D. All new water mains shall then be left under system pressure for testing.

E. To avoid damage to pavement and inconvenience to the public, fire hoses shall be used to direct flushing water from the main into suitable drainage channels or sewers.

F. The Contractor shall coordinate with the Inspector prior to beginning flushing activities.

3.2 CLEANING

A. All scaffolding, planks, tools, rags, dirt, debris, and any other material not part of the structural or operating facilities shall be removed prior to chlorination.

B. The surfaces of the walls, floors, and operating facilities shall then be thoroughly cleaned by sweeping, a high-pressure water hose, scrubbing, or another equally effective method.

C. All water, dirt, or foreign material accumulated in this operation shall be removed from the water storage facility.

3.3 CHLORINATION PROCEDURE

A. Facilities requiring disinfection shall be chlorinated by one of the following methods described in AWWA C652:

1. Method 1: Chlorination of treatment facilities such that at the end of the appropriate retention period the water will have a free chlorine residual of not less than 10 mg/l.

2. Method 2: Applying a solution of 200 mg/l available chlorine to the surfaces of all treatment facilities that will come in contact with water.

3. Method 3: Chlorination of treatment facilities with water having a free chlorine residual of 2 mg/l after 24 hours.

B. Contractor shall:

1. Provide all temporary taps, plugs, valves (including any necessary temporary valves to isolate new piping or structures from existing system), drains, pumps, piping, and connections required to clean, flush, disinfect, and remove the disinfectant.

2. Provide all temporary pumps, piping, and facilities, as required, to drain all flushing water to the work area runoff control area in accordance with the Contractor's Storm Water Pollution Prevention Plan (SWPPP).

3. Perform disinfection of each facility immediately before the facility is placed in operation and ensure that the facility is not contaminated after being acceptably disinfected.

3.4 BACTERIOLOGICAL SAMPLING AND TESTING

A. After the chlorination procedure is completed and before each facility is

placed in service, water from the completed facility shall be sampled and tested by Owner for coliform organisms and odor.

B. Samples for bacteriological tests will be taken by the Owner. These samples shall indicate microbiologically-satisfactory water before the facilities will be accepted.

C. If initial test results indicate contamination is present, the Contractor shall repeat the cleaning and disinfection procedure until the test results indicate microbiologically-satisfactory water.

D. The initial cleaning and disinfection procedures shall be performed at the Contractor's expense. The initial sampling and testing shall be at the Owner's expense. However, all expenses associated with subsequent cleaning, disinfection, sampling, and testing required due to positive bacteriological tests resulting from the Contractor's error or negligence shall be paid for by the Contractor. No extra payment or extension of Contract Times will be given to the Contractor for the time elapsed to achieve acceptable disinfection of the pipe.

E. Bacteriological tests will be completed in accordance with AWWA C652.

1. If a test is negative (satisfactory bacteriological sample), the facility may be placed in service.

2. If a test is positive, Owner will perform an additional set of tests to confirm the results of the initial tests.

3. If a repeat test for coliform organisms indicates positive results, the Contractor shall repeat the cleaning and disinfection procedure for the facility until satisfactory results are obtained.

3.5 HYDROSTATIC TESTING FOR PIPES

A. After the water pipeline has been laid and after inspection by the Owner, all newly laid main shall be subjected to a hydrostatic pressure test in accordance with AWWA C600/C605. The Contractor shall perform a hydrostatic pre-test to provide reasonable assurance of acceptance prior to performance of the witnessed test. Upon accomplishing a successful pre-test, the Contractor shall contact the Owner/ Engineer at least 48 hours prior to the test. The Owner or the Inspector shall be present during all hydrostatic pipeline tests.

B. Testing shall not be performed before three (3) days after all portions of water mains installation work has been completed.

C. Proper measures shall be taken to ensure that no cross connections are made during testing activities.

D. Test Pressure: The hydrostatic test pressure shall be 1.5 times the anticipated maximum sustained working pressure of the line or 150 psi, whichever is higher. However, in no case shall the test pressure exceed the rated working pressure for any joint, thrust restraint, valve, fitting, or other connected appurtenance of the test section.

E. Slowly fill the pipe with water and allow it to stand for 24 hours. Expel all air from the main. Apply and maintain the specified test pressure by continuous

pumping if necessary, for the entire test period. The test pressure shall be calculated for the point of lowest elevation, or as specified by the Owner. The pump suction shall be in a barrel or similar device or metered so that the amount of water required to maintain the test pressure may be measured accurately.

F. Each pressure test duration shall be a minimum of two (2) hours, and allowable leakage shall be determined according to the following formula, unless otherwise directed by the Owner:

1. Leakage shall be defined as the quantity of makeup water required to hold the specified test pressure for the duration of the test period. No pipe installation will be accepted if the leakage is greater than the number of gallons per hour as determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

L = quantity of makeup water, in gallons per hour. S = length of pipe section being tested, in feet. D = nominal pipe diameter, in inches. P = average hydrostatic test pressure, in psi (gauge).

G. Test service connection pipe by either testing in conjunction with the main at the test pressure required for the main, or by testing at the normal hydrostatic main pressure after the main has been completely installed and tested. Inspect visually for leaks and repair any leaks before backfilling. Duration of the test shall be at 15 minutes.

H. Upon completion and disinfection, the water mains shall be tested to determine water tightness according to AWWA C605 or most recent revision.

I. The hydrostatic pressure test must be successful. If the test is unsuccessful the contractor, at his expense, must rectify any problems and repeat the testing protocol.

3.6 HYDROSTATIC TESTING FOR TAPPING SLEEVES

A. Tapping tees shall be tested per manufacturer's recommendation. Inspect sleeve for leaks, and remedy leaks prior to tapping operation. The test pressure shall be maintained for a minimum of 10 minutes without any perceivable decline in pressure.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Unless shown on the Drawings or called out within the Specifications as a pay item, the hydrostatic testing and disinfection quantities shown or described are for informational purposes only. No separate measurement of hydrostatic testing and disinfection quantities will be made by the Contractor for this Work.

4.2 PAYMENT: Unless specified as a pay item, hydrostatic testing and disinfection performed and materials furnished in accordance with this Section will not be paid for directly but will be subsidiary to the pertinent items associated with construction

activities. No separate payment will be made to the Contractor for this Work.

END OF SECTION

SECTION 01410
TESTING LABORATORY SERVICES

PART 1 – GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all labor, materials, equipment, and incidentals required for testing laboratory services as specified herein.

1.2 DESCRIPTION OF REQUIREMENTS

A. The Owner will employ and pay for the services of an Independent Testing Laboratory to perform specified services and testing.

B. Employment of the laboratory shall in no way relieve the Contractor's obligations to perform the Work of the Contract.

1.3 QUALIFICATION OF LABORATORY

A. Authorized to operate in the State of Texas.

1.4 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

1.5 REFERANCE STANDARDS

A. Laboratory of National Institute of Standards and Technology (NIST).

1.6 SUBMITTALS

A. Submit a copy of report of inspection of facilities made by Materials Reference Laboratory of National Institute of Standards and Technology (NIST) during the most recent tour of inspection, with memorandum of remedies of any deficiencies reported by the inspection.

PART 2 – TESTING EQUIPMENT

2.1 GENERAL

A. Calibrated at reasonable intervals by devices of accuracy traceable to either:

1. NIST
2. Accepted values of natural physical constants.

PART 3 - EXECUTION

3.1 LABORATORY DUTIES

A. Cooperate with Engineer and Contractor to provide qualified personnel after due notice.
B. Perform specified inspections, sampling and testing of materials and methods of construction.
C. Comply with specified standards.
D. Promptly notify Engineer/Owner and Contractor of observed irregularities or deficiencies of work products.
E. Promptly submit written report of each test and inspection; one copy each to Engineer, Owner and Contractor. Each report shall include:

1. Date issued.
2. Project title and number.
3. Testing laboratory name, address and telephone number.
4. Name and signature of laboratory inspector.
5. Date and time of sampling or inspection.
6. Record of temperature and weather conditions.
7. Date of test.
8. Identification of product and specification section.
9. Location of sample or test in the Project.
10. Type of inspection or test.
11. Results of tests and compliance with Contract Documents.
12. Interpretation of test results, when requested by Engineer.
13. Employment of personnel making test samples.
14. Perform additional tests as required by Engineer or the Owner.

3.2 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or expand requirements of the Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of the Contractor.

3.3 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel, provide access to Work, and to Manufacturer's operations.
B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.
C. Furnish copies of Products test reports as required.

D. Furnish incidental labor and facilities.

E. Provide access to Work to be tested.

F. Obtain and handle samples at the Project site or at the source of the product to be tested.

G. Facilitate inspections and tests.

H. Provide a suitable storage box at the site for storage and curing of test samples.

I. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

J. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor's negligence.

K. Make arrangements with laboratory and pay for additional samples and tests required for Contractor's convenience, including concrete design mixes.

L. Pay for the services of the Independent Testing Laboratory to perform additional inspections, sampling, and testing required when initial tests indicate that work does not comply with the Contract Documents.

PART 4 – MEASUREMENT AND PAYMENT

4.1 Measurement and payment shall be the sole responsibility of the Owner. No separate measurement shall be done by, or payment made to, the Contractor for this Work.

END OF SECTION

SECTION 01500
CONCRETE FOR STRUCTURES

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section shall consist of furnishing all material, storage, handling, proportioning, and mixing of materials for Portland cement concrete construction of buildings, bridges, culverts, slabs, prestressed concrete, and incidental appurtenances.

B. The Work in this section shall also include the furnishing and placing of reinforcing steel, deformed smooth, of the size and quantity specified in the Drawings.

C. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of said standards or code shall govern.

1.2 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) International

B. Texas Department of Transportation (TxDOT)

C. American Association of State Highway and Transportation Officials (AASHTO)

1.3 SUBMITTALS

A. The Contractor shall submit the manufacturer's product data, instructions, recommendations, shop drawings, and certifications. All submittals shall be in accordance with the Engineer's requirements and submittals shall be approved prior to delivery.

1. Submit proposed mix design and test data for each type and strength of concrete in the Work.

2. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by Engineer.

PART 2 – PRODUCTS

2.1 CONCRETE MATERIALS

A. Concrete shall be composed of Portland cement or Portland cement and fly ash, water, aggregates (fine and coarse), and admixtures proportioned and mixed as hereinafter provided to achieve specified results.

1. Cementitious Materials: Portland cement shall conform to ASTM C 150, Type I (General Purpose), Type II (General Purpose with Moderate Sulfate Resistance) and Type III (High Early Strength). Type I shall be used when none is specified. Type I and Type III shall not be used when Type II is specified. Type III may be used in lieu of Type I when the anticipated air temperature for the succeeding 12 hours will not exceed 60oF. All cement shall be of the same type and from the same source for a monolithic placement.

2. Mixing Water: Water for use in concrete and for curing shall be potable water free of oils, acids, organic matter, or other deleterious substances and shall not contain more than 1,000 parts per million of chlorides as Cl or sulfates as SO4.Contractor may request approval of water from other sources. Contractor shall arrange for samples to be taken from the source and tested at his expense. Water quality tests shall conform to AASHTO Method T 26 except where such methods are in conflict with provisions of this specification.

3. Coarse Aggregate

   a. Coarse aggregate shall consist of durable particles of crushed or uncrushed gravel, crushed blast furnace slag, crushed stone or combinations thereof; free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material either free or as an adherent coating. It shall not contain more than 0.25 percent by weight of clay lumps, nor more than 1.0 percent by weight of shale nor more than 5 percent by weight of laminated and/or friable particles when tested in accordance with TxDOT Test Method TEX-413-A. It shall have a wear of not more than 40 percent when tested in accordance with TxDOT Test Method TEX-410-A.

   b. Unless otherwise indicated, coarse aggregate shall be subjected to 5 cycles of the soundness test conforming to TxDOT Test Method TEX-411-A. The loss shall not be greater than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

   c. Coarse aggregate shall be washed. The Loss by Decantation (TxDOT Test Method TEX- 406-A), plus allowable weight of clay lumps, shall not exceed 1 percent or value indicated on the plans or in the project manual, whichever is less. If material finer than the # 200 sieve is definitely established to be dust of fracture of aggregates made primarily from crushing of stone, essentially free from clay or shale as established by TxDOT Test Method TEX-406-A, the percent may be increased to 1.5.The coarse aggregate factor may not be more than 0.82; however, when voids in the coarse aggregate exceed 48 percent of the total rodded volume, the coarse aggregate factor shall not exceed 0.85. The coarse aggregate factor may not be less than 0.68 except for a Class I machine extruded mix that shall not have a coarse aggregate factor not lower than 0.61.

   d. When exposed aggregate surfaces are required, the coarse aggregate shall consist of particles with at least 40 percent crushed faces. Uncrushed gravel, polished aggregates and clear resilient coatings are not acceptable for exposed aggregate pedestrian surfaces (i.e., sidewalks, driveways, medians, islands, etc.). Grade 5 aggregates shall be used for exposed aggregate finishes.

   e. When tested by approved methods, the coarse aggregate including combinations of aggregates when used, shall conform to the grading requirements shown in Table 1.

Table 1: Coarse Aggregate Gradation Chart (TEX 401-A, Percent Retained)										
Grade	Nom. Size	2-1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8
1	2 1/2"	0	0-20	15-50		60-80			95-100	
2	1 1/2"		0	0-5		30-65		70-90	95-100	
3	1"		0	0-5		10-40	40-75		95-100	
4	1”			0	0-5		40-75		90-100	95-100
5	3/4”				0	0-10		45-80	90-100	95-100

f. Fine aggregate shall consist of clean, hard, durable, and uncoated particles of natural or manufactured sand or a combination thereof, with or without a mineral filler. It shall be free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material and it shall not contain more than 0.5 percent by weight of clay lumps. When subjected to color test for organic impurities per TxDOT Test Method TEX-408-A, it shall not show a color darker than standard.

g. Acid insoluble residue of fine aggregate used in slab concrete subject to direct traffic shall not be less than 28 percent by weight when tested conforming to TxDOT Test Method TEX-612-J.

h. When tested by approved methods, the fine aggregate, including combinations of aggregates, when used, shall conform to the grading requirements shown in Table 2.

Table 2: Fine Aggregate Gradation Chart (TEX 401-A, Percent Retained)							
3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
0	0-5	0-20	15-50	35-75	65-90	90-100	97-100

i. Where sand equivalence is greater than 85, retainage on No. 50 sieve may be 65 to 94 percent. Where manufactured sand is used in lieu of natural sand, the percent retained on No. 200 sieve shall be 94 to 100. Sand equivalent per TxDOT Test.

j. Method TEX-203-F shall not be less than 80 nor less than otherwise indicated, whichever is greater. The fineness modulus will be determined by adding the percentages by weight retained on sieve Nos. 4, 8, 16, 30, 50 and 100 and dividing the sum of the six sieves by 100. For Class A and C concrete, the fineness modulus shall be between 2.30 and 3.10. For Class H concrete, the fineness modulus shall be between 2.40 and 2.90.

k. Mineral filler shall consist of stone dust, clean crushed sand, approved fly ash or other approved inert material.

l. Mortar (Grout) for repair of concrete shall consist of 1 part cement, 2 parts finely graded sand and enough water to make the mixture plastic. When required to prevent color difference, white cement

shall be added to produce color required. When required by the Engineer, an approved latex adhesive shall be added to the mortar.

m. All admixtures shall comply with the requirements of Specification Section 01510 within these Specifications. Calcium chloride-based admixtures shall not be approved.

2.2 STORAGE OF CEMENT AND FLY ASH

A. Cement and fly ash shall be stored in separate and well ventilated, weatherproof buildings or approved bins which will protect the material from dampness or absorption of moisture. Storage facilities shall be easily accessible, and each shipment of packaged cement shall be kept separated to provide for identification and inspection. Engineer may permit small quantities of sacked cement to be stored in the open for a maximum of 48 hours on a raised platform and under waterproof covering.

2.3 STORAGE OF AGGREGATES

A. Aggregates shall be stockpiled in sizes to facilitate blending. If the aggregate is not stockpiled on a hard, non-contaminant base, the bottom 6-inch layer of the stockpile shall not be used without recleaning the aggregate. Where space is limited, stockpiles shall be separated by walls or other appropriate barriers. Aggregate shall be stockpiled and protected from the weather a minimum of 24 hours prior to use to minimize free moisture content. When stockpiles are too large to protect from the weather, accurate and continuous means acceptable to the Engineer shall be provided to monitor aggregate temperature and moisture. Aggregates shall be stockpiled and handled such that segregation and contamination are minimized.

