not required for this pipe bridge.

2.02 GENERAL DESIGN FEATURES

A. Span

1. The bridge span shall be as noted in the design plans. The span shall be a straight line dimension measured from each end of the bridge structure. Contractor shall field verify the bridge span prior to fabrication of the pipe bridge.

B. Width

1. The bridge width shall be as noted in the design plans. The width shall be the clear width to structural members or accoutrements to the structure as

measured at deck level. Contractor shall field verify the bridge span prior to fabrication of the pipe bridge.

C. Truss Style

1. The bridge shall be designed as a half-through Pratt truss with one (1) diagonal per panel and square ended vertical members. All vertical members, unless specified otherwise, shall be plumb.

   a. Bridges may be designed utilizing an H-Section configuration where the floor beams are placed up inside the trusses.

   b. The height of the bridge shall be determined by the bridge fabricator based upon structural and/or shipping requirements.

   c. The top of the top chord shall not be less than fifty-four inches (54”) above the bottom horizontal members.

D. Maximum Weight

1. The maximum weight of the bridge shall be included in the shop drawing.

E. Member Components

1. All members of the vertical trusses (top and bottom chords, verticals, and diagonals) shall be fabricated from square and/or rectangular structural steel tubing. Other structural members and bracing shall be fabricated from structural steel shapes or square and rectangular structural steel tubing.

F. Camber

1. The bridge shall have a vertical camber dimension at midspan equal to one hundred percent (100%) of the full dead load deflection.

G. Attachments

1. Pipe Stands: Pipe roll stands shall be provided at each bridge end and at each pipe bell. Pipe roll stands shall be hot-dip galvanized Anvil Figure 271 or approved equal. U-bolts shall be 304 stainless steel Anvil Figure 137SS or approved equal. Provide ¼” neoprene rubber protection between U-bolt and DI pipe. The bridge fabricator is responsible for determining the precise location of the pipe stands and for designing the attachment of the pipe stands and the U-bolts to the bridge structure.

2. Safety Gates: provide lockable double gates at each end of the bridge to prevent unauthorized access. The gates shall be minimum 5 ft tall.

H. Elevation Difference

1. The bridge will be anchored to existing concrete abutments. Prior to fabricating the bridge, the Contractor shall field verify the elevation of the abutments on both ends of the bridge. This information shall be provided to both the bridge fabricator and the Owner's Authorized Project Representative. The bridge shall be designed to be installed in a horizontal position.

2.03 DESIGN CRITERIA

A. Structural design of the bridge shall be performed by or under the direct supervision of a professional engineer currently licensed within the State of Florida, and in accordance with recognized engineering practices and principles.

B. Design Loads - In considering design and fabrication issues, this structure shall be assumed to be statically loaded. No dynamic analysis shall be required nor shall fabrication issues typically considered for dynamically loaded structures be considered for this bridge.

1. Dead Loads (DL)

a. The bridge structure shall be designed considering its own dead load (superstructure and original decking) only. No additional dead loading shall be considered.

2. Pedestrian Live Load (LL)

a. Main supporting members, including girders, trusses and arches shall be designed for a pedestrian live load of twenty pounds (20 lbs.) per square foot of bridge walkway area. The pedestrian live load shall be applied to those areas so as to produce maximum stress in the member being designed. Pedestrian live loads shall NOT be reduced.

3. Pipe Load (PL)

a. This bridge will be designed to carry a 12-inch ductile iron pipe completely filled with water with a maximum water pressure of 150 psi, and all required pipe stands, U-bolts, and related hardware as shown in the drawings. In considering design and fabrication issues, this structure shall be assumed to not have any vehicle load.

4. Wind Load (WL)

a. Horizontal Forces

(1) The bridge shall be designed for a wind load as specified by AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges. The wind load shall be applied

horizontally at right angles to the longitudinal axis of the structure.

(2) The wind load shall be considered both in the design of the lateral load bracing system and in the design of the truss vertical members, floor beams, and their connections.

b. Overturning Forces

(1) The effect of forces tending to overturn structures shall be calculated assuming that the wind direction is at right angles to the longitudinal axis of the structure. In addition, an upward force shall be applied at the windward quarter point of the transverse superstructure width. This force shall be twenty pounds (20 lbs.) per square foot of deck.

5. Top Chord Railing Loads

a. The top chord, truss verticals, and floor beams shall be designed for lateral wind loads, per Engineering – Horizontal Forces, herein and for any loads required to provide top chord stability as outlined in Engineering – Top Chord Stability herein. In no case shall the load be less than fifty pounds (50 lbs.) per lineal foot or a two hundred pound (200 lb.) point load, whichever produces greater stresses, applied in any direction at any point along the top chord, or at the top of the safety system (42” or 54” above the deck level) if higher than the top chord.

C. Design Limitations

1. Deflection

a. Vertical Deflection

(1) The vertical deflection of the main trusses due to service pedestrian Live Load shall not exceed one three-sixtieth (1/360) of the span.

(2) The vertical deflection of cantilever spans of the structure due to service Pedestrian Live Load shall not exceed one three-sixtieth (1/360) of the cantilever arm length.

(3) The deflection of the floor beams due to service Pedestrian Live Load or Pipe Load shall not exceed one three-sixtieth (1/360) of its span.

(4) The service Pedestrian Live Load shall NOT be reduced for deflection checks.

b. Horizontal Deflection

(1) The horizontal deflection of the structure due to lateral wind loads shall not exceed one three-sixtieth (1/360) of the span.

2. Vibration

a. The fundamental frequency of the unloaded bridge shall be no less than 3.0 Hz to avoid the first harmonic.

3. Minimum Thickness of Metal

a. The minimum thickness of all structural steel members shall be three-sixteenths of an inch (3/16") nominal and be in accordance with the AISC Manual of Steel Constructions "Standard Mill Practice Guidelines". For ASTM A500 and ASTM A847 tubing, the section properties used for design shall be per the Steel Tube Institute of North America, Hollow Structural Sections, "Dimensions and Section Properties".

D. Analysis

1. Load Combinations

a. The loads listed herein shall be considered to act in the following combinations, whichever produce the most unfavorable effects on the bridge superstructure or structural member concerned. [DL = Dead Load, LL = Pedestrian Live Load, WL = Wind Load, PL = Pipe Load]

(1) Strength I
- 1.25*DL+1.75*LL+1.25*PL
- 1.25*DL+1.5*PL

(2) Strength III
- 1.25*DL+1.25*PL+1.4*WL

(3) Service I
- DL+LL+PL+WL

(4) Fatigue I
- Fatigue WL Only

2. Frequency

a. Frequency analysis shall be completed to determine that the bridge frame is sufficient to avoid resonance due to frequencies likely encountered under normal use for the load combinations noted in Section 4.3.1 and in accordance with this Specification.

3. Top Chord Stability

   a. The top chord of a half-through truss shall be considered as a column with elastic lateral supports at the panel points.

4. Welded Tubular Connections

   a. All welded tubular connections shall be checked, when within applicable limits, for the limiting failure modes outlined in the ANSI/AWS D1.1 Structural Welding Code (current edition).

   b. When outside the "validity range" defined in these design guidelines, the following limit states or failure modes shall be checked:

      (1) Chord Wall Plastification

      (2) Shear Yielding (Punching)

      (3) Local Yielding of Chord Sidewalls

      (4) Local Crippling of Chord Sidewalls

      (5) Local Yielding of Branch Due to Uneven Load Distribution

   c. All tubular joints shall be plain unstiffened joints and fabricated without the use of reinforcing plates, except as follows:

      (1) Floor beams hung beneath the lower chord of the structure may be constructed with or without stiffener (or gusset) plates, as required by design.

      (2) Floor beams which frame directly into the truss verticals (H-Section bridges) may be designed with or without end stiffening plates as required by design.

      (3) Where chords, end floor beams and in high profiles the top end struts weld to the end verticals, the end verticals (or connections) may require stiffening to transfer the forces from these members into the end vertical.

      (4) Truss vertical to chord connections.

5. Bolted Splices

   a. Bolted splice design shall be in accordance with the "AASHTO LRFD Bridge Design Specifications" and in accordance with Section 1.4 of this Specification. Bolted field splices shall be located on the bridge so as to produce a structure which can be safely shipped and erected. Splices across the width of the bridge (in floor beams and wind braces) may be used, when

necessary, to keep the overall structure width within reasonable limits for shipping.

2.04 WELDING

A. Welding

1. Welding and weld procedure qualification tests shall conform to the provisions of ANSI/AWS D1.1 "Structural Welding Code" (current edition). Filler metal shall comply with the applicable AWS Filler Metal Specification (i.e. AWS A 5.28 for the GMAW Process). For exposed, bare, unpainted applications of corrosion resistant steels (i.e. ASTM A588 and A847), the filler metal shall comply with AWS D1.1, Section 3.7.3.

B. Welders - Each welder shall be a properly accredited operator, and shall:

1. Submit certification of satisfactorily passing AWS standard qualification tests for all positions with unlimited thickness of base metal,

2. Have a minimum of six (6) months experience in welding tubular structures within the last two (2) years and

3. Have demonstrated the ability to make uniform sound welds of the type required.

2.05 FINISHING

A. Blast Cleaning

1. All Blast Cleaning shall use Best Management Practices and exercise environmentally friendly blast media recovery systems.

2. All steel surfaces shall be blasted..

3. All finishing shall be completed in manufacturer's shop prior to shipping.

B. Gavanizing

1. Proper drainage and venting shall be provided for the galvanization process. All structural steel shall be zinc coat (hot-dip) galvanized per the specifications listed in ASTM A123. Hardware shall be zinc coat (hot-dip) galvanized per the specifications listed in ASTM A153.

2.06 BEARING DEVICES

A. Bridge bearings shall consist of a setting or slide plate placed on the abutment or grout pad. The bridge bearing plate which is welded to the bridge structure shall bear on this setting plate. One end of the bridge will be fixed by fully tightening the nuts on the anchor bolts at that end. The opposite end will have finger tight only nuts to allow movement under thermal expansion or contraction.

B. Bridges in excess of 100 feet in length or bridges with dead load reactions of 15,000 pounds or more (at each bearing location) shall have Teflon on Teflon or stainless steel on Teflon slide bearings placed between the bridge bearing plate and the setting plate. The top slide plate shall be large enough to cover the lower Teflon slide surface at both temperature extremes.

2.07 FOUNDATIONS

A. The bridge shall be supported on existing concrete foundations. New adhesive anchors will be used. Unless specified otherwise, the bridge manufacturer shall determine the number, diameter, minimum grade and finish of all adhesive anchors. The anchors shall be designed to resist all horizontal and uplift forces to be transferred by the superstructure to the supporting foundations. Determination of the anchor embedments, shall be the responsibility of the bridge design engineer. The Contractor shall provide all materials for (including adhesive and anchors) for the attachment of the bridge to the foundations. The Contractor shall install the anchors in accordance with the manufacturer's bridge bearing dimensions.

B. The bridge bearings shall sit on the concrete abutment. The minimum 28-day strength for the abutment concrete may be assumed to be 3,000 PSI. The bearing seat dimensions (the top of the concrete abutment) shall be field verified by the Contractor and provided to the bridge manufacturer and the Owner's Authorized Project Representative prior to fabricating the bridge. The step height (from bottom of bearing to top-of-bottom chord) shall be determined by the bridge manufacturer.

C. Information as to bridge support reactions and adhesive anchor locations will be furnished by the bridge manufacturer after the bridge design is complete.

PART 3 - EXECUTION

3.01 STORAGE AND PROTECTION

Deliver, store, handle, and erect prefabricated components, sheets, panels, and other manufactured items such that they will not be damaged or deformed. Stock materials stored on the site before erection on platforms or pallets and cover with tarpaulins or other weatherproof covering. Store metal sheets, panels, or frames so that water accumulated during transit or storage will drain off. Do not store components in contact with materials that may cause staining. Upon arrival on the jobsite, remove moisture on sheets and panels, restack, and protect until used.