2.4 MEASUREMENT OF MATERIALS

A. Water shall be accurately metered. Fine and coarse aggregates, mineral filler, bulk cement and fly ash shall be weighed separately. Allowances shall be made in the water volume and aggregate weights during batching for moisture content of aggregates and admixtures. Volumetric and weight measuring devices shall be acceptable to Engineer. Batch weighing of sacked cement is not required; however, bags, individually and entire shipments, may not vary by more than 3 percent from the specified weight of 94 pounds per bag. The average bag weight of a shipment shall be determined by weighing 50 bags taken at random.

2.5 MIX DESIGN

A. Contractor shall furnish a mix design acceptable to the Engineer for class of concrete specified. The mix shall be designed by a qualified commercial laboratory and signed/sealed by a Texas-registered Professional Engineer to conform with requirements contained herein, to ACI 211.1 or TxDOT Bulletin C-11 (and supplements thereto). Contractor shall perform, at his own expense, the work required to substantiate the design, including testing of strength specimens. Complete concrete design data shall be submitted to the Engineer for approval. The mix design will be valid for a period of one (1) year provided that there are no changes to the component materials.

B. At the end of one (1) year, a previously approved mix may be resubmitted for approval if it can be shown that no substantial change in the component materials has occurred. The resubmittal analysis must be reviewed, signed and sealed by a Texas-registered Professional Engineer. This resubmittal will include a reanalysis of specific gravity, absorption, fineness modulus, sand equivalent, soundness, wear and unit weights of the aggregates. Provided that the fineness modulus did not deviate by more than 0.20 or that the reproportioned total mixing water, aggregate and cement (or cement plus fly ash) are within 1, 2, and 3 percent, respectively, of pre-approved quantities, a one-year extension on the approval of the mix may be granted by the Engineer. Updated cement, fly ash, and admixture certifications shall accompany the resubmittal.

C. Approved admixtures conforming to Specification Section 01510 within these Specifications may be used with all classes of concrete at the option of the Contractor provided that specific requirements of the governing concrete structure specification are met. Water reducing and retarding agents shall be required for hot weather, large mass, and continuous slab placements. Air entraining agents may be used in all mixes but must be used in the classes indicated on Table 4. Unless approved by the Engineer, mix designs shall not exceed air contents for extreme exposure conditions as recommended by ACI 211.1 for the various aggregate grades.

2.6 CONSISTENCY AND QUALITY OF CONCRETE

A. Consistency and quality of concrete should allow efficient placement and completion of finishing operations before initial set. Retempering shall not be allowed. When field conditions are such that additional moisture is needed for final concrete surface finishing operation, required water shall be applied to surface by fog spray only and shall be held to a minimum. Concrete shall be workable, cohesive, possess satisfactory finishing qualities and of stiffest consistency that can be placed and vibrated into a homogeneous mass within slump requirements specified in Table 3. Excessive bleeding shall be avoided and in no case will it be permissible to expedite finishing and drying by sprinkling the surface with cement powder. No concrete will be permitted with a slump in excess of the maximums shown unless water-reducing admixtures have been previously approved. Slump values shall conform to TxDOT Test Method TEX-415-A.

Table 3: Slump Requirements

	Slump, inches	
Type of Construction	Maximum	Minimum
Cased Drilled Shafts	4	3
Reinforced Foundation Caissons and Footings	3	1
Reinforced Footings and Substructure Walls	3	1
Uncased Drilled Shafts	6	5
Thin-walled Sections (9 inches or less)	5	4
Prestressed Concrete Members	5	4
Precast Drainage Structures	6	4
Wall Sections over 9 inches	4	3
Reinforced Building Slabs, Beams, Columns and Walls	4	1
Bridge Decks	4	2

Pavements, Fixed-form	3	1
Pavements, Slip-form	1-1/2	1/2
Sidewalks, Driveways and Slabs on Ground	4	2
Curb & Gutter, Hand-vibrated	3	1
Curb & Gutter, Hand-tamped or spaded	4	2
Curb & Gutter, Slip-form/extrusion machine	2	1/2
Heavy Mass Construction	2	1
High Strength Concrete	4	3
Riprap and Other Miscellaneous Concrete	6	1
Under Water or Seal Concrete	6	5

B. During progress of the work, Engineer or Owner's testing laboratory shall cast test cylinders and/or beams as a check on compressive and/or flexural strength of concrete actually placed. Engineer or Utility's testing laboratory may also perform slump tests, entrained air tests and temperature checks to ensure compliance with specifications.

C. Proportioning of all material components shall be checked prior to discharging. Excluding mortar material for pre-coating of the mixer drum [403.8(2)] and adjustment for moisture content of admixtures and aggregates, material components shall fall within the range of ± 1% for water, ± 2% for aggregates, ± 3% for cement, -2% for fly ash and within manufacturer recommended dosage rates for admixtures except that air entrainment shall be ± 1-1/2 points of the mix design requirements.

D. Unless otherwise specified, concrete mix temperature shall not exceed 90° F except in mixes with high range water reducers where a maximum mix temperature of 100° F will be allowed. Cooling an otherwise acceptable mix by addition of water or ice will not be allowed.

E. Test beams or cylinders will be required for small placements such as manholes, inlets, culverts, wing walls, etc. Engineer may vary the number of tests to a minimum of 1 for each 25 cubic yards placed over a several day period.

F. Test beams or cylinders shall be required for each monolithic placement of bridge decks or superstructures, top slabs of direct traffic culverts, cased drilled shafts, structural beams and as otherwise directed by Engineer for design strength or early form removal.

G. Test beams or cylinders made for early form removal or use of structure will be at Contractor's expense, except when required by Engineer.

H. A strength test shall be defined as the average of breaking strength of 2 cylinders or 2 beams as applicable. Specimens will be tested conforming to TxDOT Test Method TEX- 418-A or TEX-420-A. If required strength or consistency of class of concrete being produced cannot be secured with minimum cementitious material specified or without exceeding maximum water/cementitious material ratio, Contractor will be required to furnish different aggregates, use a water reducing agent, an air entraining agent or increase cementitious material content in order to provide concrete meeting these specifications. Test specimens shall be cured using the same methods and under the same conditions as the concrete represented. Design strength beams and cylinders shall be cured conforming to TxDOT Bulletin C-11 (and supplements thereto).

I. When control of concrete quality is by 28-day compressive tests, job control will be by 7- day flexural tests. If the required 7-day strength is not secured with the quantity of cement specified in Table 4, changes in the mix design shall be made and resubmitted for approval.

Table 4: Classes of Concrete

Class	Sk Cement Per CY	Minimum 28 Day (psi)	Minimum Beam 7 Day (psi)	*Maximum W/C Ratio	Coarse Agg. Number	** Air Ent.
A	5.0	3000	500	6.5	1,2,3,4,5	Yes
B	4.0	2000	300	8.0	2,3,4,5	No
C	6.0	3600	600	6.0	1,2,3,4,5	Yes
D	4.5	2500	425	7.5	2,3,4	No
H	6.0	As indicated	As Indicated	5.5	3,4	Yes
I	5.5	3500	575	6.2	2,3,4,5	Yes
J	2.0	800	N/A	N/A	2,3,4,5	No
S	6.0	3600	600	5.0	2,3,4,5	Yes

Notes:

1. Grade 1 coarse aggregate may be used in massive foundations only (except case drilled shafts) with 4 inch minimum clear spacing between reinforcing steel.
2. When Type II cement is used in Class C or S concrete, the 7-day beam break requirement will be 550 psi; with Class A, 460 psi., minimum.
3. *The design water-cement ratio shall be appropriately adjusted for mixes with fly ash per ACI 211.1 or TxDOT C-11 (and supplements thereto), as applicable.
4. **Maximum air design contents for the five grades of coarse aggregate, unless otherwise approved by Engineer, are: 4.5% for Grade 1, 5.5% for Grade 2, and 6.0% for Grades 3, 4, and 5.

2.7 MIXING AND MIXING EQUIPMENT

A. All equipment, tools and machinery used for hauling materials and performing any part of the work shall be maintained in such condition to insure completion of the work without excessive delays. Mixing shall be done in a mixer of approved type and size that will produce uniform distribution of material throughout the mass and shall be capable of producing concrete meeting requirements of ASTM C 94, Ready-mixed Concrete, and these specifications. Mixing equipment shall be capable of producing sufficient concrete to provide required quantities. Entire contents of the drum shall be discharged before any materials are placed therein for a succeeding batch. Improperly mixed concrete shall not be placed in a structure. The mixer may be batched by either volumetric or weight sensing equipment and shall be equipped with a suitable timing device that will lock the discharging mechanism and signal when specified time of mixing has elapsed.

1. Proportioning and Mixing Equipment

   a. For all miscellaneous concrete placements, a mobile, continuous, volumetric mixer or a volumetric or weight batch mixer of the rotating paddle type may be used.

   b. When approved by Engineer in writing or when specified for use, these mixers may be used for other types of concrete construction,

including structural concrete, if the number of mixers furnished will supply the amount of concrete required for the operation in question.

c. These mixers shall be designed to receive all the concrete ingredients, including admixtures, required by the mix design in a continuous uniform rate and mix them to the required consistency before discharging. Mixers shall have adequate water supply and metering devices.

d. For continuous volumetric mixers, the materials delivered during a revolution of the driving mechanism or in a selected interval, will be considered a batch and the proportion of each ingredient will be calculated in the same manner as for a batch type plant.

e. Mixing time shall conform to recommendations of manufacturer of mixer unless otherwise directed by Engineer.

2. Ready-mixed Concrete: Use of ready-mixed concrete will be permitted provided the batching plant and mixer trucks meet quality requirements specified herein. When ready-mixed concrete is used, additional mortar (1 sack cement, 3 parts sand and sufficient water) shall be added to each batch to coat the mixer drum. Ready-mixed concrete, batching plant and mixer truck operation shall include the following:

a. A ticket system will be used that includes a copy for the Inspector. Ticket will have machine stamped time/date of concrete batch, weight of cement, fly ash, sand and aggregates, exact nomenclature and written quantities of admixtures and water. Any item missing or incomplete on ticket may be cause for rejection of concrete.

b. Sufficient trucks will be available to support continuous placements. Contractor will satisfy Engineer that adequate standby trucks are available to support monolithic placement requirements.

c. A portion of mixing water required by the mix design to produce the specified slump may be withheld and added at the job site, but only with permission of Engineer and under the Inspector's observation. When water is added under these conditions, it will be thoroughly mixed before any slump or strength samples are taken. Additional cement shall not be added at the job site to otherwise unacceptable mixes.

d. A metal plate(s) shall be attached in a prominent place on each truck mixer plainly showing the various uses for which it was designed. The data shall include the drum's speed of rotation for mixing and for agitating and the capacity for complete mixing and/or agitating only. A copy of the manufacturer's design, showing dimensions of blades, shall be available for inspection at the plant at all times. Accumulations of hardened concrete shall be removed to the satisfaction of the Engineer or Owner.

e. The loading of the transit mixers shall not exceed capacity as shown on the manufacturer's plate attached to the mixer or 63 percent of the drum volume, whichever is the lesser volume. The loading of transit mixers to the extent of causing spill-out enroute to delivery will not be acceptable. Consistent spillage will be cause for disqualification of a supplier.

f. Excess concrete remaining in the drum after delivery and wash water after delivery shall not be dumped on the project site unless approval of the dump location is first secured from the Engineer or Owner.

3. Hand-mixed Concrete

a. Hand mixing of concrete may be permitted for small placements or in case of an emergency and then only on authorization of the Engineer. Hand-mixed batches shall not exceed a 4 cubic foot batch in volume. Material volume ratios shall not be leaner than 1 part cement, 2 parts large aggregate, 1 part fine aggregate and enough water to produce a consistent mix with a slump not to exceed 4 inches. Admixtures shall not be used unless specifically approved by the Engineer.

2.8 REINFORCED STEEL

A. Bars

1. Bar reinforcement shall be deformed and shall conform to ASTM A 615, A 616, Grades 40, 60 or 75 and shall be open-hearth, basic oxygen or electric furnace new billet steel, unless otherwise indicated. Large diameter new billet steel (Nos. 14 and 18), Grade 75, will be permitted for straight bars only.

2. Where bending of bar sizes No. 14 or No. 18 of Grades 40 or 60 is required, bend testing shall be performed on representative specimens as described for smaller bars in the applicable ASTM specification. The required bend shall be 90 degrees at a minimum temperature of 60 F around a pin having a diameter of 10 times the nominal diameter of the bar and shall be free of cracking.

3. Spiral reinforcement shall be either smooth or deformed bars or wire of the minimum diameter indicated. Bars for spiral reinforcement shall comply with ASTM A 675, A 615 or A 617. Wire shall comply with ASTM A 82. The minimum yield strength for spiral reinforcement shall be 40,000 psi.

4. In cases where the provisions of this item are in conflict with the provisions of the ASTM Designation to which reference is made, the provisions of this item shall govern.

5. Report of chemical analysis showing the percentages of carbon, manganese, phosphorus and sulphur will be required for all reinforcing steel when it is to be welded, except for drill shafts. No tack welding will be allowed. All welding shall conform to the requirements of AWS D-1-72.

6. Smooth bars, larger than No. 4, may be steel conforming to the above or may be furnished in any steel that meets the physical requirements of ASTM A 36.

7. Smooth, round bars shall be designated by size number through No.4. Smooth bars above No. 4 shall be designated by diameter in inches.

8. The nominal size and area and the theoretical weight (lbs.) of reinforcing steel bars covered by these specifications are as follows:

Table 5: Reinforced Steel Bars			
Bar Size Number	**Nominal Diameter (inches)**	**Nominal Area (Square Inches)**	**Weight/ Linear Foot**
2	0.250	0.05	0.167
3	0.375	00.11	0.376
4	0.500	0.20	0.668
5	0.625	0.31	1.043
6	0.750	0.44	1.502
7	0.875	0.875	2.044
8	1.000	0.79	2.670
9	1.128	1.00	3.400
10	1.270	1.27	4.303
11	1.410	1.56	5.313
14	1.693	2.25	7.65
18	2.257	4.00	13.60

B. Placing

1. Reinforcement shall be placed as near as possible in the position indicated. Unless otherwise indicated, dimensions shown for reinforcement are to the centers of the bars. In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of the spacing between bars. In the plane of the steel perpendicular to the nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch. Cover of concrete to the nearest surface of steel shall be as follows:

Table 6: Reinforced Steel Minimum Cover	
Description	**Minimum Cover (inches)**
(a) Concrete cast against and permanently exposed to earth	3
(b) Concrete exposed to earth or weather	
Bar No. 6 through 18 bars	2
(c) Concrete not exposed to weather or in contact with ground:	
Slabs, walls, joists:	
Bar No. 14 and 18 1 1/2	1-1/2
Bar No. 11 and smaller 1	1

PART 3 - MEASUREMENT AND PAYMENT

3.1 MEASUREMENT

A. The quantities of concrete of the various classifications which constitute the completed and accepted structure or structures in place will be measured by the cubic yard, each, square foot, square yard or linear foot as indicated in the Drawings. Measurement will be as follows:

1. General

a. Measurement based on dimensions shall be for the completed structure as measured in place. However, field-measured dimensions shall not exceed those indicated on the plans or as may have been directed by the Engineer in writing.

b. No deductions shall be made for chamfers less than 2 inches in depth, embedded portions of structural steel, reinforcing steel, nuts, bolts, conduits less than 5 inches in diameter, pre/post tensioning tendons, keys, water stops, weep holes and expansion joints 2 inches or less in width.

c. No measurement shall be made for concrete keys between adjoining beams or prestressed concrete planks.

d. No measurement shall be made for fill concrete between the ends or adjoining prestressed concrete planks/box beams at bent caps or between the ends of prestressed concrete planks/box beams and abutment end walls.

e. No measurement shall be made for inlet and junction box invert

concrete.

f. No measurement shall be made for any additional concrete required above the normal slab thickness for camber or crown.

g. No measurement shall be made for reinforced steel unless it is included as a separate bid item in the contract documents.

3.2 PAYMENT: Payment will be made for the Work completed per the bid item unit as described above. The unit bid price shall include labor, equipment, materials, time and incidentals necessary to complete the Work.