3.02 FABRICATION

A. Drain Holes When the collection of water inside a structural tube is a possibility, either during construction or during service, the tube shall be provided with a drain hole at its lowest point to let water out.

B. Bolt Holes Unless otherwise specified, standard holes shall be used in high-strength bolted connections. Oversize holes may be used in any or all plies of slip-critical

connections. They shall not be used in bearing-type connections. Cut, drill, mechanically thermal cut, or punch bolt holes perpendicular to metal surfaces. Do not enlarge bolt holes by burning.

C. Bearing Holes/Slots Cut, drill, mechanically thermal cut, or punch bearing holes/slots perpendicular to steel surfaces.

3.03 ERECTION

A. Delivery and Erection:

1. Delivery of the bridge shall be made to a location nearest the site which is accessible to over-the-road trucks.

2. The Contractor shall be responsible for unloading the bridge and associated components from the truck at the time of arrival. Bridge manufacturer shall notify the Contractor in advance of the expected time of arrival at the site.

3. The manufacturer or its representative shall instruct the Contractor or his representative in the proper lifting procedure for the unloading of the bridge components. Prevent damage to the finish of the bridge.

4. The unloading, splicing (if required), and placement of the bridge shall be the responsibility of the Contractor. The bridge manufacturer shall provide the procedure for bolting field splices to the Contractor.

B. Erect in accordance with the manufacturer's erection instructions and drawings and the requirements herein. Keep exposed surfaces clean and free from sealant, metal cuttings, and other foreign materials.

C. Insulate incompatible dissimilar materials that are in contact by means of gaskets or insulating compounds.

D. The bridge manufacturer shall provide written inspection and maintenance procedures to the Owner’s Authorized Project Representative.

END OF SECTION

SECTION 15062
DUCTILE IRON PIPE AND FITTINGS

PART – GENERAL

1.01 SCOPE OF WORK

A. Install within the project site all materials and incidentals including flanged joint, mechanical joint, push-on joint, and restrained joint ductile iron pipe and/or ductile iron restrained, flanged, or mechanical joint fittings for reclaimed water and potable water mains, sewage force mains and sewer fittings, complete, as shown on the project drawings.

B. The Contractor shall coordinate all deliveries with the related Vendor(s) in a manner not to impede construction on individual projects.

1.02 SEPARATION OF RAW WATER, POTABLE WATER, AND WASTEWATER LINES

A. A minimum horizontal separation of 6 feet outside to outside shall be maintained between raw water or potable water mains and sanitary sewers or sanitary force mains. Where a raw or potable water main crosses a sanitary sewer or a sanitary force main, a minimum of 18 inches vertical clearance shall be maintained. Where 18 inches of vertical clearance cannot be maintained, the crossing shall be arranged so that the joints of the two pipes are equidistant from the point of crossing with no less than 10 feet between any two joints. Alternatively, the raw water main may be placed in a casing to obtain the equivalent of the required 10 feet separation.

B. A minimum horizontal separation of 3 feet outside to outside shall be maintained between raw and potable water mains and reclaimed water mains or storm water mains. Where a raw or potable water main crosses a reclaimed water or a storm water main, a minimum of 18 inches vertical clearance shall be maintained.

1.03 SYSTEM IDENTIFICATION

A. All reclaimed water piping and appurtenances shall be clearly identified to inform the public and employees that the water is not intended for drinking.

B. The following features shall be included in the design of reclaimed water facilities:

1. All buried reclaimed water transmission and distribution piping shall be color coded purple. For PVC mains, color shall be an integral part of the pipe material.
2. All above ground valves, meters, and other devices, and other appurtenances shall be painted purple. The color standard for paint shall be Pantone color 522C with light color stableant or approved equal.
3. Tracer Wire: See Section 15065.

4. Covers for all valve boxes, meter boxes, and other below ground devices on the reclaimed water system shall be painted purple. Covers shall be permanently embossed with the wording "Reclaimed Water". Valve boxes shall be square, U.S. Foundry or approved equal.

PART 2 – PRODUCTS

2.01 MATERIALS

A. DUCTILE IRON PIPE

1. General

a. Ductile iron pipe shall be minimum thickness class 50 or greater as required by load conditions or as called out on the plans conforming to AWWA C150 and ANSI A21.50.

b. All pipe shall conform to AWWA C151.76 (ANSI A21.51-76 or latest revision thereof). Pipe shall be furnished in standard 18 or 20-foot lengths. All pipe and fittings shall have standard bituminous enamel coating outside and shall have an internal cement-mortar lining in accordance with ANSI A21.4 (AWWA C104) for potable or reclaimed water. For sewage pipe and fittings, internal coating shall be ceramic epoxy, Protecto 401 or equal.

c. All materials shall be new and have a manufacturer's certificate verifying compliance to all tests and inspections as required herein. The weight, class and casting period shall be shown on each piece of pipe. The manufacturer's "mark", the year produced and the word "Ductile" or letters "DI" shall be cast or stamped on all pipe. All fittings, furnished by the approved manufacturer(s), shall be cast and machined at one foundry location to assure quality control and provide satisfactory test data.

d. All tests as required by AWWA C151-76 shall be performed by the manufacturer and records of all such tests shall be retained for a period of one year and shall be available to the Owner upon request.

e. All pipe shall be installed according to the manufacturer's requirements with lubricants, gaskets and accessories furnished by the manufacturer.

f. Restrained joint shall be provided at all horizontal and vertical bends and fittings, and at other locations indicated by the ductile

iron pipe restraint detail on the drawings. Restraining devices shall be Megalug by EBBa Iron, or approved equal.

g. Except as otherwise shown on the Drawings, either mechanical, restrained, or flanged joints shall be used. Prior to commencing work, jointing systems for pipe shall be submitted to the Engineer for approval.

h. All burial ductile iron pipe and fittings shall be provided with a minimum 8 mil thick cross laminated low density polyethylene encasement per ANSI/AWWA A21.5-99. The polyethylene material shall meet the requirements for tensile strength, elongation, and dielectric strength for a cross laminated low density polyethylene. Polyethylene encasement shall be either:

1) Solid purple color for reclaimed water piping and fittings, or
2) Solid blue color for potable water piping and fittings, or
3) Solid green color for sewage piping and fittings, or
4) Solid olive green color for raw water piping and fittings.

i. Pipe and fittings exposed to view in the finished work to be painted shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of Koppers No. 621 Rust Inhibitive Primer or approved equal. All other pipe and fittings shall be shop coated on the outside with a 1.0 mils thick bituminous coat in accordance with ANSI A21.51.

j. Should portions of the pipe inadvertently be given the outside coating of coal tar enamel instead of the rust inhibitive primer as required for exposed piping the surfaces shall be sealed with a non-bleeding sealer coat such as Inertol Tar Stop, or Mobil Anti-Bleeding Aluminum Sealer. Sealing shall be a part of the work of this Section.

2. PUSH-ON JOINT

a. Push-on joints shall conform with the latest revision of ANSI/AWWA C111/A21.11.

b. Joint material shall be made up with rubber gaskets conforming to ANSI standard A21.11.

3. MECHANICAL JOINT

a. Mechanical joints shall conform with the latest revision of ANSI/AWWA C110/A21.

b. Joint material shall be made up with rubber gaskets conforming to ANSI Standard A21.11. Glands for mechanical joint pipe shall be bituminous coated and bolts and nuts shall be of high strength cast iron, or high strength low alloy steel as specified in ANSI Standard A21.11.

c. Align bolt holes and insert bolts, with bolt heads behind the bell flange, and tighten opposite nuts to keep the gland square with the socket. Tighten the nuts in accordance with following table:

Bolt Diameter (in.)	Torque (ft-lb)
5/8	45-60
3/4	75-90
1	85-100
1¼	105-120

4. FLANGED JOINT

a. Flanged joints shall conform with the latest revision of ANSI/AWWA C110/A21.

b. Flanged connections shall comply with the requirements of ANSI Standard B16.1, 125 pound class. Flanges for ductile iron pipe shall be of ductile iron. Machine bolts shall be the best commercial quality steel with hexagonal nuts of the same quality metal. Nuts, bolts and gaskets for flanged fittings and blind flanges shall be designed to withstand the design and test pressures for the pipe.

c. Gaskets shall be 1/8 inches thick red rubber, flat ring gaskets unless otherwise specified on the drawings.

d. Bolts and nuts shall be low carbon steel as per ASTM A- 307 Grade B. Threads shall be as per ANSI B1.1 course thread series, Class 2A external and Class 2B internal.

e. Bolt requirements are as follows:

PIPE SIZE (in.)	NUMBER PER JOINT	BOLT SIZE (in.)	THREADS PER INCH	TORQUE (ft-lbs)
4	8	5/8 x 3	11	60
6	8	3/4 x 3½	10	100
8	8	3/4 x 3½	10	100
10	12	7/8 x 4	9	160
12	12	7/8 x 4	9	160
16	16	1 x 4½	8	245
20	20	1⅛ x 3	7	390
24	20	1¼ x 5½	7	545
30	28	1¼ x 6½	7	545
36	32	1½ x 7	6	875
42	36	1½ x 7½	6	875
48	44	1½ x 8	6	875
54	44	1¾ x 8½	5	1550

B. DUCTILE IRON FITTINGS: All fittings shall be new. Previously used or refurbished fittings will not be allowed.

1. DUCTILE IRON FITTINGS

a. Fitting from 4-inch through 16-inch in size will be compact ductile iron cast in accordance with ANSI/AWWA C153/A 21.53 with mechanical joint bells. Bolts, nuts and gaskets shall be in accordance with requirements of ANSI/AWWA C153/A 21.53. The working pressure rating shall be 350 P.S.I. Ductile iron fittings shall be coated and lined in accordance with require requirements of ANSI/AWWA C104/A21.4. Mechanical joint glands shall be ductile iron in accordance with ANSI/AWWA C111/A 21.11. When reference is made to ANSI/AWWA Standards, the latest revisions apply. Only those fittings and accessories that are of domestic (USA) manufacture will be acceptable.

b. All fittings shall be furnished with all joint material (bolts, nuts, gaskets and glands) complete, ready for installation. Nuts, bolts and gaskets for flange fittings and blind flanges shall be designed to withstand the design and test pressures for the pipe.

c. All fittings shall have distinctly cast upon them the manufacturer's identification, pressure rating, nominal diameter and the number of degrees or fraction of a circle on all bends. Ductile iron fittings shall have the letters "DI" or "DUCTILE" cast on them. Only castings that have been poured in a foundry located in the USA will be allowed and the Contractor shall provide an affidavit to prove the origin of those fittings.

PART 3 – EXECUTION

3.01 HANDLING PIPE AND FITTINGS

A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before installation, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Engineer.

B. All pipe and fittings shall be subjected to a careful inspection and hammer test just prior to being installed.

C. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Owner.

3.02 UNDERGROUND PIPE INSTALLATION

A. Alignment and Grade: The pipelines shall be laid and maintained to lines and grades established by the Drawings and Specifications, with fittings, valves and hydrants at the required locations unless otherwise approved by the Engineer. Valve-operating stems shall be oriented to allow proper operation. Hydrants shall be installed plumb.

B. Underground Conflicts: Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care shall be exercised to avoid damage to existing structures. When obstructions that are not shown on the drawings are encountered during the progress of the work and interfere so that an alteration of the Drawings is required, the Engineer will alter the Drawings or order a deviation in line and grade or arrange for removal, relocation, or reconstruction of the obstructions. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the Engineer, to provide clearance as required by federal, state, or local regulations or as deemed necessary by the Engineer to prevent future damage or contamination of either structure.