END OF SECTION

SECTION 01510
CONCRETE ADMIXTURES

PART 1 - GENERAL

1.1 SCOPE

A. The Work in this Section consists of materials requirements of admixtures for Portland cement concrete.

B. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 RELATED SECTIONS

A. Section 01500, Concrete for Structures

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) International

B. Texas Department of Transportation (TxDOT)

1.4 SUBMITTALS

A. All admixture submittals must be approved by the Engineer. No admixture shall be chloride-based or have chloride(s) added in the manufacturing process. Admixtures must be pretested by the TxDOT Materials and Tests Engineer and be included in the State's current approved admixture list. All admixtures must retain an approved status through the duration of a mix design's one-year approval period.

PART 2 - PRODUCTS

2.1 Air Entraining Admixture: An "Air Entraining Admixture" is defined as a material which, when added to a concrete mixture in the proper quantity, will entrain uniformly dispersed microscopic air bubbles in the concrete mix. The admixture shall meet the requirements of ASTM Designation: C 260 modified as follows:

A. The cement used in any series of test shall be either the cement proposed for the specific work or a "reference" Type I cement from one mill.

B. The air entraining admixture used in the reference concrete shall be Neutralized Vinsol Resin.

2.2 Water-Reducing Admixture: A "Water-reducing Admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of a given consistency and required strength. This admixture shall conform to ASTM C 494, Type A.

2.3 Accelerating Admixture: An "Accelerating Admixture" is defined as an admixture that accelerates the setting time and the early strength development of concrete. This

admixture shall conform to ASTM C 494, Type C. The accelerating admixture will contain no chlorides.

2.4 Water-reducing, Retarding Admixture: A "Water-reducing, Retarding Admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of a given consistency and retard the initial set of the concrete. This admixture shall conform to ASTM C 494, Type D.

2.5 High-range Water Reducing Admixtures: A "High-range Water Reducing Admixture", referred to as a superplasticizer, is defined as a synthetic polymer material which, when added to a low slump concrete mixture increases the slump without adversely affecting segregation, impermeability, or durability of the mix. This admixture shall conform to ASTM C 494, Type F or G.

2.6 Fly Ash: Fly ash used in Portland cement concrete as a substitute for Portland cement or as a mineral filler shall comply with TXDOT Materials Specification D-9-8900 and be listed on TXDOT's current list of approved fly ash sources. Fly ash obtained from a source using a process fueled by hazardous waste (30 Texas Administrative Code, Section 335.1) shall be prohibited. This applies to any other specification concerning the use of fly ash. Contractor shall maintain a record of source for each batch. Supplier shall certify that no hazardous waste is used in the fuel mix or raw materials.

2.7 Certification and Product Information

A. The Contractor shall submit the name of the admixture proposed and manufacturer's certification that the selected admixtures meet the requirements of this item and of ASTM C 260 and C 494 as applicable. Admixtures for a mix design shall be of the same brand. If more than one admixture is proposed in the concrete mix, a statement of compatibility of components shall accompany certification. Manufacturer's product literature shall specify when in the batching/mixing operation the admixture must be added.

B. The Engineer may request additional information such as infrared spectrophotometry scan, solids content, pH value, etc., for further consideration. Any unreported changes in formulation discovered by any of the tests prescribed herein may be cause to permanently bar the manufacturer from furnishing admixtures for Owner's work.

2.8 Construction Use of Admixtures

A. All mixtures used shall be liquid except high-range water reducers, which may be a powder. Liquid admixtures shall be agitated as needed to prevent separation or sedimentation of solids; however, air agitation of Neutralized Vinsol Resin will not be allowed.

B. No admixture shall be dispensed on dry aggregates. Admixtures shall be dispensed at the batching site separately, but at the same time as the mixing water. Only high range water reducers may be introduced into the mix at the job site.

C. When other admixtures are used with fly ash, the amount of the other admixture to be used shall be based on the amount of Portland cement only and not the amount of Portland cement and fly ash.

D. When high-range water reducers are to be added at the job site, transit mixers shall be used. Admixture manufacturer literature shall indicate recommended mixing methods and time for the specific equipment and mix design used. The transit mix equipment shall not be loaded in excess of 63 percent of its rated capacity to ensure proper mixing of the admixture at the site. If during discharging of concrete a change in slump in excess of 30% is noted, the remaining concrete shall be rejected unless prior approval was given by the Engineer to retemper a load with a second charge of admixture. Retempering with water shall not be allowed.

E. Accelerating admixtures will not be permitted in combination with Type II cement.

F. All mixes with air entrainment shall have a minimum relative durability factor of 80 in accordance with ASTM C 260. Dosage of air entrainment admixtures may be adjusted by the Contractor to stay within the specified tolerances for air entrainment requirements within Section 1500 of these Specifications.

PART 3 – MEASUREMENT AN PAYMENT

4.1 MEASUREMENT: Unless shown on the Drawings or called out within the Specifications as a pay item, admixtures quantities shown or described are for informational purposes only. No separate measurement for admixture quantities will be made by the Contractor for this Work.

4.2 PAYMENT: Unless specified as a pay item, admixtures furnished in accordance with this Section will not be paid for directly but will be subsidiary to the pertinent items associated with construction activities. No separate payment will be made to the Contractor for this Work.

END OF SECTION

SECTION 01600

CONCRETE ENCASEMENT, CRADLES, CAPS AND SEALS

PART 1 – G E N E R A L

1.1 SCOPE

A. The Work in this Section consists of furnishing all labor, materials, equipment, and incidentals for placing of concrete encasements, cradles, caps, and seals on either existing or proposed water and sewer mains, as shown in the Drawings.

B. Where references are made to other standards or codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 RELATED SECTIONS

A. Section 01500, Concrete for Structures

1.3 REFERENCE STANDARDS

A. Texas Commission of Environmental Quality (TCEQ)

1. Chapter 217 – Design for Domestic Wastewater Systems

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

1. ASTM C 138 - Standard Test Method for Unit Weight, Yield and Air Content (Gravimetric) of Concrete.
2. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.
3. ASTM C 150 - Standard Specification for Portland Cement.
4. ASTM C 494 - Standard Specification for Chemical Admixture for Concrete.
5. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcinated Natural Pozzolan for use as Mineral Admixture in Portland Cement Concrete.
6. ASTM C 869 - Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.
7. ASTM C 937 - Standard Specification for Grout Fluidifier for Pre-placed Aggregate Concrete.
8. ASTM C 942 - Standard Test Method for Compressive Strength of Grout for Pre-placed Aggregate Concrete into Laboratory.
9. ASTM C 1017 - Standard Specification for Chemical Admixture for Use in Producing Flowing Concrete.

PART 2 – P R O D U C T S

2.1 MATERIALS

A. Concrete Class D shall confirm to all requirements of Section 01500 of these Project Specifications.

PART 3 – CONSTRUCTION

3.1 When trench foundation is excessively wet or unstable or installation of water or wastewater main will result in less than 36 inches of cover, Contractor shall notify Engineer. The Engineer may require Contractor to install a concrete seal, cradle, cap, encasement, or other appropriate action.

3.2 Concrete Encasement: Concrete encasement shall be installed when shown in the Drawings. The trench shall be excavated and fine graded to a depth conforming to the Concrete Encasement Detail as shown in the Drawings.

A. The water main or sewer main shall be supported by precast concrete blocks of the same strength as the concrete for encasement and securely tied down to prevent floatation.

B. Encasement shall be placed to a depth and width conforming to the details and sections shown in the Drawings.

3.3 Concrete Cradles: Concrete cradles shall be installed when shown in the Drawings. The trench shall be prepared and the main supported. Straps and tie downs shall be a minimum of No. 4 diameter rebar.

3.4 Concrete Caps: Concrete caps shall be installed when shown in the Drawings.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot of concrete encasement, cradles, caps, and seals installed as accepted by the Owner for the size of the pipe specified.

4.2 PAYMENT: Payment shall be full compensation for the labor, materials, and installation of concrete encasement, cradles, caps, and seals. This item shall include, but not necessarily be limited to: carrier pipe, concrete encasement, cradle, caps, seals, tracer wire, marker tape, excavation and backfill, compaction, bracing, sheeting, and shoring; grout; compaction; hydrotesting and disinfection; and all other incidental work for the concrete encasement, cradles, caps, and seals, complete in place.

END OF SECTION

SECTION 01700
SITE RESTORATION

PART 1 – GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all labor, materials, and equipment for preparing and spreading topsoil, fertilizer, seeding, and mulch as shown in the Drawings and specified herein.

B. The Work included in this Section shall also include site restoration of soils to original grade along pipeline installations.

C. Where references are made to other standards or codes, unless specified date references are indicated, the latest edition of said standard or code shall govern.

1.2 RELATED SECTIONS

A. Section 01100, Site Preparation

1.3 REFERENCE STANDARDS

A. Comply with the applicable provisions and recommendations, except where otherwise shown or specified.

1. Association of Official Analytical Chemists, Official Methods of Analysis.
2. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
3. FSO-F-241D, Fertilizer, Mixed, Commercial.

1.4 SUBMITTALS

A. The Contractor shall submit certification from supplier that each type of seed conforms to this Section's requirements and the requirements of the Texas Seed Law.

B. The Contractor shall submit certification stating that the fertilizer complies with this Section's requirements and the requirements of the Texas Fertilizer Law.

1.5 PRODUCT DELIVERY STORAGE, AND HANDLING

A. Materials shall be delivered in proper containers and protect materials from deterioration during delivery.

B. Store and cover material to prevent deterioration. Remove packaged materials which have become damaged or show deterioration from the site.

PART 2 – MATERIALS

2.1 TOPSOIL

A. Topsoil shall be reasonably free from subsoil, stumps, roots, brush, stones (2 inches or more in diameter), clay lumps or similar objects.

B. The topsoil and or soil mixture, unless otherwise specified or approved, shall have a pH range of approximately 5.5 to 8.0.

C. The organic content of topsoil shall be not less than 1%.

2.2 GRASS SEED

A. Grass seed shall conform to the U.S. Department of Agriculture rules and regulations of the Federal Seed Act and the Texas Seed Law.

B. Seed shall be certified 90 percent pure and furnish 80 percent germination and meet the following requirements:

1. Rye: Fresh, clean, Italian rye grass seed (lollium multi-florum), mixed in labeled proportions. As tested, minimum percentages of impurities and germination must be labeled. Deliver in original unopened containers.

2. Bermuda: Extra-fancy, treated, lawn type common Bermuda (Cynodon dactylon). Deliver in original, unopened container showing weight, analysis, name of vendor, and germination test results.

3. Wet, moldy, or otherwise damaged seed will not be accepted.

4. Seed requirements, application rates and planting dates are:

Type	Application Rate (pounds/acre)	Planting Date
Hulled Common Bermuda Grass 98/88 Unhulled Common Bermuda Grass 98/88	40/40	Jan 1 to Mar 31
Hulled Common Bermuda Grass 98/88	40	Apr 1 to Sep 30
Hulled Common Bermuda 98/88 Unhulled Common Bermuda Grass 98/88 Annual Rye Grass (Gulf)	40/40/30	Oct 1 to Dec 31

2.4 FERTILIZER

A. Fertilizer shall be dry and free flowing, inorganic, water soluble commercial fertilizer, which is uniform is composition. Caked, damaged, or otherwise unsuitable fertilizer

will not be accepted.

B. Fertilizer shall be standard commercial fertilizers containing 12%, nitrogen, 8% phosphoric acid, and 8% potassium.

C. The fertilizers shall meet the specified requirements of the applicable State and Federal laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon.

2.5 MULCH

A. Mulch shall be virgin wood cellulose fibers from whole wood chips having a minimum of 20 percent fibers 0.42 inches (10.7mm) in length and 0.01 inches (0.27 mm) in diameter.

B. Mulch shall be dyed green for coverage verification purposes. Straw mulch or hydromulch may be used in lieu of wood mulch if accepted by the Engineer.

C. The Contractor shall demonstrate comparable performance of straw mulch or hydromulch to wood mulch for acceptance.

PART 3 - EXECUTION

3.1 PREPARATION OF AREA

A. Before applying fertilizer, areas to be seeded shall be rolled or otherwise cleared of stones larger than 2 inches in any diameter, sticks and other debris which might interfere with sowing of seed, growth of grass or subsequent maintenance of grass covered areas.

3.2 PLACING TOPSOIL

A. Topsoil shall be spread evenly on the prepared area to a uniform depth of 4-inches, after compaction.

B. Spreading shall not be done when the ground or topsoil is excessively wet or otherwise in a condition detrimental to the Work.

C. Spreading shall be carried on so that sodding operations can proceed with a minimum of soil preparation or tilling. After spreading, any large stiff clods and hard lumps shall be broken with a pulverizer or by other effective means and all

stones or rocks (2-inches or more in diameter), roots litter, or any foreign material shall be raked up and disposed of by the Contractor.

D. The topsoil surface shall conform to the required lines, grades and cross sections. Any topsoil or other dirt falling upon pavements as a result of hauling or handling of topsoil shall be promptly removed.

3.3 DISPOSAL OF WASTE MATERIALS

A. The Contractor shall legally dispose of all waste materials, (i.e. roots, stumps, brush, stones, clay lumps, etc.) generated during the processing of the on-site topsoil.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per square yard of topsoil at 4-inch minimum depth completed with seed, fertilizer, mulch, and watering as agreed upon by the Owner and the Contractor.

4.2 PAYMENT: Payment shall be made for all labor, materials, and equipment necessary for preparing and spreading topsoil, fertilizer, seeding, and mulch in square yard at 4-inch minimum depth as specified in the Drawings and specified herein. This shall include, but not necessarily be limited to: spreading topsoil, seeding, mulching, fertilizing, watering, and any other work incidental and included within this Section.

END OF SECTION

SECTION 01720
REMOVE AND REPLACE EXISTING GRAVEL/CHIP SEAL DRIVEWAY

PART 1 – GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all labor, materials, and equipment for the reconstruction of existing gravel and chip seal driveways.

B. Where references are made to other standards or codes, unless specified date references are indicated, the latest edition of said standard or code shall govern.

1.2 SUBMITTALS

A. The Contractor shall submit certification stating that type of Asphaltic Cement and Aggregates conform to this Section's requirements.

PART 2 – MATERIALS

2.1 ASPHALTIC CEMENT

A. TxDOT Item 300, "Asphalts, Oils, and Emulsions"

2.2 AGGRETATES

A. TxDOT Item 302, "Aggregates for Surface Treatments."

PART 3 - EXECUTION

3.1 REMOVAL OF EXISTING DRIVEWAY

A. If an existing driveway is to be removed and replaced, remove the existing driveway pavement to the depths and limits shown on the plans or identified by the Engineer using the methods described herein. Asphaltic concrete driveway pavements shall be cut with a concrete saw or other equipment approved by the Engineer. Existing gravel driveways shall be removed with appropriate excavation equipment as shown on the plans or approved by the Engineer. If necessary, remove adjacent soil and vegetation to prevent contamination of the driveway area, and place it in a windrow or stockpile. Do not damage adjacent pavement structure during removal and reconstruction operations.

3.2 PREPARING SUBGRADE

A. Compaction. Use approved equipment to compact the subgrade layer. The plans or the Engineer may require specific equipment. Compact until there is no evidence of further consolidation. Maintain a level layer to ensure uniform compaction. If the required stability or finish is lost for any reason, recompact and refinish the subgrade at no additional expense to the Owner. Backfill shall be placed in a

maximum of 8" thickness compacted to match existing density.

3.3 SURFACING

A. Gravel Driveway. A gravel driveway is defined as a driveway consisting entirely of flexible base material without an asphaltic concrete, Portland cement concrete, or surface treatment layer. The surface of the compacted base shall be smooth and in conformity with typical sections and to the established lines and grades.

B. Chip Seal Driveway. A chip seal driveway is a driveway with a surface treatment layer.

1. Weather

a) Standard Temperature Limitations. Apply surface treatment when air temperature is above 50ºF and rising. Do not apply surface treatment when air temperature is 60ºF and falling. In all cases, do not apply surface treatment when surface temperature is below 60ºF.

b) Polymer-Modified Asphalt Cement Temperature Limitations. When using materials described in TxDOT Item 300, Section 2.B, "Polymer Modified Asphalt Cement," apply surface treatment when air temperature is above 70ºF and rising. Do not apply surface treatment when air temperature is 80ºF and falling. In all cases, do not apply surface treatment when surface temperature is below 70ºF.

c) Asphalt Material Designed for Winter Use. When winter asphalt application is allowed, the Engineer will approve the air and surface temperature for asphalt material application. Apply surface treatment at air and surface temperatures as directed.