C. Trench Construction:

1. Trench preparation shall proceed in advance of pipe installation for only as far as necessary to allow proper pipe installation. The width of the trench at the top of the pipe shall be ample to permit the pipe to be laid and joined properly and allow the backfill to be placed as specified.

2. Holes for the bells shall be provided at each joint but shall not be larger than necessary for joint assembly and assurance that the pipe barrel will lie

flat on the trench bottom. Other than noted previously, the trench bottom shall be true and even in order to provide support for the full length of the pipe barrel, except that slight depression may be provided to allow withdrawal of pipe slings or other lifting-tackle.

3. When excavation of rock is encountered, all rock shall be removed to provide a clearance of at least 6-inches below and on each side of all pipe, valves, and fittings for pipe sizes 24 inches or smaller, and 9 inches for pipe 30 inches and larger. When excavation is completed, a bed of sand, crushed stone or earth that is free from stones, large clods, or frozen earth shall be placed on the bottom of the trench to the previously mentioned depths, leveled, and tamped. These clearances and bedding procedures shall also be observed for pieces of concrete or masonry and other debris or subterranean structures, such as masonry walls, piers, or foundations that may be encountered during excavation.

4. This installation procedure shall be followed when gravel formations containing loose boulders greater than 8 inches in diameter are encountered. In all cases, the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection, or point of rock, boulder, or stones of sufficient size and placement which, in the opinion of the Engineer could cause fulcrum point.

5. Should the trench pass over a sewer or other previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.

6. When the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed, to a minimum of at least 3 inches, or to the depth ordered by the Engineer and replaced under the directions of the Engineer with clean, stable backfill material. The bedding shall be consolidated and leveled in order that the pipe may be installed as specified.

7. When the bottom of the trench or the subgrade is found to consist of material that is unstable to such a degree that, in the judgment of the Engineer it cannot be removed, a foundation for the pipe and/or appurtenance shall be constructed using piling, timber, concrete, or other materials at the direction of the Engineer.

3.03 PIPE INSTALLATION

A. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, valves, and hydrants shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or equipment in such a manner as to prevent damage to pipeline

material and protective coatings and linings. Under no circumstances shall pipeline materials be dropped off or dumped into the trench. The trench should be dewatered prior to installation of the pipe.

B. All pipe fittings, valves, hydrants, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the engineer who may prescribe corrective repairs or reject the materials.

C. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign material before the pipe is laid.

D. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

E. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

F. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. When practical, the plug shall remain in place until the trench is pumped completely dry. Care shall be taken to prevent pipe flotation should the trench fill with water.

G. Trench width at the top of pipe, bedding conditions, and backfill placement and compaction shall be such that design loadings on the pipe will not be exceeded.

H. Joint Assembly: Pipe joints shall be assembled in accordance with the Manufacturer's instructions and the requirements of ANSI/AWWA C600.

I. Pipe Deflection: When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, or where long radius curves are permitted, the amount of deflection shall not exceed that shown in ANSI/AWWA C600.

J. Pipe Cutting: Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without creating damage to the pipe or lining. Ductile cast iron may be cut using an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw, milling wheel saw, or oxyacetylene torch. Cut ends and rough edges shall be ground smooth and for push-on joint connections, the cut end shall be beveled.

K. Thrust Restraint:

1. All plugs, caps, tees, and bends shall be suitably restrained by attaching clamps or restrained joints as specified.

2. Thrust-restraint design pressure shall be equal to the test pressure of the line.

3. Restrained push-on joints, mechanical joints utilizing approved joint restraints shall be used in place of concrete backing. Tie rods clamps, or other components of dissimilar metal shall be protected against corrosion by hand application of a bituminous coating or by encasement of the entire assembly with 8-mil thick, loose polyethylene film in accordance with ANSI/AWWA C105.

3.04 ABOVE GROUND PIPE INSTALLATION

A. Install pipe in horizontal or vertical planes, parallel or perpendicular to building surfaces unless otherwise shown. Support pipe and fittings to prevent strain on joints, valves and equipment. Install flanged joints so that contact faces bear uniformly on the gasket. Tighten bolts with relatively uniform stress.

3.05 PREPARATION PRIOR TO MAKING CONNECTIONS INTO EXISTING PIPING SYSTEMS

A. Approximate locations for existing piping systems are shown in the construction documents. Prior to making connections into existing piping systems, the Contractor shall:

1. Field – verify location, size, piping material and piping system of the existing pipe.
2. Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or others as shown in the construction documents.
3. Have installed all temporary pumps and/or pipes in accordance with established connection plans.

B. Unless otherwise approved, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.

3.06 PIPE SYSTEM CONNECTIONS

A. Pipe connections shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines and as indicated in the construction documents. Pipe connections to structures shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines.

3.07 TAPPING FOR POTABLE AND NON-POTABLE WATER APPLICATIONS

A. Tapping shall be performed using standard tapping saddles for use on ductile iron piping. Tapping shall be performed only with use of tap saddles or sleeves. NO DIRECT TAPPING WILL BE PERMITTED. Steel body tapping sleeves shall be JCM Industries Inc., JCM 412 or Smith-Blair 622. All steel body tapping sleeves shall have heavy welded ASTM A 285, Grade C steel body, stainless steel bolts, manufacturer's epoxy coated body, and 3/4-inch bronze test plug.

B. All connections requiring a larger diameter than that recommended by the pipe supplier, shall be made with a pipe connection as specified and indicated on the drawings.

C. Taps may be performed while the pipeline is filled with water and under pressure (‘wet’ tap), or when the pipeline is not filled with water and not under pressure (‘dry’ tap).

3.08 PIGGING, FLUSHING AND CLEANING

A. All existing and proposed mains shall be pigged, cleaned and flushed to remove all sand and other foreign matter. The Contractor shall be responsible for developing a pigging and flushing plan to be submitted to the Engineer for approval prior to pigging and flushing. The Contractor is responsible for providing the required water and pressure to push the pig through the line. The cost of this water shall be included with the pigging cost in the piping bid items. The Contractor shall dispose of all water used pigging and for flushing without causing a nuisance or property damage.