2. Surface Preparation. Remove dirt, dust, or other harmful material before sealing.

3. Asphalt Placement. Select an application temperature, as approved, in accordance with TxDOT Item 300, "Asphalts, Oils, and Emulsions." Uniformly apply the asphalt material at the rate of 0.2 Gallons per Square Yard, within 15ºF of the approved temperature, and not above the maximum allowable temperature.

4. Aggregate Placement. As soon as possible, apply aggregate uniformly at the rate directed without causing the rock to roll over.

5. Rolling. Start rolling operation on each shot as soon as aggregate is applied. Use sufficient rollers to cover the entire mat width in 1 pass, i.e., 1 direction. Unless otherwise shown on the plans, make a minimum of 5 passes.

6. Brooming. After rolling, sweep as soon as aggregate has sufficiently bonded to remove excess.

3.4 DISPOSAL OF WASTE MATERIALS

A. The Contractor shall legally dispose of all waste materials, generated during the processing of the on-site topsoil.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per square yard of removal and replacement of existing gravel or chip seal driveway as agreed upon by the Owner and the Contractor.

4.2 PAYMENT: Payment shall be made for all labor, materials, and equipment necessary for "Remove/Replace Existing Gravel/Chip Seal Driveway" in the unit price bid of square yard at 2-inch minimum depth as specified in the Drawings and specified herein. This shall include, but not necessarily be limited to: removal of existing driveway, preparing the subgrade, for furnishing and placing all materials, manipulations, labor, tools, equipment, and any other work incidental and included within this Section.

END OF SECTION

SECTION 02300
DIRECTIONAL DRILLING

PART 1 - GENERAL

1.1 SCOPE

A. This item shall govern the furnishing and installation of product piping (and casing where applicable) by the method of directional boring, sometimes referred to as horizontal directional drilling (HDD).

B. The Contractor shall provide all necessary tools, materials, and equipment to successfully complete the installation of directionally drilled piping as specified herein and shown on the drawings. The Contractor shall be responsible for the final constructed product and for furnishing the qualified labor and supervision necessary for this method of construction.

C. The Contractor shall furnish all items necessary to perform the horizontal directional drilling operation and construct the pipe to the lines and grade shown on the drawings.

1.1 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO).

B. Occupational Safety and Health Administration (OSHA).

1.2 SUBMITTALS

A. The Engineer and Owner will base the review of submitted details and data on the requirements of the completed work, safety of the work in regard to the public, potential for damage to public or private utilities and other existing structures and facilities, and the potential for unnecessary delay in the execution of the work. Such review shall not be construed to relieve the Contractor in any way of his responsibilities under the contract. Contractor shall not commence work on any items requiring Contractor's construction drawings or other submittals until the drawings and submittals are reviewed and accepted by the Engineer and Owner.

1. The Contractor shall submit for review complete construction drawings and/or complete written description identifying details of the proposed method of construction, a drill plan, and the sequence of operations to be performed during construction as required by the method of HDD excavation approved. The drawings and descriptions shall be sufficiently detailed to demonstrate to the Owner and Engineer whether the proposed materials and procedures will meet the requirements of this specification. Contractor shall submit arrangement drawings and technical specifications of the machine and trailing equipment (including any modifications), three-year experience record with this type of machine, and a copy of the manufacturer's operations manual for the machine.

2. Contractor's construction drawings shall be submitted on the following items.

a. Complete details of the equipment to be utilized as well as the methods and procedures to be used, including but not limited to primary lining installation, timing of installation in relation to the

excavation plan and sequence, bulkheads, etc.

b. Fluid pumping techniques including equipment, pumping procedures, pressure grout types, mixtures, and plug systems.

c. Method of controlling line and grade of excavation.

d. Details of cuttings & drilling fluid removal including equipment type, number, and disposal location. The composition of all drilling fluids proposed shall be submitted for approval. No fluid will be approved or utilized that does not comply with permit requirements and all applicable national, state, and local environmental regulations.

e. Proposed contingency plans for critical phases and areas of directional drilling.

B. Quality Control Methods. At least two (2) weeks prior to the start of directional drilling, Contractor shall submit a description of his quality control methods he proposes to use in his operations to the Engineer and Owner for review and approval. The submittal shall describe:

1. Procedures for controlling and checking line and grade.

2. Field forms for establishing and checking line and grade.

C. Safety. Procedures including, but not limited to, monitoring for gases encountered shall be submitted.

D. Hazardous chemical list as well as all MSDS and technical data sheets.

1.3 DESIGN CRITERIA

A. Compatibility of Methods.

1.4 The methods of excavation, lining, and groundwater control shall be compatible job conditions:

A. Environmental Protection

1. Take all necessary measures to eliminate the discharge of water, drilling mud, and cuttings to nearby waterways during the HDD work. If applicable, provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste.

B. Safety Requirements

1. Perform work in a manner to maximize safety and reduce exposure of personnel and equipment to hazardous and potentially hazardous conditions, in accordance with applicable safety standards.

2. Whenever there is an emergency or stoppage of work which is likely to endanger the excavation or adjacent structures, operate a full work force for 24 hours a day, including weekends and holidays, without intermission until the emergency or hazardous conditions no longer jeopardize the stability and safety of the work.

C. Air Quality

Conduct directional drilling operations by methods and with equipment which will positively control dust, fumes, vapors, gases, or other atmospheric

impurities in accordance with applicable safety requirements.

1.5 PERMITS

Obtain any and all other permits required for prosecution of the work.

PART 2 – PRODUCTS

2.1 GENERAL

A. The product pipe must comply with all applicable ASTM standards depending on the purpose and material of the product pipe. Join the pipe sections so that the joining pipe sections are installable using HDD. Ensure that the joined product pipes have adequate strength and flexibility to withstand the installation stresses, overburden pressures, and operating pressures without compromising the structural stability of the pipe wall. Ensure that the product pipe meets the bend radius required for the proposed installation.

B. The following material standards are the minimum in place standards for the product pipe:

Material Standards for HDD Installation		
Material Type	Non-Pressure	Pressure
Polyethylene (PE)	ASTM D 2447	ASTM 2513 ASTM D 2447
High Density Polyethylene (HDPE)	ASTM D 2447 ASTM D 3350 ASTM F 714	ASTM D 2447 ASTM D 3350 ASTM F 714 ASTM 2513
Polyvinyl-Chloride (PVC)	ASTM F 789	ASTM D1785 ASTM D2241
Steel	ASTM A129 Grade B	AWWA C200 API 2B

C. Detection Wire: Electronic detection material for non-conductive piping products. Select tracer wire design for HDD to conductively locate underground utility lines according to ASTM D-1248. Use either a continuous green sheathed solid conductor copper wire line (minimum #12 AWG for external placement) or a coated conductive tape. Select a minimum 12-gauge copper clad steel wire that is able to withstand the installation tension along the entire length of the line.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall be responsible for his means and methods of directional drilling construction and shall ensure the safety of the work, the Contractor's employees, the public, and the adjacent property, whether public or private.

B. Contractor should anticipate that portions of the drilled excavation could be below the groundwater table and/or under waterways.

C. Comply with all local, state, and federal laws as well as rules and regulations at all times to prevent pollution of the air, ground, and water.

3.2 EQUIPMENT

A. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback of the pipe, a drilling fluid mixing and delivery system of sufficient capacity to successfully complete the installation, a guidance system to accurately guide boring operations, and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials, and spare parts on hand to maintain the system in good working order for the duration of this project.

B. Diesel, electrical, or air-powered equipment will be acceptable and is subject to applicable federal and state regulations.

C. Any method or equipment that the Contractor can demonstrate will produce the specified results will be considered.

D. Contractor shall employ equipment that will be capable of handling the various anticipated ground conditions. In addition, the equipment shall:

1. Be capable of minimizing loss of ground ahead of and around the machine and providing satisfactory support of the excavated face at all times.

2. Provide a system to indicate whether the amount of earth material removed is equivalent to that displaced by the advance of the machine such that the advance rate may be controlled accordingly.

E. Provide adequate secondary containment for any and all portable storage tanks.

D. Drilling must be accomplished with fluid-assisted mechanical cutting. Design/select drilling fluid to transport the spoils, maintain temperature of bits and transmitter, clean cutting from drill bit, reduce friction and pullback on drill rod and product pipe, stabilize the borehole, and reduce migration of drilling fluids in soil. Drilling fluids shall be a mixture of potable water and bentonite (or other stabilizing agent polymers and additives). It is mandatory that minimum pressures and flow rates be used during drilling operation as to avoid fracturing the sub-grade material around and above the bore.

E. The mobile drilling system must be capable of being launched from the surface at an inclined angle and drilling a sufficient diameter pilot hole. The pilot hole will then be enlarged with reamers as required to achieve the completed directional drill bore hole diameter.

3.3 DIRECTIONAL DRILLING DATA

A. Daily logs of construction events and observations shall be submitted on at least the following:

1. Location and elevation of significant soil strata boundaries and brief soil descriptions.

2. Jacking pressures and torsional forces, if applicable.

B. The path of the pilot hole shall be monitored during drilling by taking downhole survey readings at intervals not to exceed 35 feet. These readings shall be used to calculate the horizontal and vertical coordinates of the downhole probe as it progresses along the pilot hole. Calculations shall be performed according to API Bulletin D20. Recorded data and calculations from downhole surveys shall include, but not be

limited to the following items:

1. Course length. The distance between two downhole surveys as measured along the drilled path.
2. Measured distance. The total distance of a downhole survey from the entry points as measured along the drilled path; also the summation of the course lengths.
3. Inclination. The angle at which the downhole probe is projecting from the vertical axis at a particular downhole survey point; vertically downward corresponds to zero degrees.
4. Azimuth. The angle at which the downhole probe is projecting in the horizontal plane at a particular downhole survey point; magnetic north corresponds to zero degrees.
5. Station. The horizontal position of a downhole survey measured from an established horizontal control system.
6. Elevation. The vertical position of a downhole survey measured from an established vertical control system.
7. Right. The distance of a downhole survey from the design path reference line; positive values indicate right of the reference line while negative values indicate left of the reference line.

3.4 CONTROL OF THE DRILL LINE AND GRADE

A. Construction Control

1. The Contractor shall establish and be fully responsible for the accuracy of his own control for the construction of the entire project, including structures, drill line, and grade.
2. The Contractor's control points shall be established sufficiently far from the drilling operation not to be affected by construction operations.
3. The Contractor shall maintain daily records of alignment and grade and shall submit three copies of these records to the Owner and Engineer. However, the Contractor remains fully responsible for the accuracy of his work and the correction of it, as required.
4. The Contractor shall check his control for the bore alignment against an above ground undisturbed reference at least once for each rod length of bore constructed or more often as needed or directed by the Owner and Engineer. Contractor shall furnish a "Directional Bore Log" for each bore completed.

3.5 DISPOSAL OF EXCESS MATERIAL

A. Where such effort is necessary, cost for groundwater control during the course of the drilling work shall be included in the unit contract price for the work.

B. Dewatering required during the course of the project to lower water table, to remove standing water, surface drainage seepage, or to protect ongoing work against rising waters or floods shall be considered incidental to the work being performed.

C. Contractor shall remove all puddled bentonite (drillers mud) and dispose of off- site

in a legal manner, at no additional cost to the Owner.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot for each diameter and type of HDD pipe installed and as accepted by the Owner.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for drilling and installing various diameter and type of HDD pipe per linear foot. Includes removal of excavated materials and spoils, removal and disposal of drilling fluids, backfilling, and complete restoration of the site according to the unit prices submitted in the bid. No payment will be made for failed bore paths, injection of flowable fill, products taken out of service or incomplete installations due to fault of the Contractor.

A. No payment will be made for the HDD work until the daily construction logs and records of alignment have been delivered to and reviewed by the Engineer.

END OF SECTION

SECTION 02400
VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all labor, materials, equipment and incidentals required to install complete and ready for operation and testing all valves and appurtenances as shown within the Construction Drawings and as specified herein.

B. The Work includes, but not necessarily limited to, all types of valves required for buried, exposed, submerged, and other types of piping, except where otherwise specifically included in other Sections.

C. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 DESCRIPTIONS OF REQUIREMENTS

A. The Contractor shall furnish and install the gate valves in accordance with the Typical Iron Valve Box Standard Detail as per the Drawings.

B. The Contractor shall furnish and install flush valves in accordance with the Flush Valve details as per the Drawings

C. The Contractor shall install valve markers in accordance with the Marker Standard Detail drawing as per the Drawings.

1.3 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer shall have a minimum of five (5) years of experience in the production of substantially similar equipment and shall show evidence of satisfactory service in at least five (5) installations.

2. All units of the same type shall be the product of one Manufacturer.

3. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.4 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01350, Hydrotesting and Disinfection

C. Section 02660, Ductile-Iron Pipe

1.5 REFERENCE STANDARDS

A. Comply with the following applicable provisions and recommendations, except as otherwise shown or specified where reference is made to one of the below referenced standards, the revision in effect at the time of bid opening shall apply.

1. ASTM A48 - Specification for Gray Iron Castings
2. ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 psi Tensile Strength
4. ASTM A436 - Specification for Austenitic Gray Iron Castings
5. ASTM A536 - Specification for Ductile Iron Castings
6. AWWA C500 – Metal-Seated Gate Valves for Water Supply Service
7. AWWA C504 – Rubber-Seated Butterfly Valves
8. AWWA C507 – Ball Valves, 6-inch through 48-inch
9. AWWA C508 – Swing-Check Valves for Waterwork Service, 2-inch through 24-inch NPS
10. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service
11. AWWA C518 - Double-Disc Swing- Check Valves for Waterworks Service, 2-inch through 48-inch NPS
12. AWWA C520 - Knife Gate Valves, Sizes 2 In. Through 96 In.
13. AWWA C540 – Power Actuating Devices for Valves and Sluice Gates
14. AWWA C541 – Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates
15. AWWA C542 – Electric Motor Actuators for Valves and Slide Gates
16. AWWA C550 - Protective Interior Coatings for Valves and Hydrants
17. MSS-SP-67 – Butterfly Valves
18. MSS-SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends
19. MSS-SP-82 - Valve Pressure Testing Methods
20. MSS-SP-98 - Protective Coatings for Interior of Valves and Hydrants
21. Valves shall be NSF-61 certified.
22. AGMA Standards
23. NEMA, National Electrical Manufacturer's Association.

1.6 SUBMITTALS

A. Shop Drawings

1. Manufacturer's literature, illustrations, paint certifications, specifications, detailed drawings, data and descriptive literature on all valves and

appurtenances.

2. Proposed deviations from the Contract Documents.

3. Engineering data including dimensions, materials, sizes and weights.

4. Fabrication, assembly, installation and wiring diagrams.

5. Additional submittal data, where noted, with individual pieces of equipment.

B. Test Reports

1. Provide certified hydrostatic test data, per Manufacturer's standard procedure or MSS-SP-61 for valve.

2. Hydrostatic tests shall be performed, when required by the valve specifications included herein.

C. Certificates

1. For each valve specified to be manufactured, tested and/or installed in accordance with AWWA and other standards, submit an affidavit of compliance with the appropriate standards, including certified results of required tests and certification of proper installation.

D. Operating and Maintenance Data

1. Operating and maintenance instructions shall be furnished to the Owner. The instructions shall be prepared specifically for the project installation and shall include all required cuts, drawings, equipment lists, descriptions, and other information required to instruct operating and maintenance personnel that may be unfamiliar with such equipment.

2. Provide copies of all shop drawings, test reports, maintenance data and schedules, description of operation; and, spare parts information.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping

1. Care shall be taken in loading, transporting and unloading to prevent damage to the valves, appurtenances, or coatings. Equipment shall not be dropped. All valves and appurtenances shall be examined before installation and no piece shall be installed which is found to be defective. Any damage to the coatings shall be repaired by the Contractor as acceptable to the Owner.

2. Prior to shipping, the ends of all valves shall be acceptably covered to prevent entry of foreign material. Covers shall remain in place until just before installation and connecting piping is completed.

B. Storage and Protection

1. Special care shall be taken to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, to prevent deformation. See the individual valve specifications and manufacturer's information for further requirements.

C. Delivery

1. Deliver material to the site to ensure uninterrupted progress of the Work.

a. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to not delay Work.

1.8 MAINTENANCE

A. Special tools and the manufacturer's standard spare parts if required for normal operation and maintenance, shall be supplied with the equipment in accordance with the Contract Documents and where notes, as specified herein.

B. Provide all special tools required for normal maintenance. Tools shall be packaged in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended.

C. Provide to the Owner a list of all spare and replacement parts with individual prices and locations where they are available.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Valves shall have manufacturer's name and working pressure cast in raised letters on valve body.

B. Manual valve operators shall turn clockwise to close, unless otherwise specified.

C. Unless otherwise specified, all flanged valves shall have ends conforming to ANSI B16.1, Class 150 (Class 200 for valves 12 inches or smaller).

D. Buried valves shall be provided with adjustable two-piece valve boxes and provided with extension stems, operating nuts and covers unless otherwise shown or specified. Extension stems shall terminate 12-inches below furnished grade.

E. All bolts, nuts, and studs on or required to connect buried or submerged valves shall be Type 316 stainless steel.

F. All bolts and studs embedded in concrete and studs required for wall pipe shall be of Type 316 stainless steel.

G. All other bolts, nuts, and studs shall, unless otherwise approved, conform to ASTM A 307, Grade B; or ASTM A 354.

H. Bolts shall have hexagon heads and nuts.

I. Gasket material and installation shall conform to manufacturer's recommendations.

J. Identification: Identify each valve 4 inches and larger with a stainless steel nameplate stamped with the approved designation. Nameplate shall be permanently fastened to valve body at the factory. Stenciled designations are acceptable for buried valves.

K. The Contractor shall be responsible to coordinate compatible materials of construction for all wettable parts of all valves for each process application.

L. The use of a manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

M. Valves shall be of the size shown on the Drawings or as noted; and equipment of the same type shall be identical and from one Manufacturer.

N. Each valve box shall be fitted with a plastic valve ID tag (Blue Emedco 3 ½" x 2 ¾"). Tags shall be securely fastened to valves.

O. Valves and appurtenances shall be marked per AWWA Standards with the Owner name (CCSUD), valve size, flow directional arrows, year of manufacture, working pressure for which they are designed and standard referenced, cast in raised letters or indelibly marked upon some appropriate part of the body.

P. Joints, size and material - unless otherwise noted or required by the Owner:

1. Except where noted, all joints referred to herein shall be of the same type, nominal diameter, material, and with a minimum rating equal to the pipe or fittings they are connected to.

2. Valves and appurtenances shall be of the same nominal diameter as the pipe or fittings they are connected to.

3. All valves exposed to view (above-grade), or in vaults (below-grade).

   a. 3-inches and smaller - threaded ends

   b. 4-inches and larger - flanged ends

Q. Provide all special adaptors as required to ensure compatibility between valves, appurtenances, and adjacent pipe.

R. Valves located outdoors but not within a building; within maximum 2-ft above liquid; in vaults; or where otherwise noted shall be especially designed for submerged service where water may completely submerge the valve. All other units shall be as a minimum weather tight.

S. Rising stem valves shall be sealed with adjustable and replaceable packing; valve design must permit packing replacement under operating system pressures with only moderate leakage.

T. Non-rising stem valves shall use a double O-ring stem seal, except that packing shall be used where geared operators are required.

U. Except as otherwise specified, valves shall be rated for the following working water pressures:

Valve Size	Pressure (psi)
3-inches to 12-inches	200
14-inches to 20-inches	150
24-inches and greater	150

2.2 GATE VALVES

A. Valves shall be iron body, bronze mounted, non-rising stem and in conformance with AWWA C500.

B. Unless otherwise shown or specified, exposed valves shall have flanged ends conforming to ANSI B16.1, Class 150. Buried valves shall be provided with mechanical joint adapters.

C. Exposed manually operated gate valves shall be equipped with hand wheels. Gate valves located more than five feet above the operating floor shall be provided with chain wheels, sprockets, and aluminum chain. The chain shall extend to three feet above the operating floor.

D. Buried gate valves shall be furnished with valve boxes, nut operated extension stems and tee wrenches as required.

E. Shop painting:

1. Interior metal surfaces of cast iron valves shall be cleaned with a near white blast (SSPC-SP10) and shall be shop painted with two coats of an NSF 61 approved epoxy coating applied in accordance with the manufacturer's recommendations.

2. Exterior surfaces of the valves shall be shop painted as specified hereinafter under Paragraph 2.10 of this Section.

F. Product and Manufacturer: Provide gate valves of one of the following, as listed in the Approved Equipment List (AEL):

1. Mueller Water Products, Inc.

2. American Cast Iron Pipe Company.

3. EJ Group, Inc.

4. Or Approved Equivalent.

G. Exposed gate valves 16-inches and greater in size shall have valve by-pass.

H. All bonnet and packing gland bolts and nuts shall be zinc-coated or made corrosion resistant by some other approved equivalent.

I. Exposed gate valves 16-inches and greater indicated for horizontal stem Installation shall be furnished with rollers, tracks and scrapers and enclosed bevel gear grease case.

J. Unless otherwise indicated, gate valves 12-inches and smaller shall be capable of installation in the vertical or horizontal position, sealing in both directions at the rated pressure.

K. Resilient wedge valves shall be coated, interior and exterior, with fusion bonded epoxy per AWWA C550.

L. Valve Requirements

1. Resilient Wedge

a. Tongue and grooved guides for wedges.

2. Resilient Seated

a. Internal and external epoxy coating of valve body, including bonnet, per AWWA C550.

b. No recesses in valve body.

2.3 KNIFE GATE VALVES

A. Valves shall be ductile iron construction, steel gate. Shall be designed, manufactured, and tested in accordance with AWWA C520.

B. Unless otherwise shown or specified, valves shall have flanged ends conforming to ANSI B16.5, Class 150.

C. Exposed manually operated knife gate valves shall be equipped with hand wheels. Gate valves located more than five feet above the operating floor shall be provided with chain wheels, sprockets, and aluminum chain. The chain shall extend to three feet above the operating floor

D. Shop painting:

1. Interior metal surfaces of cast iron valves shall be cleaned with a near white blast (SSPC-SP10) and shall be shop painted with two coats of an NSF 61 approved epoxy coating applied in accordance with the manufacturer's recommendations.

2. Exterior surfaces of the valves shall be shop painted as specified hereinafter under Paragraph 2.10 of this Section.

E. Product and Manufacturer: Provide knife gate valves of one of the following, as listed in the Approved Equipment List (AEL):

1. Wey Valve

2. Emerson

3. Dezurik

4. Or approved equivalent.

2.4 CHECK VALVES - LIQUID SERVICE

A. General:

1. Check valves shall absolutely prevent the return of water back through the valve when the upstream pressure decreases below the downstream pressure. The valve shall be tight seating.

B. Double Disc Type

1. Valves shall be designed, manufactured, and tested in accordance with ANSI/AWWA C518.

2. Shall be provided with ANSI B16.1 Class 125 flanges for installation

3. Shop Painting:

a. Exterior surfaces of the valve shall be shop painted as specified hereinafter under Paragraph 2.10 of this Section.

4. Product and Manufacturer: provide double disc type check valves of one of the following:

a. Valmatic 8800

b. Or Approved Equivalent.

C. Slanting Disc Type – Pump Discharge (Vertically Oriented)

1. The check valve shall be designed to operate in full open position with a velocity range of 3 to 10 feet per second.

2. Disc position indicator shall be provided.

3. 125 lb. class.

4. Shop Painting:

a. Interior metal surfaces of the valve, except finished or bearing surfaces, shall be cleaned with a near white blast (SSPC-SP10) and shall be shop painted with two coats of an NSF 61 approved epoxy coating applied in accordance with the manufacturer's recommendations.

b. Exterior surfaces of the valve shall be shop painted as specified hereinafter under Paragraph 2.10 of this Section.

5. Product and Manufacturer: Provide tilting disc, slow opening and controlled closing check valves of one of the following:

a. APCO Series 800 T (APCO Willamette Valve & Primer Corp.).

b. Or Approved Equivalent.

2.5 BUTTERFLY VALVES – WATER SERVICE

A. Valves shall be short body, except where otherwise shown or required to obtain required clearances for valve operator or disc. Valves shall conform to AWWA C504.

B. Valves shall be of the 125 psi pressure class.

C. Flanged ends, where required, shall conform to ANSI B16.1, Class 125.

D. Valve seats shall be mounted in cast-iron valve body, made of rubber suitable for water service.

E. Shafts, retaining rings and internal hardware shall be of stainless steel.

F. Shafts seals of non-buried valves shall have a stuffing box and pull down packing gland. Packing shall be replaceable without removing the valve operator. Buried valves shall be furnished with self-adjusting "V" type packing.

G. Provide a stainless steel seating edge on all discs.

H. Product and Manufacturer. Provide butterfly valves (Circular) of one of the following:

1. Mueller Water Products, Inc.

2. DeZurick/APCO/Hilton.

3. Or Approved Equivalent.

I. Valve Operator – Manual:

1. Valves shall be equipped with an enclosed worm gear drive and nut, hand

wheel or chain wheel operator.

2. Enclosed worm gear operators shall have a gear ratio designed not to exceed 80 pounds pull to meet the required operator torque.

3. Gears shall be permanently lubricated and totally enclosed.

4. Operators shall be designed to hold the valve disc in any intermediate position without creeping or fluttering.

5. Adjustable stops shall be provided to prevent over-travel in either position, to withstand a pull of 200 pounds.

6. Stops shall be enclosed within the operator housing and be capable of absorbing the full operator torque with minimum safety factor of five (5).

7. Operators shall be equipped with a direct coupled indicator.

8. Valves regardless of size, if installed with the operating wheel more than five feet above the operating floor, shall be provided with a chain wheel, sprocket, and aluminum chain. The chain shall extend to three feet above the operating floor.

9. Valve operator shall be designed to fully close or fully open the valve in a maximum of 30 turns. Valves shall open counter-clockwise and shall have a position indicator.

10. Shop Painting:

    a. Interior metal surfaces of the valve, except finished or bearing surfaces, shall be cleaned with a near white blast (SSPC-SP10) and shall be shop painted with two coats of an NSF 61 approved epoxy coating applied in accordance with the manufacturer's recommendations.

    b. Exterior surfaces of the valve shall be shop painted as specified hereinafter under Paragraph 2.10 of this Section.

11. Product and Manufacturer: Provide manual operators of one of the following:

    a. Flowserve Corporation.

    b. Or Approved Equivalent.

2.6 RUBBER SEAT BALL VALVES

A. Valves shall have a cast iron body suitable for 150 psi pressure. Body shall have stainless steel conical seating surfaces to provide abrasion-free, corrosion free surfaces for mating with the resilient seat on the rotor.

B. Ends shall be flanged, conforming to ANSI B16.1, Class 125.

C. Shaft seal shall be of bronze, provided with "O" ring seals.

D. Shaft bearings shall be of bronze, permanently lubricated, sealed with "O" ring seals.

E. Seats shall be of rubber suitable for water service, secured to the rotor by means of ductile Ni-Resist adjusting segments.

F. Rotor shall be of cast iron, secured to stub shafts with stainless steel taper pins.

G. Stub shafts shall be of stainless steel.

H. Provide adjustable thrust bearings for alignment of the rotor in the body.

I. Manufacturer: Provide rubber seat valves of one of the following:

1. Mueller Water Products, Inc.

2. Or Approved Equivalent.

2.7 PINCH CHECK VALVES

A. Pinch Check Valves shall be all rubber, and of the flow operated check type with a slip-on end connection.

B. Valve shall be one-piece rubber construction with fabric reinforcement.

C. Valve shall have protective EDPM exterior wrapping for UV protection.

D. Provide stainless steel attachment straps and hardware as needed to securely attach valve to pipe.

E. Manufacturer: Provide rubber pinch check valve of one of the following:

1. Tideflex Technologies.

2. Or Approved Equivalent.

2.8 PINCH VALVES

A. Pipe Automatic Pinch Valves shall be cast iron construction.

B. connections shall be ANSI Class 125/150 flanged.

C. Sleeves shall be made of EDPM.

D. Provide stainless steel bolts and hardware as needed to securely attach the valve to the pipe.

E. Provide manufacturers standard protective exterior coating for outdoor service.

F. Manufacturer: Provide manual pinch valve of one of the following:

1. Red Valve Company, Inc.

2. Or Approved Equivalent.

2.9 SPECIALS

A. Corporation Stops:

1. Where shown or necessary to complete the Work, corporation stops shall be furnished with bronze stem, washer, nut, body, and key.

2. Product Manufacturer: Provide Corporation Stops of one of the following:

a. Ford Meter Corporation Stops: Box Company, Inc.

b. Or Approved Equivalent.

B. Hose Bibbs:

1. House bibbs shall consist of a boiler drain type valve and vacuum breaker.

2. Valve shall be ¾-inch size or 1-inch size as shown on Drawings, bronze bodied, with aluminum hand wheel and renewable composition disc, suitable for 125 psi working pressure.

3. Valve shall have one male copper joint end and one male hose thread end.

4. Product and Manufacturer: Provide House Bibbs of one of the following:

   a. NIBCO.

   b. Jenkins.

   c. Or Approved Equivalent.

2.10 VALVE APPURTENANCES

A. Operators:

1. General: The operators shall be sized based on the maximum expected torque as per valve manufacturer's recommendations and in no case shall the force required to open or close the valve (i.e., rim pull) exceed 40 pounds. The responsibility for proper operation shall reside with the valve supplier.

2. Manual Operators: Manual operators shall be in compliance with AWWA C504 and shall be of the worm gear type and feature a housing that encloses all gearing and can either be buried or is of weatherproof construction for exposed locations. The operator housing shall be constructed of cast iron and shall be permanently grease packed. All housing O-rings, gaskets, and other features shall be designed to ensure permanent water tightness and maintenance free operation. The axis of the worm gear shaft shall remain fixed during operation and stop-limiting devices shall be provided to limit operator travel. Valves scheduled for above ground service shall be equipped with a hand wheel. Buried valves shall be equipped with a 2-inch square AWWA operating nut. Suitable manufacturers include Limitorque, E-I-M, DeZurick, or approved equivalent.

3. Chain Operators:

   a. All valves more than 5 feet-0 inches above operating floor level shall be equipped with chain operator and sprocket wheel bolted directly to the valve operating wheel

   b. Aluminum chain shall be provided. Equip all operators with a ½-inch hook bolt located to keep chain out of walking areas.

B. Extension Stems, Stem Guides, Wrenches and Keys:

1. Extension stem shall be at least as large as valve stem it operates.

2. Provide intermediate stem guide for extensions more than 7 feet long.

3. Stem brackets and guides shall be made of cast iron and have fully adjustable bronzed bushed guide block. Fasten brackets to walls with approved expansion bolts.

4. Operating nuts about 2 inches square shall be included with each

extension stem and located in floor box or grating recess, as required.

5. Provide operating key or wrench of suitable length and size for each valve that is not readily accessible for direct operation.

C. Valve Boxes: Provide each buried valve with a valve box as follows:

1. Made of heavy pattern cast-iron, 2-piece adjustable telescoping type.
2. Lower section shall enclose operating nut and stuffing box and rest on bonnet.
3. Inside diameter shall be at least 4 ½ inches.
4. Provide extension stem and operating nut
5. Cover shall be heavy duty cast iron with direction to open arrow cast in.
6. Provide valve box of adequate size for operation and maintenance of buried air release valves where shown.
7. Square covers shall be provided for all recycled water main valve boxes. Round covers shall be provided for all potable water main valve boxes and labeled "WATER".

2.11 SURFACE PREPARATION AND PAINTING

A. Notwithstanding any of these Specifications, all coatings, and lubricants in contact with potable water shall be certified as accepted for use with that fluid.

B. If Manufacturer's requirements are not to provide finished coating on any interior surfaces, then the Manufacturer shall so state and no interior finish coating will be required, if acceptable to the Owner.

C. Clean and prime coat all ferrous metal surfaces of each valve in the shop.

D. Coat all machined, polished and non-ferrous surfaces including gears, bearing surfaces and similar unpainted surfaces with a corrosion prevention compound which shall be maintained during storage and until equipment begins operation.