B. Pigs shall be of sufficient size to clear the pipelines of any sand, debris and construction materials. In addition, Engineer approval is required prior to placing the pipeline into service to ensure that the pipeline has been sufficiently cleaned of any sand and debris. The Contractor shall be required to re-apply a series of individual swabs in varying diameters and/or densities as required, to attain proper cleanliness of the pipeline. Pigs for existing mains shall be scrubbing pigs. Pigs for all proposed piping shall be polyurethane of varying dimensions, coatings, and densities (poly pig) determined by:

1. The particulars of the system to be cleaned.
2. The recommendation of the Design Engineer.
3. The recommendation of the manufacturer of the poly pig
4. The recommendation of the Contractor whose specialty is in the use and application of the poly pig for cleaning the piping systems.
5. application of the poly pig for cleaning the piping systems.

3.09 PRESSURE AND LEAKAGE TESTS

A. Pressure Testing:

1. The Contractor shall backfill all pipe and thrust blocking before pressure testing unless the Project Representative directs certain joints or connections left uncovered. Where thrust blocking is provided the pressure test shall not be made until at least five (5) days after the thrust blocking has been installed. A high early strength concrete may be used to reduce this time.

2. All newly laid pipe, including fitting and valves shall be pressure tested in accordance with AWWA C-600. The duration of each such test will be at least two hours.

3. Each valved section of pipe shall be slowly filled with water and a pump shall be hooked to the pipe in a manner satisfactory to the Project Representative to supply the test pressure of 150 psi. The pump, pipe connection and all necessary apparatus shall be furnished by the Contractor. The gauges used shall be furnished by the Contractor. The Contractor shall, upon request of the Project Representative, furnish to the Utilities Department certified test data for pressure gauges used for pressure testing.

4. Before applying the specified test pressure, all air shall be expelled from the pipe. Permanent air relief valves shall be located as shown on the plans. If air relief valves are not furnished the Contractor shall install corporation cocks for this purpose.

5. All exposed pipe, fittings, valves, joints and appurtenances shall be carefully examined during the open-trench test. Any cracked or defective pipe, fittings, valves or appurtenances discovered in consequence of this test shall be removed and replaced with acceptable material and the test shall be repeated to the satisfaction of the Project Representative.

B. Leakage Test:

1. A leakage test shall be conducted after the pressure test has been satisfactorily completed. The Contractor shall, as before, furnish all pumps, pipe, connections and other items required to satisfactorily complete the leakage test. The leakage test shall have a duration of two hours at the pressure specified for the pressure test. No pipe installation will be accepted if the leakage is greater than that determined by the formula for mechanical and push-on joints:

$$L = \frac{SDP^{1/2}}{133{,}200}$$

L= Allowable leakage [gph]
S= Length of pipe tested [feet]
D= Nominal diameter of pipe [inches]
P= Average pressure during test [psig]

2. The Project Representative, or his duly authorized representative, shall witness these tests. The Contractor shall be responsible for finding and repairing leaks. No additional cost may be incurred by the Owner due to repairs because of failure of either test. The Project Representative has the authority to determine the number of repairs that will be made within a given length of pipe and has the right to request the Contractor to remove and relay a section of pipe if such does not comply with the established leakage rates as shown in the following table:

ALLOWABLE LEAKAGE IN GALLONS PER HOUR
(Test Pressure = 150 psi)

Pipe Diameter	Leakage per 1,000 feet
2	0.18
4	0.37
6	0.55
8	0.74
10	0.92
12	1.10
16	1.47

C. Notice of Test: The Contractor shall give the Owner 48 hours advance notice of the time when the installation is ready for hydrostatic testing.

END OF SECTION

SECTION 15065
TRACER WIRE

PART 1 - GENERAL

1.01 TRACER WIRE FOR PIPELINES

A. All pipe (HDPE, PVC and DI) 4-inches and greater installed by open cut shall have two (2) 12-gauge minimum solid strand copper locator wire taped to the top of the pipe at intervals no greater than 4-feet.

B. All pipe (HDPE, PVC or DI) installed by directional bore shall have (2) 10-gauge high-carbon steel inner core reinforcement directional drilling tracer wires taped to the top of the pipe at intervals no greater than 4-feet.The tracer wire shall be Copperhead Extra High Strength copper-clad steel tracer wire as manufactured by Copperhead Industries or Pro-Trace HD-CCS PE45 tracer wire manufactured by Pro-Line Safety Products Company or approved equal.

C. All potable water or RCW service lines will have one (1) 12-gauge minimum solid strand copper locator wire installed together with the service line in a PVC casing pipe.

D. The locator wires shall have colored insulation matching the type of service provided in the main and be acceptable for direct burial.

E. All splices of the wires shall be made only by direct bury 3M brand splice kit, as approved by the Engineer.

F. The wires shall each be continuous throughout the project, with splices made only by methods approved by the Project Representative.

G. The wire is to be tied to all valves, tees and elbows.

H. The locator wires shall be brought up to the surface through a 2-inch PVC pipe.

I. The locator wires shall be brought up into all valve boxes with enough slack provided to extend 10 to 12 inches out of each box and installed as shown in the Standard Details.

J. Contractor shall perform a 12-volt DC electrical continuity test on each of the wires. Test each wire with both positive and negative charge. No more than one volt of loss per 1000 feet of wire will be acceptable. The locator wire system shall pass the 12-volt DC electrical continuity test for at least one wire prior to final acceptance of the pipeline. Any cuts or breaks in the wire shall be repaired by the Contractor at his expense.

K. The locator wire shall be tested by the Owner at the time of pressure testing. If this test fails, the Contractor is responsible for repairing the locator wire and the pressure test will be rescheduled when the wire passes the continuity test.