PART 3 – EXECUTION

3.1 INSTALLATION

A. All valves and appurtenances shall be installed per the Manufacturer's instructions in the locations shown, true to alignment and rigidly supported. Any damage to the valves and appurtenances shall be repaired to the satisfaction of the Owner before they are installed.

B. Install all brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings, or otherwise required. Before setting these items, the Contractor shall check all Drawings and figures which have a direct bearing on their location. The Contractor shall be responsible for the proper location of valves and appurtenances during the construction of the Work.

C. All components shall be carefully inspected for defects in construction and materials. All debris and foreign material shall be cleaned out of openings, etc. All valve flange covers shall remain in place until connected piping is in place. All operating mechanisms shall be operated to check their proper functioning and all

nuts and bolts checked for tightness. Valves and other equipment which do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the Owner.

D. All items (including valve interiors) shall be cleaned prior to installation, testing, disinfection and final acceptance.

E. Unless otherwise noted, joints for valves and appurtenances shall be made up utilizing the same procedures as specified under the applicable type connecting pipe joint and all valves and other items shall be installed in the proper position as recommended by the Manufacturer. Contractor shall be responsible for verifying manufacturer's torquing requirements for all valves.

F. Install all valves so that operating wheels or wrenches may be conveniently turned from operating floor but without interfering with access, and as approved by the Engineer.

G. Unless otherwise approved, install all valves plumb and level. Install valves free from distortion and strain caused by misaligned piping, equipment or other causes.

H. Set valve boxed plumb and centered with the bodies directly over the valves. Carefully tamp earth fill around each valve box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face, if less than 4 feet.

3.2 INSTALLATION OF MANUAL OPERATIONAL DEVICES

A. Unless otherwise noted, all operational devices shall be installed with the units at the factory, as shown on the Drawings or as acceptable to the Owner, to allow accessibility to operate and maintain the item and to prevent interference with other piping, valves and appurtenances.

B. For manually operated valves 3-inches in diameter and smaller, valve operators and indicators shall be rotated to display toward normal operation locations.

C. Floor boxes, valve boxes, and extension stems shall be installed vertically centered over the operating nut, with couplings as required and the elevation of the box top shall be adjusted to conform with the elevation of the finished floor surface or grade at the completion of the Contract. Boxes and stem guides shall be adequately supported during concrete pouring to maintain vertical alignment.

3.3 INSPECTION, TESTING AND CORRECTION OF DEFICIENCIES

A. Take care not to over pressure valves or appurtenances during pipe testing. If any unit proves to be defective, it shall be replaced or repaired to the satisfaction of the Owner.

B. Functional Test: All items shall be inspected for proper alignment, operation, proper connection and satisfactory performance. All units shall be operated continuously while connected to the attached piping for at least 8 hours, without vibration, jamming, leakage, or overheating and perform the specified function.

C. The various pipelines in which the valves and appurtenances are to be installed are specified to be field tested. During these tests, any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the Owner.

D. Various regulating valves, strainers, or other appurtenances shall be tested to demonstrate their conformance with the specified operational capabilities and any deficiencies shall be corrected or the device replaced or otherwise made acceptable to the Owner.

E. Gate valves: Perform shop tests in accordance with AWWA C500, except no leakage shall occur with design pressure held for one minute.

F. Conduct functional field test of each valve in presence of Engineer to demonstrate that each part and all components together function correctly.

3.4 HYDROTESTING AND DISINFECTION

A. Hydrotesting and disinfection shall be in accordance with Section 01350 of these Project Specifications.

B. All valve bodies shall be hydrostatically tested to at least twice the rated working water pressure. In addition, valves shall be seat-tested, bi-directional at the rated working pressure, with seat leakage not to exceed one fluid ounce per inch of valve diameter per hour. Provide certificates of hydrostatic testing results to Engineer.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity that is measured, “per each,” for payment shall be the actual number of valves of each class, type, and size (including actuators, valve boxes, and marker posts/signs) that are furnished and installed by the Contractor for acceptance by the Owner.

4.2 PAYMENT: Payment shall include all labor, materials, testing, and equipment necessary for furnishing and installing complete functioning valves and valve boxes of various sizes as per the Drawings and as specified herein. This item shall also include, but not be limited to: all types and sizes of valves; valve stem; valve box and cover; valve box extensions; concrete collar around valve box; base material below the valve per the Drawings; valve marker, project staking; sheeting; gearing; painting; coating; nut operator extension; excavation and backfill; trenching; restraining utility poles; hydrotesting and disinfection; all items related to trench excavation safety; and all other work incidental to the installation of functional gate valve and box with marker sign complete in place and in reliable service.

END OF SECTION

SECTION 02440
COMBINATION AIR RELEASE VALVE

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all labor, materials, testing, equipment, and incidentals required to install a complete combination air release valve assembly.

B. The Contractor shall furnish and install combination air valve assemblies in accordance with the Air Release Valve Standard Detail as shown within the Drawings.

C. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 QUALITY ASSURANCE

A. Qualifications

1. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

2. Provide the services of a qualified and factory-trained service representative of the Manufacturer to provide operational and maintenance instructions.

1.3 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01350, Hydrotesting and Disinfection

1.4 REFERENCE STANDARDS

A. Comply with the following applicable provisions and recommendations, except as otherwise shown or specified where reference is made to one of the below listed standards, the revision in effect at the time of bid opening shall apply.

1. ASTM A48 Class 35 – Gray Iron Castings

2. ASTM A126 Class B – Gray Iron Castings for Valves, Flanges, and Pipe Fittings

3. ANSI/NSF Standard 60 – Drinking Water Treatment Chemicals

4. ANSI/NSF Standard 61 – Drinking Water System Components

1.5 SUBMITTALS

A. Shop Drawings

1. Manufacturer's literature, illustrations, paint certifications, specifications, detailed drawings, data and descriptive literature on combination air valves.

2. Engineering data including dimensions, materials, size, and weight.

3. Additional submittal data, where noted with individual pieces of equipment.

B. Certificates

1. The Manufacturer shall provide certification that products furnished under this specification are manufactured in an ISO 9001 certified facility or documentation from an accredited facility that ISO 9001 certification is in process.

C. Operating and Maintenance Data

1. Operating and maintenance instructions shall be furnished to the Owner. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions and other information required to instruct operating and maintenance personnel unfamiliar with such equipment.

2. Copies of all shop drawings, test reports, maintenance data and schedules, description of operation and spare parts information shall be provided to the Owner.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping

1. Care shall be taken in loading, transporting, and unloading to prevent injury to the valves, appurtenances, or coatings. Equipment shall not be dropped. Each combination air valve and assembly components shall be examined before installation and no piece shall be installed which is found to be defective. Any damage to the coatings shall be repaired as acceptable to the Owner.

2. Prior to shipping, the ends of all valves shall be acceptably covered to prevent entry of foreign material. Covers shall remain in place until after installation and connecting piping is completed.

B. Storage and Protection

1. Special care shall be taken to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, to prevent deformation. See the individual piping specifications and Manufacturer's information for further requirements.

1.7 MAINTENANCE

A. Special tools and the Manufacturer's standard spare parts, if required for normal operation and maintenance, shall be supplied with the equipment in accordance with the Contract Documents and where noted, as specified herein.

B. Provide all special tools required for normal maintenance. Tools shall be packaged in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended.

C. Provide to the Owner a list of all spare and replacement parts with individual prices and location where they are available.

PART 2 – PRODUCTS

2.1 COMBINATION AIR VALVE ASSEMBLY

A. The valve assembly shall be furnished and installed as per the Combination Air Valve standard detail shown within the Construction Drawings.

B. The use of a Manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

C. Valves shall be of the size shown on the construction Drawings or as noted; equipment of the same type shall conform to the Approved Equipment List and the models specified in these Specifications.

D. The combination air valve assembly shall be from the list below, also shown in the Approved Equipment List (AEL), or an approved equivalent.

Manufacturer	1" NPT x 5/64"	2" NPTx3/32"
Empire Controls	945 (1" NPT)	945
Val-Matic	201C	202C
Apco	143C	145C

E. The combination air release shall be designed to vent accumulated air automatically. The outlet orifice shall be sized properly to facilitate valve operation at pressures of up to 150 psi. The air release valve shall be simple-lever, compound-lever, ball and orifice, or rolling seal depending upon volume requirements and the design of the valve.

F. The combination air release valve shall be designed with the inlet and outlet of equal cross-sectional area where applicable. The valve shall be capable of automatically allowing large quantities of air to be exhausted during the filling cycle and also capable of automatically allowing air to re-enter the system to prevent a negative pressure at water column separation or during the draining cycle. The float shall be guided to minimize premature closure by air and to provide proper alignment for normal closure by floating on the water surface.

G. Combination air release valves shall provide for both automatic air release under system pressure and to allow air movement during filling or draining operations or water column separation. The combination air valve may be housed in a single casting. The housing shall be designed to incorporate conventional or kinetic flow principles to properly vent the air without premature closure. Flanged sized (4 inch and larger) may be furnished in a dual housing. When dual casings are used a bronze manual isolation valve shall be installed if indicated by the manufacturer.

This will allow the air release valve to be serviced when the system is under pressure. Field service of the valve may also be performed by closing the isolation valve between the air valve and the pipe connection.

2.2 SURFACE PREPARATION AND PAINTING

A. Notwithstanding any of these Specifications, all coatings and lubricants in contact with potable water shall be certified as acceptable for use with that fluid.

B. If the manufacturer's requirement is not to require finished coating on any interior surfaces, then Manufacturer shall so state and no interior finish coating will be required, if acceptable to the Owner.

C. Clean and prime coat all ferrous metal surfaces of each valve in the shop.

D. Coat all machined, polished and non-ferrous surfaces including gears, bearing surfaces and similar unpainted surfaces with a corrosion prevention compound which shall be maintained during storage and until equipment begins operation.

PART 3 – EXECUTION

3.1 INSTALLATION - GENERAL

A. Combination air release valve and vault assembly shall be installed per the Manufacturer's instructions in the locations shown, true to alignment and rigidly supported. Any damage to the items listed above shall be repaired to the satisfaction of the Owner before they are installed.

B. Before setting these items, the Contractor shall check all Drawings and figures which have a direct bearing on their location. The Contractor shall be responsible for the proper location of valves and appurtenances during the construction of the work.

C. All materials shall be carefully inspected for defects in construction and materials. All debris and foreign material shall be cleaned out of openings, etc.

D. All items (including valve interiors) shall be cleaned prior to installation, testing, disinfection, and final acceptance.

E. The galvanized iron pipe on the combination air valve is to be installed next to a fence or property and/or R.O.W. line. A 3” 6-foot-tall aluminum post shall be installed to stabilize the galvanized pipe.

3.2 INSTALLATION OF MANUAL OPERATIONAL DEVICES

A. Unless otherwise noted, all operational devices shall be installed with the units at the factory, as shown on the construction drawings or as acceptable to the Owner, to allow accessibility to operate and maintain the item and to prevent interference with other piping, valves and appurtenances.

3.3 INSPECTION, TESTING AND CORRECTION OF DEFICIENCIES

A. Take care not to over pressure valves or appurtenances during pipe testing. If any unit proves to be defective, it shall be replaced or repaired to the satisfaction of the Owner.

3.4 AIR RELEASE VALVE MARKER

A. The Contractor shall furnish and install a combination air release valve marker for each air release valve installed in accordance with the Air Release Valve Standard Detail.

3.5 HYDROTESTING AND DISINFECTION

A. Hydrotesting and disinfection shall be in accordance with Section 01350 of these Specifications.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be for each installed complete and functioning combination air valve and assembly of various sizes with valve marker as accepted by the Owner.

4.2 PAYMENT: Payment shall be compensation all labor, materials, testing, and equipment necessary for furnishing and installing a complete and functioning combination air valve assembly of various sizes as per the construction drawings and as specified herein. This item shall also include, but not necessarily be limited to: all sizes of combination air valves and assemblies; combination air valve marker; approved tapping saddle; corporation stop; copper tubing; brass ball valve with lever; brass nipple threaded; box; vault box lid; galvanized iron pipe and fittings; security enclosure; accessories and appurtenances; painting; excavation and backfill;; trenching; selected embedment material; anti-corrosion embedment when specified; hydrotesting and disinfection and all other work incidental to the installation of combination air valve assembly complete and in reliable service.

END OF SECTION

SECTION 02500
ABANDONMENT OF WATER INFRASTRUCTURE

PART 1 – GENERAL

1.1 SCOPE

A. The Work included within this Section consists of furnishing all material, equipment, and labor while performing all operations necessary for abandoning water mains, valves, water service lines and/or fire hydrants as shown within the Drawings and specified herein.

1.2 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 02650, PVC Pipe for Water Mains

C. Section 02660, Ductile Iron Pipe

D. Section 02665, HDPE Pipe

E. Section 02670, Ductile Iron Fittings

PART 2 – PRODUCTS

A. A cement-based grout shall be used to fill the void of the existing water main. The grouting material must have strength of at least 100 psi and shall have flow characteristics appropriate for filling the water main. The grout mix design and method of installation shall by approved by the Engineer prior to beginning operation.

B. Plugs and Clamps: Applicable for type of pipe to be plugged

PART 3 – EXECUTION

3.1 WATER MAIN ABANDONMENT

A. The Contractor shall accomplish all cutting, capping, plugging, and blocking necessary to isolate existing mains retained in service from abandoned mains.

B. Do not begin to cut, plug, and abandonment operations until replacement water main has been constructed and tested, all service connections have been installed, and replacement main is approved for use.

C. For water mains that are 8” in diameter and larger, the open ends of abandoned mains and all other openings or holes in such mains occasioned by cutting or removal of outlets shall be blocked off by pressure forcing cement grout into and around the openings in sufficient quantity to provide a permanent substantially watertight seal.

D. All pipe ends of abandoned water mains (both smaller diameter and larger diameter grouted filled pipe) shall be plugged. Pipes less than 24 inches in

diameter shall be plugged with a manufactured plug suitable for the particular type of pipe. The plug provided must be watertight and adequate to seal the pipe from groundwater.

E. When specified or shown within the contract documents, Contractor shall remove the main and all related appurtenances that are to be replaced or will no longer be in service. All effort to accomplish this requirement will be considered subsidiary to the work required, and no direct payment will be made.

F. In no instance shall water mains be abandoned by valve closure.

3.2 WATER VALVE ABANDONMENT

A. Valves to be abandoned in place shall have the rising stem, ductile iron shaft casing and cap removed and backfilled and buried. The valve covers shall be salvaged and returned to the Owner.

3.3 WATER SERVICE LINE ABANDONMENT

A. All water service lines that are being abandoned and not transferred to a new distribution line shall be disconnected at the corporation stop at the main and all other valves and appurtenances, including the water meter and backflow device, removed.

B. Unless otherwise specified, the old service line shall be abandoned after the existing meter has been reset in the existing or new meter box.

C. The Contractor shall accomplish all cutting, capping, and plugging necessary to isolate new service lines transferred to new and existing mains from those abandoned. The corporation stop for an abandoned service line tapped on a ferrous main shall be removed, and the tap at the main shall be plugged with an appropriately sized brass plug. For a non-ferrous main the corporation stop shall not be removed from the main. Instead, the corporation stop shall be closed, and the flared nut shall be removed from the corporation stop. After the appropriately sized copper disc is inserted inside the flared nut, replace the flared nut on the corporation stop. The Contractor shall salvage copper service line tubing, brass fittings, and other materials as directed by the Inspector and return them to Owner.

3.4 FIRE HYDRANTS

A. Fire hydrant branches shall be abandoned by cutting and capping the fire hydrant cast iron tee at the service main and the service restored to its original condition.

B. The contractor shall salvage the existing fire hydrants and other materials as designated in the field by the Inspector and shall deliver this material to 2370 FM 1979, San Marcos, TX 78666.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Unless shown on the construction plans or called out within the technical specifications as a pay item, abandonment activities described herein are for informational purposes only. No separate measurement of abandonment activities will

be made by the Contractor for this Work.

4.2 PAYMENT: The abandonment of existing water infrastructure will be considered subsidiary to the work required. No separate payment will be made to the Contractor for this Work.

END OF SECTION

SECTION 02640
FIRE HYDRANT ASSEMBLY

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all material, equipment, labor, and performing all operations necessary for the supply of fire hydrants, ductile iron pipe, valves, nozzles, markers and accessories as shown within the Construction Drawings and specified herein.

B. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 DESCRIPTION OF REQUIREMENTS

A. The Contractor shall furnish and install fire hydrants in accordance with the Fire Hydrant Assembly drawing as shown within the Drawings.

1.3 QUALITY ASSURANCE

A. Install fire hydrants to meet current requirements of Owner.

B. Provide manufacturer's certificate for those products that meet or exceed minimum requirements as specified herein.

1.4 RELATED SECTIONS

A. Section 01230, Excavation and Backfill.

B. Section 01350, Hydrotesting and Disinfection

C. Section 02400, Valves and Appurtenances

D. Section 02680, Joint Restraints and Thrust Blocking

1.5 REFERENCED STANDARDS

A. AWWA C502 – Dry-Barrel Fire Hydrants.

B. AWWA C550 – Protective Interior Coatings for Valves and Hydrants.

C. Fire hydrants shall be NSF-61 certified.

1.6 SUBMITTALS

A. Submit Manufacturer’s certificates of conformance to the requirements of these Technical Specifications.

B. Shop Drawings: Submit Manufacturer's drawings and data sheets for material to be supplied under this section. Indicate sizes and types of fire hydrants to be installed.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. During loading, transportation and unloading, exercise care to prevent damage to materials.

B. Handling: Fire hydrants should be unloaded carefully. The hydrant should be carefully lowered from the truck to the ground, not dropped. Only hoists and slings with adequate load capacity to handle the weight of the hydrant shall be used.

C. Storage: Hydrants should be stored in the fully closed position to prevent entry of foreign material that could cause damage to the seating surfaces. Whenever practical, hydrants should be stored indoors. If outside storage is required, means shall be provided to protect the operating mechanism from contamination or weathering. In outside storage, parts and flanges shall be protected from the weather and foreign materials.

PART 2 – PRODUCTS

2.1 STANDARD CRYSTAL-CLEAR SUD FIRE HYDRANTS

A. Fire hydrants shall conform to the requirements of the latest revision of AWWA C502 "Dry- Barrel Fire Hydrants" or latest revision thereof. Hydrant barrel shall have safety breakage feature above the ground line. All hydrants shall have 6-inch mechanical joint shoe connections, two (2) 2 ½-inch hose nozzles and one (1) 4 ½-inch pumper nozzle with caps fitted with cap chains. Connection threads shall conform to National Standard Specifications as adopted by the National Board of Fire Underwriters.

Operating nut shall be a 1 ½-inch pentagon, measure from flat to point, and shall open left (counterclockwise). Main valve shall have 5 ¼ -inch fill opening and be of the compression type, opening against water pressure so that valve remains closed should the barrel be broken off.

B. Operating stem shall be equipped with anti-friction thrust bearing to reduce operating torque and assure easy opening. Stops shall be provided to limit stem travel. Stem threads shall be enclosed in a permanently sealed lubricant reservoir with O-ring seals.

C. Fire hydrants shall be designated for 150 psi working pressure and shop tested to 300 psi pressure with main valve both opened and closed. Under test, the valve shall not leak, the automatic drain shall function, and there shall be no leakage into the bonnet.

D. Fire hydrant shall be the following:

1. Mueller Super Centurion 250 (Model A 423).
2. American Darling (Model B-84-B).
3. Approved equivalent.

2.2 FIRE HYDRANTS (INSTALLED WITHIN NEW BRAUNFELS AND SAN MARCOS JURISDICTIONAL AREAS)

A. Lower barrel shall be rigid to assure above ground break at traffic feature. Bury length of hydrant shall be four (4) feet minimum, five (5) feet maximum (hydrant lead pipe may be elbowed up from main using restrained joints;

flanged joints in lead pipes are not allowed). Flange type connections between hydrant shoe, barrel sections and bonnet shall have minimum of 6 corrosion resistant bolts.

1. New Braunfels fire hydrant barrel shall have an inside diameter of not less than 7 inches. Hydrant shall have non-rising stem.

B. Hydrant Main Valves (for New Braunfels fire hydrants only) shall be 5 ¼ I.D. Valve stem design shall meet requirements of AWWA C502, with Operating Nut turning clockwise to close. Operating Nut shall be pentagonal, 1 ½ -inch point to flat at base, and 1 7/16 inches at top and 1-inch minimum height. Seat ring shall be bronze (bronze to bronze threading) and shall be removable with light weight stem wrench. Valve mechanisms shall be flushed with each operation of valve; there shall be a minimum of two (2) drain ports.

C. Outlet Nozzles shall be located approximately 18 inches above ground. Each hydrant shall have two (2) 2 ½ inch (63.5 mm) nozzles 180 degree apart with National (American) Standard Fire Hose Coupling Screw Thread NFPA 1963 Nozzles shall be threaded or cam-locked, O-ring sealed and shall have type 302 or 304 stainless steel locking device. Nozzle caps (without chains) and cap gaskets shall be furnished on the hydrant. The cap nut shall have the same configuration as the operating.

1. New Braunfels fire hydrants shall have one (1) 4-inch pumper nozzle with City of New Braunfels standard 4-480.

2. San Marcos fire hydrants shall have one (1) 4-inch pumper nozzle with City of Austin standard thread-six (6) threads per inch “Higbee” cut, 4.8590 inch O.D., 4.6425 inch root diameter.

D. Hydrant shall have double O-ring seals in a bronze stem sheath housing to assure separation of lubricant from water and shall have a weather cap or seal, or both, as approved by the Owner, to provide complete weather protection.

E. All below ground bolts shall be corrosion resistant. The hydrant valve shall be Neoprene, 90 durometer minimum. The seat ring, drain ring, operating nut and nozzles shall be bronze, AWWA C-502 current, containing not over 16 percent zinc. Break-away stem coupling shall be of ferrous material; its retaining pins, bolts, nuts, etc. of type 302 or 304 stainless steel.

F. Fire hydrants shall be designated for 200 psi working pressure and shop tested to 400 psi pressure with main valve both opened and closed. Under test, the valve shall not leak, the automatic drain shall function, and there shall be no leakage into the bonnet.

G. Fire hydrant shall be the following for San Marcos jurisdictional areas:

1. Mueller Super Centurion 250 Model A 423.

2. American Darling (Model B-84-B-5).

3. Approved equivalent.

H. Fire hydrant shall be the following for New Braunfels jurisdictional areas:

1. Mueller Super Centurion 250 Model A 423

2. American Darling (Model B-84-B).

3. Approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall field stake proposed hydrant installation locations for Owner and/or Engineer confirmation and field relocation, if necessary. The Contractor shall provide a minimum of seven (7) calendar days for the Owner and/or Engineer to review/approve the field stake locations and field relocations.

B. Fire hydrant shall be set plumb with not less than two and one-half (2.50) cubic feet of crushed stone.

C. The Contractor shall place a blue-colored reflective marker at a location in the adjacent roadway in accordance with the Marker Details Standard drawing.

D. Before installing any valve, care shall be taken to see that all foreign material is removed from the interior of the body and the valve is opened and closed to see that all parts are in proper working condition. Valves shall be closed prior to installation. Valves shall be set on gravel or ¾-inch stone with a minimum of one (1) square foot bearing area and four (4) inches thick to support the weight of the valve. Valves shall be set plumb with valve boxes placed directly over the operators. The top section of the valve box shall be set to allow equal movement above and below finished grade. After being correctly positioned, fill shall be carefully tamped around the valve box for a distance of four (4) feet on all sides of the box. In unpaved areas, a 24 inches x 24 inches x 9 inches thick reinforced concrete pad shall be poured around the top of the box as shown in the Typical Iron Valve Box Standard detail drawing as shown within per the Construction Drawings. The box shall be adjusted flush with the finished grade. All fire hydrant valves shall be harnessed or restrained as shown.

E. Fire hydrants shall be set so that the bury line is flush with the surface of the proposed ground as recommended by the Manufacturer and shall be connected to the mains with main line tees, ductile iron pipe, gate valve and box, fittings, marker, all being part of the assembly. Hydrants shall be set on gravel or ¾-inch stone pad with a minimum of one (1) square foot bearing area and four (4) inches thick to support the weight of the hydrant. The fire hydrant valve shall be restrained back to the tee. After connections are made, the hydrants shall be set at such elevations that the connecting pipe and the distributing mains shall have the same depth of cover. All backfill around hydrants shall be thoroughly compacted to the surface of the ground. Hydrants shall be turned such that the hose nozzles are parallel with, or at a right angle to the curb with the pumper nozzle facing the curb or street, unless directed otherwise by the Engineer.

3.2 PAINT

A. The interior of the hydrant shoe shall be coated with fusion-bonded epoxy having a normal dry film thickness of 8 mils, conforming to ANSI/AWWA C550 and NSF 61.

B. After the fire hydrant has been installed, the exterior of the fire hydrants shall be painted with suitable primer and finished with oil-based aluminum paint. Paint

shall be applied to all exposed metal surfaces above the hydrant base flange.

3.3 TESTING AND INSPECTION

A. All Fire Hydrant tests and inspections shall conform to ANSI/AWWA C502 Section 5.1 “Production Testing”, ANSI/AWWA C502 Section 5.2 “Prototype Testing”, and ANSI/AWWA C502 Section 5.3 “Inspection and Rejection” or latest edition thereof.

3.4 FIRE HYDRANT REPLACEMENT

A. The Contractor shall make every effort to maintain water service to existing fire hydrants throughout the construction period, unless otherwise approved by the Engineer.

PART 4 – MEASUREMENT AN PAYMENT

4.1 MEASUREMENT: Standard fire hydrants with 6-inch valve and box with marker sign will be measured by the unit of each as a fire hydrant assembly.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for furnishing and installing complete new standard fire hydrant with 6-inch valve and box with marker sign as shown within the Drawings and as specified herein. This item shall include, but not necessarily be limited to excavation and backfill, selected material, anti-corrosion embedment when specified, nipples, ductile iron pipe, and fittings inclusive of the tee from the main line pipe, polyethylene wrap, concrete pad, painting, valve marker, hydrotesting and disinfection, inspection and all other work incidental to furnishing and installing a fire hydrant assembly.

END OF SECTION

SECTION 02650
POLYVINYL CHLORIDE (PVC) PIPE FOR WATER MAINS

PART 1 - G E N E R A L

1.1 SCOPE

A. The Work included in this Section consists of furnishing all material, equipment, testing, and labor while performing all operations necessary for the installation of Polyvinyl Chloride (PVC) pipe that is compliant with all AWWA C900 and C905 standards as shown within the Drawings and as specified herein.

B. Where references are made to other standards or codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of five (5) years of experience producing PVC pipe and shall show evidence of at least five (5) installations that are currently in satisfactory operation.

B. PVC pipe shall be the product of one manufacturer.

1.3 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01240, Trench Excavation Safety

C. Section 01350, Hydrotesting and Disinfection

D. Section 02670, Ductile Iron Fittings

E. Section 02680, Joint Restraints and Thrust Blocking

1.4 REFERENCE STANDARDS

A. Comply with the current Texas Commission on Environmental Quality (TCEQ) rules and the American Water Works Association (AWWA) standards for materials relating to water distribution systems.

1.5 SUBMITTALS

A. Shop Drawings

1. Submit Manufacturer's drawings and data sheets for material to be supplied under this Section. Indicate sizes and types to be installed.

2. Submit Manufacturer's certificate of conformance with referenced standards.

3. Submit Manufacturer's specifications for the tracer wire. Indicate size and print legend to be installed.

4. Submit Manufacturer's specifications for the detectable marker tape. Indicate size and color code to be installed.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Pipe shall be unloaded and inspected in accordance with the Manufacturer's instructions.

B. Pipe stored on the site shall be contained within the protective unit packages provided by the Manufacturer. If packages need to be opened, the pipe shall be stored on a flat surface and not in direct contact with the ground. Do not stack packages higher than four (4) vertical feet. Keep inside of pipe free from dirt and debris. Care shall be exercised to avoid compression damage to or deformation of the pipe.

C. All pipe segments that are stored shall be covered to provide protection from the sunlight.

D. Handle all material carefully at all times. Any pipe having a crack or which has received a severe blow shall be marked as rejected and immediately removed from the jobsite.

PART 2 - P R O D U C T S

2.1 PVC PIPE

A. PVC pressure pipe shall conform to the requirements of AWWA C900 with outside diameter equal to that of cast iron pipe, or to the requirements of AWWA C905 with outside diameter equal to that of cast iron or steel pipe.

B. All PVC pressure pipe shall be a rated DR 18 and blue in color unless otherwise noted on the plans.

C. PVC pipe shall be furnished in standard laying lengths of 20 feet (plus or minus one inch) unless stated otherwise.

D. PVC pipe marking shall include the following:

1. Manufacturer's name or trademark.
2. Standard to which it conforms.
3. Pipe dimeter size.
4. Material design code.
5. Pressure rating.
6. Standard Dimension Ratio (SDR) number or schedule number.
7. Laboratory seal or mark attesting to suitability for potable water use.
8. Manufacture date (date of installation shall not exceed one year from this date).

2.2 SLICK BORE INSTALLATION METHOD

A. PVC pipe shall be Certa-Lok C900/RJIB (DR 18) for all pipe diameter sizes.

2.3 PIPE JOINT RESTRAINTS AND THRUST BLOCKING

A. Pipe joint restraints and thrust blocking shall conform to all requirements within Section 02680 of these Specifications.

2.4 DUCTILE IRON FITTINGS

A. All buried fittings shall be ductile iron with mechanical joints and shall conform to all requirements within Section 02670 of these Project Specifications.

2.5 PIPE JOINT LUBRICANT

A. The joint lubricant shall have been tested and approved for potable water service. No lubricant shall be used that will harbor bacteria or damage the gaskets.

2.6 PIPE TRACER WIRE

A. Tracer wire shall be installed for future use in locating pipe. Tracer wire shall be No. 12 AWG copper-clad steel, extra high-strength with minimum 1,150-lb break load and 30 mil HDPE insulation.

B. Tracer wire shall be taped or zip-tied to the main pipeline in a minimum of 60-inch increments.

C. Tracer wire shall be placed on all new PVC pipe whether it is installed by open trench, slick bore or jack and bore method.

D. A conductivity test shall be made on all wire installed. Tests and visual inspection shall be made at each valve box, meter box and listening port as applicable. Conductivity may be tested by using as electrical conductivity meter by attaching underground locating equipment and tracing the signal to each valve box and meter box. No acceptance or payment will be made on any section or reach of pipe installed that does not have a conductive electrical locator wire installed in accordance with the Drawings.

2.7 MARKER TAPE

A. Marker tape shall be installed as an additional pipe identification device when pipe is installed by open trench method only.

B. During the backfilling process, all water mains, service lines and system appurtenances shall have a continuous warning tape placed immediately above them and throughout their length at a depth of eighteen (18) inches above the utility line surface. The tape shall be six (6) inches wide. Tape material shall be formulated from 100 percent virgin polyolefin resins. Resins shall be pigmental for chemical stability and resistance to sulfide staining (color fastness). Tape shall be constructed by the mechanical (non-adhesive) lamination of two piles of three layers blown film in such a manner as to produce a bi-axially oriented structure. The tape shall be able to provide a 700 percent elongation prior to rupture as per ASTM-D882.

C. The warning tape shall be manufactured with a permanent American Public Works Administration (APWA) blue color pigment and at a maximum of every thirty (30) inches along its length, be imprinted with a continuous warning message as follows: “CAUTION: POTABLE WATER LINE BURIED BELOW.”

2.8 WATER MAIN CROSSING MARKER

A. The Contractor shall install the water main crossing marker in accordance with the Marker Standard Detail drawing as shown within the Drawings.

B. The water main crossing marker shall be placed on Right-of-Way or fence line at all road crossings.

C. The water main crossing marker detail shall be used for water main detecting services.

PART 3 - E X E C U T I O N

3.1 PIPE UNLOADING AT THE SITE

A. Inspect each shipment of pipe and make provision for a timely replacement of any damaged material. Unload by hand or use canvas slings to avoid scratching the pipe. Do not slide or drag PVC pipe over an abrasive surface. Pipe with deep scratches shall be replaced with new pipe and removed from the site immediately.

B. Stack pipe packages no higher than four (4) vertical feet and provide support for the pipe barrel to prevent bending of the pipe. Pipe stockpiled for more than thirty (30) days shall be covered to protect it from the sun's rays. Provide for air circulation through the stockpile.