1.02 ALARMING TAPE

A. Provide underground warning tape constructed of heavy gage 0.004-inch polyethylene film to identify all buried utilities except 3-inch and smaller irrigation pipe. Provide 6-inch wide tape as follows:

Film Legend	Film Color
Electric line below	Red
Telephone line below	Orange
Water line below	Blue
Raw Water	Olive Green
Sewer line below	Green
Nonpotable water below	Brown
Reclaimed water below	Purple (Pantone 522C)

1. Install tape directly above each buried utility at a depth of 18-inches below final grade.

PART 2 - PRODUCTS

2.01 12-GAUGE EXTRA HIGH STRENGTH HARD DRAWN TRACER WIRE

A. Conductor Specifications

1. Material Description: Copperweld® Copper-clad steel wire composed of a steel core with a uniform and continuous copper cladding thoroughly bonded to the steel throughout.

a. Cladding: The steel and copper interface must have a metallurgical bond achieved through a high heat and pressure bonding process. Established process for porosity-free material.
b. Steel: Extra High Strength with 0.54 carbon or greater. Verified to meet required mechanical properties.
c. Copper: UNS-C10200; OF Copper according to ASTM B-170 (latest revision). High conductivity, oxygen free copper to achieve optimal signal performance.

2. Surface Condition: Wire surface shall be free of any defects, including flakes, grooves, pits, and voids. Wire surface shall be smooth, bright and shiny, and free of excessive copper dust and residual drawing lubricants.

3. Physical, Mechanical, and Electrical Properties

   The wire shall conform to the properties listed in Table 1.

TABLE 1: Physical, Mechanical, and Electrical Properties

#12 CCS 1055 Hard Drawn 21% Conductivity	**CCS Conductor**
Conductor Size	12 AWG
Conductor Type	Copper Clad Steel (CCS)
Temper	Hard Drawn (HD)
Average Break Load	1150 lbs.
Minimum Tensile Strength	200,000 psi
Minimum Elongation	1.0%
Copper Thickness (% of Diameter)	3.0%
Minimum Copper Weight	13%
Nominal DC Resistance (ohms/1000 ft.)	7.5648

**Diameter tolerances: ± 1%*

B. Insulating Jacket Specifications

1. Material Description: insulating jacket is comprised of a co-polymer high molecular weight natural high density polyethylene (HDPE) designed specifically for high-speed copper wire insulating. It contains the required levels and types of primary antioxidant and metal deactivator additives to satisfy most Wire and Cable industry requirements. HDPE material will be produced with an excellent balance of surface smoothness, processing ease, tensile and elongation properties, abrasion toughness, environmental stress crack, thermal stress crack resistance, and electrical consistency.

2. Physical, Mechanical, and Electrical Properties

   The wire shall conform to the properties listed in Table 2.

TABLE 2: Physical, Mechanical, and Electrical Properties

High Density Polyethylene Insulator	Value
Density (ASTM D 792)	0.943 g/cc
Bulk Density (ASTM D 1895)	0.58 g/cc
Melt Index (ASTM D 1238/E)	0.70 dg/min
Tensile-Yield (ASTM D 638)	4300 psi
Tensile-Ultimate (ASTM D 638)	2900 psi
Tensile-Elongation (ASTM D 638)	850%
Flexural Modulas (ASTM D 790/1)	120,000 psi
Hardness (ASTM D 2240)	63 Shore D
Environmental Stress-Crack (ASTM D 1693/B)	F20 > 48 h
Thermal Stress-Crack (ASTM D2951)	F0 > 1000 h
Brittleness Temperature (ASTM D 746)	< -95° F
Melting Point (DSC) (ASTM D 3417)	262° F
Softening Point (Vicat) (ASTM D 1525)	250° F
Oxidative Induction Time (ASTM D 3895)	> 50 min. @ 200° C
Dielectric Constant (ASTM D 1531)	2.34 @ 1MHz
Dissipation Factor (ASTM D 1531)	0.00007 @ 1 MHz
Volume Resistivity (ASTM D 257)	5 x 1017 ohm-cm
Dielectric Strength (ASTM D 3755)	1000 volts @ 20 mils

END OF SECTION

SECTION 15100
VALVES AND APPURTENANCES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and as specified herein.

B. All valves and appurtenances shall be of the size shown on the Drawings and to the extent possible, all equipment of the same type shall be from one manufacturer.

C. All valves and appurtenances shall have the name of the maker and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

D. The equipment shall include, but not be limited to, the following:

1. Gate Valves
2. Valve Boxes
3. Combination Air Valves
4. Service Saddles

1.02 HANDLING

A. All valves, unless otherwise directed, shall be loaded and unloaded by lifting, and under no circumstances shall valves be dropped, skidded, or rolled. Valves shall not be stacked or placed under pipe, fittings or other valves in such a manner that damage could result.

B. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surface or interior linings and valve components. If any part of the valve's coating, lining or components is damaged, the repairs or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the Engineer prior to attempting installation of such valves.

C. Only new valves will be allowed for installation and all valves shall be stored in a manner that they won't be damaged and kept free of dirt, mud, or other foreign matter that will be deemed detrimental to the proper performance of the valve.

1.03 INSTALLATION

A. Valves shall be set and joined to the pipe and each type of joint as described in Section 15062 and this Section of these specifications.

B. All valves shall be permanently stamped or tagged with stainless steel tags on the extension stem which differentiate reclaimed water valves from potable water valves.

C. Cast iron valve boxes shall be firmly supported, maintained centered and plumb over the operating nut of the valve and set in a 2-foot by 2-foot by 6-inches thick concrete collar as shown on standard details. The box cover shall be flush with the surface of the finished pavement. All box lids shall be painted to type of service.

1.04 DESCRIPTION OF SYSTEMS

A. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of reclaimed water.