C. Store rubber gasket rings in a cool, dark place out of the direct rays of the sun.

3.2 DISTRIBUTING PIPE ALONG THE TRENCH

A. Distribute pipe by hand. Do not drop or drag pipe. Distribute sufficient pipe for one day's work, and place with bell end in the direction of pipe laying. Prevent dirt and contaminants from entering the pipe.

3.3 ASSEMBLING THE PIPE

A. Closely follow the Manufacturer's recommended procedure for cleaning, setting the gasket ring, lubricating the spigots end of pipe, and assembling.

3.4 PIPE PLACING IN TRENCH

A. Pipe that is assembled prior to placing in the trench shall be carefully fed by hand (or with the use of approved equipment) on the pipe bed. Provide pockets in the pipe bed material to accommodate bell ends and eliminate a concentration of load at these points.

3.5 PREVENTING TRENCH WATER FROM ENTERING PIPE

A. When pipe laying is not in progress, close the open ends of pipe with a watertight plug and allow no water or other objectionable materials to enter the pipe.

3.6 WATER MAIN INSTALLATION

A. The Contractor shall start his work at a tie-in point or as designated by the Engineer/Owner. Pipe shall be laid with bell ends facing in the direction of the pipe laying, unless otherwise authorized or directed by the Owner. All valves and fire hydrants and valves must be installed as soon as the pipe laying reaches their designated location.

B. All pipes shall be installed to the required lines and grades with fittings, valves, and hydrants placed at the required locations. The pipe shall be laid by inserting the

spigot end into the bell flush with the intersection line or as recommended by the Manufacturer. At no time shall the bell end be allowed to go past the "insertion line". A gap between the end of the spigot, and the adjoining pipe is necessary to allow for expansion and contraction.

C. New water main crossing any other utility shall have a minimum of 30 inches of cover over the top of the pipe, unless otherwise modified by the Engineer. Excavation around other utilities shall be done at least 12 inches all around. Any damage to other utilities shall be reported to their governing entity. In both of these cases of existing utility damage, the Contractor shall promptly notify the Inspector.

D. Water main crossings of other utility lines shall be made in accordance with all applicable TCEQ rules and regulations.

3.7 HYDROTESTING AND DISINFECTION

A. Hydrotesting and disinfection of PVC pipe shall be completed in accordance with Section 01350 of these Specifications.

3.8 TRENCH EXCAVATION SAFETY

A. Trench excavation safety shall be provided by the Contractor in accordance with Section 01240 of these Specifications.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot for each size diameter and type of PVC pipe installed by open cut method regardless of trench depth as accepted by the Owner.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for furnishing and installing the PVC pipe per linear foot of the various diameter size and types by the open cut method regardless of trench depth as per the Drawings and as specified within. This item shall also include, but not necessarily be limited to all types and sizes of PVC pipe; tracer wire; marker tape; water main crossing marker; selected embedment; compaction; hydrotesting and disinfection; project staking; excavation and backfill; all items related to trench excavation safety; and all other work incidental to the installation of the PVC pipe complete in place and in reliable service.

END OF SECTION

SECTION 02660
DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all material, equipment, labor, testing and performing all operations necessary for the supply of all ductile iron piping within the limits of work, as shown on the Drawings and specified herein.

B. Where references are made to other standards or codes unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Manufacturer shall have a minimum of five years of experience producing ductile iron pipe and fittings and shall show evidence of at least five installations in satisfactory operation.

2. Ductile iron pipe and fittings shall be the product of one manufacturer.

B. Material Qualifications

1. All pipe, fittings and other materials supplied under this contract shall be subject to inspection while still on the delivery truck. It is the sole responsibility of the vendor and supplier to make prior contact with the Owner and provide a minimum of 48-hours prior notice of delivery.

2. Materials found to be defective, not in strict compliance with the quality standards of samples supplied, or of these specifications shall be immediately returned to the vendor at no expense of the Owner. If defects are discovered at a later time, the vendor shall be required to remove said items and shall bare all costs for so doing together with any replacement costs. Rejection of items may subject the vendor to liquidated and/or actual damages as specified elsewhere herein.

1.3 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01240, Trench Excavation Safety

C. Section 01350, Hydrotesting and Disinfection

D. Section 02670, Ductile Iron Fittings

E. Section 02680, Joint Restraints and Thrust Blocking

1.4 REFERENCE STANDARDS

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. AWWA C104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105, Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.
3. AWWA C110, Ductile-Iron and Gray-Iron Fittings, 3 inches through 48 inches, for Water and Other Liquids.
4. AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C115, Flanged Ductile-Iron Pipe with Threaded Flanges.
6. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
7. ANSI B18.2.1, Square and Hex Bolts and Screws Inch Series, Including Hex Cap Screws and Lag Screws.
8. ANSI B18.2.2, Square and Hex Nuts.
9. ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
10. ASTM A 354, Specification for Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners.

1.5 SUBMITTALS

A. Submit Manufacturer's certificate of conformance with Standards.

B. Submit Manufacturer's drawings and data sheets for material to be supplied under this section. Indicate sizes and types to be installed.

C. Submit Manufacturer's specifications for marker tape.

1.6 DELIVERY, STORAGE AND HANDLING

A. During shipping, delivery and installation of pipe and accessories, handle in a manner as to ensure a sound, undamaged condition.

B. Exercise particular care not to injure pipe coatings.

PART 2 – PRODUCTS

2.1 DUCTILE IRON PIPE

A. Ductile iron pipe shall conform to ANSI/AWWA Standard C151/A21.51 or latest revision thereof.

B. Ductile iron pipe for water applications shall be in full compliance with ANSI/NSF 61. Manufacturers shall maintain their NSF certification for the duration of the Contract and any extensions thereof.

C. All pipes thickness and outside diameter of pipe for water usage shall conform to Table 1 (Standard dimensions of push-on-joint and mechanical-joint ductile-iron pipe) and Table 2 (Dimensions for special thickness classes of push-on-joint ductile-iron pipe and mechanical-joint ductile-iron pipe) from ANSI/AWWA Standard C151/A21.51 for the following sizes. (The pressure class specified is the minimum permitted):

Pipe Diameter Size	Pressure Class (psi)
3-inches through 12-inches	350
14-inches through 20-inches	250
24-inch	200
30-inches through 64-inches	150

D. For restrained joint pipe, the thickness of the pipe barrel remaining after grooves are cut, if required in the design of restrained end joints, shall not be less than the nominal wall thickness of equal sized non-restrained joint pipe as shown above.

E. Each piece of pipe shall be marked as required in Section 4.7 of AWWA C151-Letters and numerals on pipe sizes 12-inch and smaller shall be not less than 3/8-inch.

F. The single gasket push-on pipe shall be shipped in standard 20-foot lengths, but not both. The restrained single-gasket push-on joint pipe shall be shipped in standard 20-foot lengths as specified above or fabricated lengths as noted in each order. At least two lengths of each size of single gasket push-on pipe furnished under each order shall be tested with circumferential gauges to ensure that the pipe may be cut at any point along its length and have an outside diameter which will be within the Manufacturer's standard design dimensions and tolerances for plain pipe. These lengths shall be identified with an easily distinguished, painted marking, longitudinally along the full length of the pipe.

2.2 DUCTILE IRON FITTINGS

A. Ductile iron fittings shall be in accordance with Section 02670 of these Specifications.

2.3 LININGS AND COATINGS

A. Asphaltic Coating

1. All pipe and fittings shall be outside coated with an asphaltic material applied by means of the airless spray method. The exterior coating shall meet AWWA Specifications for this type of coating, shall be smooth without pinholes, thin, bare, or overly thick areas. Smoothness shall be such that when hand rubbed, no “sandpaper” feeling will be experienced and such that the spigot area will readily slide through the gasket without pulling, tearing, rolling, or otherwise disturbing the sealing capabilities of the gasket. Spigot ends shall be beveled prior to

painting and to an extent that will permit ready insertion of the spigot through the gasket area.

B. Interior Cement-Mortar Lining

1. Pipe and fittings for potable water use shall be cement-lined and seal-coated in accordance with ANSI/AWWA Standard C104/A21.4-95, "Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water."

C. Exterior Painting

1. All exterior, above grade ductile iron piping, valves, and fittings, excluding stainless steel hardware, shall be prepared for painting by:

a. Cleaning all surfaces as per NAPF 500-03-01 Solvent Cleaning to remove all oil, grease, factory-applied tars and/or bitumastic coatings and all other soluble contaminants.

b. Preparing ductile iron pipe as per NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron Pipe providing a minimum 1.5 mil angular anchor profile.

c. Preparing ductile iron valves and fittings as per NAPF 500-03-05 Abrasive Blast Cleaning for Cast Ductile Iron Fittings.

2. Following surface preparation, the following coating system shall be applied:

a. First Coat: Tnemec Series 27WB Typoxy applied at 6.0 to 8.0 dry mils.

b. Second Coat: Tnemec Series 27WB Typoxy applied at 6.0 to 8.0 dry mils.

c. Third Coat: Tnemec Series 740 UVX applied at 3.0 to 5.0 dry mils.

d. Total minimum dry film thickness shall be 13.0 mils.

e. The Coatings colors shall be selected by the Owner using a color chart supplied by the Contractor with shop drawing submittals.

2.4 PIPE MARKER TAPE

A. Marker tape shall be used as a buried pipe identification service.

B. During the backfilling process, all Ductile Iron water mains, service lines and system appurtenances shall have a continuous warning tape placed immediately above them and throughout their length at a depth of eighteen (18) inches above the utility line surface. The tape shall be six (6) inches wide. Tape material shall be formulated from 100 percent virgin polyolefin resins. Resins shall be pigmential for chemical stability and resistance to sulfide staining (color fastness). Tape shall be constructed by the mechanical (non-adhesive) lamination of two plies of three layers blown film in such a manner as to produce a bi-axially oriented structure. The tape shall be able to provide a 700 percent elongation prior to rupture as per ASTM-D882.

C. The warning tape shall be manufactured with a permanent American Public Works Administration (APWA) blue color pigment at a maximum of every thirty

(30) inches along its length, be imprinted with a continuous warning message as follows: "CAUTION: POTABLE WATER LINE BURIED BELOW." At tees, tape ends, etc., the warning tape shall be tied together (spliced) with a knot to create a continuous warning tape throughout the length of the pipeline and associated branch lines, appurtenances, etc.

2.5 WATER MAIN CROSSING MARKER

A. The Contractor shall install the water main crossing marker in accordance with the Marker standard detail drawing as shown within the Drawings.

B. The water main crossing marker shall be placed on the Right of Way or fence line at all road crossings.

C. The water main crossing marker detail shall be used for water main detecting services.

PART 3 - EXECUTION

3.1 General

A. The Contractor shall provide all barricades and/or flashing warning lights necessary to warn of the construction throughout the Project.

B. Pipe and fittings shall at all times be handled with great care to avoid damage. In loading and unloading, they shall be lifted with cranes or hoists or slid or rolled on skidways in such manner as to avoid shock. Under no circumstances shall this material be dropped or allowed to roll or slide against obstructions.

C. All work shall be performed by skilled workmen experienced in similar installations.

D. All pipes shall be adequately supported by clamps, brackets, straps, concrete supports, rollers, or other devices as shown and/or specified. Supports or hangers shall be spaced so that maximum deflection between supports or hangers shall not exceed 0.05 inches for pipe filled with liquid, but shall not be further than 6 feet apart, whichever is closer, unless otherwise shown.

E. All pipe supports shall be secured to structures by approved inserts or expansion shields and bolts.

F. All pipe shall be thoroughly cleaned internally before being installed. All pipes, except oxygen service, air and gas, shall be flushed with water and swabbed to assure removal of all foreign matter before installation. Air and gas piping shall be tapped with a hammer to loosen scale or other foreign matter that might be within the pipe, then thoroughly blown with a high-pressure air hose. Air shall be from the Contractor's air compressor.

G. Whenever possible, the pipe will be installed with minimum 48-inches of cover, however, due to the numerous utilities in the area, this burial depth could change substantially.

H. At all horizontal or vertical pipe deviations, the Contractor shall install both restrained pipe and thrust blocks. Joints may only be opened to adjust alignment by half of the AWWA or Manufacturer's recommended opening (which is smaller).

3.2 INSTALLATION OF PIPE, FITTINGS AND VALVES

A. All bends, tees, and plugs, unless otherwise specified, shall be backed with concrete thrust blocks to undisturbed ground. Provision shall be made to prevent concrete from adhering to plugs or bolts.

B. Bolts, nuts, and rubber gaskets for use in flanged and mechanical joints shall be stored under cover. Gaskets shall not be exposed to heat, light or any petroleum products, shall be kept clean and shall not be handled with greasy or dirty hands.

C. Before making up flanged joints in cast iron pipe and fittings, the back of each flange under the bolt heads, and the face of each flange shall have all lumps, blisters and excess bituminous coating removed and shall be wire brushed and wiped clean and dry.

D. Before laying the ductile iron pipe, all lumps, blisters and excess coal-tar coating shall be removed from the bell and spigot ends of each pipe and the outside of the spigot and the inside of the bell wire brushed and wiped clean and dry. The entire gasket groove area shall be free of bumps or any foreign matter which might displace the gasket.

E. The cleaned spigot and gasket shall not be allowed to touch the trench walls or trench bottom at any time. Vegetable soap lubricant shall be applied in accordance with the pipe Manufacturer's recommendations, to aid in making the joint. The workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt. Deflections shall be made only after the joint has been assembled.

F. Cutting of ductile iron pipe for inserting valves, fittings, etc., shall be done by the Contractor with a mechanical pipe saw in a neat and workmanlike manner without damage to the pipe, the lining, or the coating.

G. Unless otherwise directed, ductile iron pipe shall be laid with the bell ends facing in the direction of laying; and for lines on an appreciable slope, the bells shall, at the discretion of the Engineer, face upgrade.

H. Push-on and mechanical joints in ductile iron pipe and fittings shall be made in accordance with the Manufacturer's standards except as otherwise specified herein. Joints between push-on and mechanical joint pipe and/or fittings shall be made in accordance with AWWA Standard Specifications, "Installation of Ductile-Iron Mains and Their Appurtenances," C600-10, except that deflection at joints shall not exceed one-half of the Manufacturer's recommended allowable deflection, or one-half of the allowable deflection specified in AWWA C600-10, whichever is the lesser amount.

I. Flanged joints shall be used only were indicated on the Drawings. Before making up flanged joints in the pipeline, the back of each flange under the bolt heads and the face of each flange shall have all lumps, blisters and excess bituminous coating removed and shall be wire brushed and wiped clean and dry. Flange faces shall be kept clean and dry when making up the joint, and the workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt. Bolts and nuts shall be tightened by opposites in order to keep flange faces square with each other, and to ensure that bolt stresses are evenly distributed.

J. Bolts and nuts in flanged and mechanical joints shall be tightened in accordance

with the recommendations of the pipe Manufacturer for a leak-free joint. The workmen shall exercise caution to prevent overstress. Torque wrenches shall be used until, in the opinion of the Engineer, the workmen have become accustomed to the proper amount of pressure to apply on standard wrenches.

3.3 PIPE PROTECTION

A. Paint all uninsulated metal (ductile iron or steel) piping underground with two coats of asphaltic paint.

B. Wrap soil pipe that touches metal or is exposed to masonry with a layer of 6 mils polyethylene.

C. Spirally wrap all pipelines embedded in concrete with two layers of 30 lb. felt.

D. Coat all exposed threads on galvanized steel pipe after assembly with two coats of zinc chromate.

E. Cleaning and Testing: All the piping installed under this project shall be tested as follows and as directed by the Engineer.

1. All potable water piping shall be disinfected per AWWA standards.

2. No leakage shall be permitted for flanged or any other type of above ground piping.

F. Installation of Aboveground and Exposed Piping

1. Aboveground and exposed pipe fittings, valves and accessories shall be installed as shown or indicated on the drawings.

2. Piping shall be cut accurately to measurements established at the job site and shall be worked into place without springing or forcing, properly clearing all equipment access areas and openings. Changes in sizes shall be made with appropriate reducing fittings rather than bushings. Pipe connections shall be made in accordance with the details shown and Manufacturer's recommendations.

3. Open ends of pipelines shall be properly capped or plugged during installation to keep dirt and other foreign material out of the system. Pipe supports and hangers shall be provided where indicated and as required to insure adequate support of the piping.

4. Welded connections shall be made in conformity with the requirements of AWWA Standard C206 and shall be done only by qualified welders. The Engineer may, at his option, require certificates that welders