1.05 QUALIFICATIONS

A. All of the types of valves and appurtenances shall be products of well established reputable firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.06 TOOLS

A. Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

PART 2 – PRODUCTS

2.01 RESILIENT SEATED GATE VALVES

A. Gate Valves 4 in. – 12 in

1. Valves 4 in. – 12 in. in size shall be of a resilient wedge design. The valve shall have a cold water rated working pressure of 250 psig. All cast ferrous components shall be ductile iron and shall be manufactured in compliance with the latest edition of ANSI/AWWA C515. The valve shall also be UL Listed and FM Approved, in applicable configurations. All valves shall be certified to NSF/ANSI 61 and NSF/ANSI 372.

2. The valve design shall be lightweight, easy to handle, and constructed with wall thickness per Table 2, of ANSI/AWWA C515. Heavy wall and/or cast gray-iron bodies are not acceptable. The valve shall have a smooth and oversize waterway and have the marking "D.I." or "Ductile Iron" cast onto the body. The valve wedge shall be constructed of ductile iron in sizes 4 in.–12 in. All 4 in.–12 in. wedges shall be fully encapsulated with EPDM rubber and provided with male type guides and polymer guide covers.

3. Valve stems shall be sealed by three O-rings. Two of the O-rings shall reside above the thrust collar. O-rings set in a cartridge shall not be allowed.

4. The valve shall also be equipped with thrust washers above and below the stem thrust collar for reduced operating torque.

5. All exterior valve body bolting shall be Type 304 stainless steel and shall be provided with hexagonal heads with dimensions conforming to ANSI B18.2.1. Metric size and/or socket head cap screws, or bolts, are not allowed. The operating nut shall be 2 in. square and shall be constructed of ductile iron fitted to a square tapered stem to help ensure even distribution of input torque. All body gaskets shall be of the pressure energized O-ring style design.

6. All internal and external ferrous surfaces of the valve body and bonnet shall have fusion-bonded epoxy coating, complying with ANSI/AWWA C550.

B. Gate Valves 14 in. – 66 in

1. This Section supersedes Specification 502-3 of Section IV – Technical Specifications.

2. Valves 14 in.–66 in. shall be resilient wedge type rated for 250 psig cold water working pressure. All cast ferrous components shall be ductile iron, ASTM A536. Valves 14 in. - 66 in. shall meet or exceed all applicable requirements of ANSI/AWWA C515. The words "Ductile Iron" or "D.I." shall be cast on the valve. The wedge shall be constructed of ductile iron fully encapsulated with EPDM rubber.

3. The wedge shall be symmetrical and seal equally well with flow in either direction. Wedge guides shall be equipped with male guide covers. The use of auxiliary bronze rollers and plow-style shoes are not acceptable. The wedge nut shall be independent of the wedge and held in place on three sides by the wedge to prevent possible misalignment. Valves 16 in. and larger shall be furnished with spur gears for vertical installations and bevel gears for horizontal installations.

4. Body bolting material shall be 304 stainless steel unless otherwise specified. Bolts may have either regular square or hexagonal shaped heads with dimensions conforming to ANSI B18.2.1. Metric size and/or socket head cap screws, or bolts, are not allowed. The operating nut shall be constructed of ductile iron. All gaskets shall be pressure energized O-ring type seals. Stem shall be sealed by three O-rings. O-rings set in a cartridge shall not be allowed. The valve shall have thrust washers located with 1 above and 1 below the thrust collar to assist operation of the valve. All internal and external surfaces of the valve body and bonnet shall have an epoxy coating, complying with ANSI/AWWA C550. Valves shall be AMERICAN Flow Control's Series 2500 Resilient Wedge Gate Valve.

2.02 VALVE BOXES

A. Valve boxes shall be of standard extension design and manufacture and shall be made of cast iron. No PVC Risers or Derisers are allowed as part of a valve box assembly. They are to be 3-piece valve box assembles. The lower part of the assembly can be ordered in various heights to accommodate different depths. Suitable sizes of valve boxes and extension pieces shall be provided where shown. The valve box cover shall be of cast iron. Valve boxes and their installation shall be included in the bid price for valves. Refer to City Index No. 402; Sheet 1 of 5 & Sheet 2 of 5 for potable water valve pad detail, and City Index No. 502; Sheet 1 of 3 & Sheet 2 of 3 for reclaimed water valve boxes and pad detail.

2.03 COMBINATION AIR VALVES & POLYETHYLENE COVERS

A. The combination air valves for the RCW pipelines shall be as shown on Sheet 8 of the Plans.

2.04 SERVICE SADDLES

A. Service saddles shall be used on all service taps to 4-inch P.V.C. water main. The largest service connection allowable on 4-inch main shall be 1-1/2-inch. Service saddles shall be used on all 2-inch service connections to 6-inch and larger mains. Service saddles (JCM 406 series or Ford FC 202 series) shall be wide bodied ductile iron with epoxy or nylon coating and shall have stainless steel straps.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All valves and appurtenances shall be installed in the location shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.

B. After installation, all valves and appurtenances shall be tested at least two hours at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the Engineer.

C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.

D. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe.

E. Alloy steel bolts and nut for flanged joints shall be made with high strength, low alloy Cor-Ten bolts, nuts and washers. Cor-Ten for mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe. All valves and joints to be wrapped with 8 mil. Color coded poly wrap.

F. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8 inches. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6 inches from the end, and the middle ring shall be placed on the substantial completion date unless otherwise requested by the Owner.

G. Valve boxes with concrete collars shall be installed as shown on the Drawings. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place cast iron box over each stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe. Remove any sand or undesirable fill from valve box.

3.02 SHOP PAINTING

A. Ferrous surfaces of valves and appurtenances shall receive a coating of rust-inhibitive primer. All pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.

B. All exposed piping, valves and meters shall receive one (1) primer coat of Tnemec Series 66 or equal (4-5 dry mils) and two (2) coats of Tnemec Series 72 or equal (2-3 dry mils each). The color shall be blue.

3.03 INSPECTION AND TESTING

A. Completed valves and appurtenances shall be subjected to hydrostatic pressure test as described in other sections of these specifications. All leaks in valves and appurtenances shall be repaired and lines retested as approved by the Project Representative. Prior to testing, the pipelines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION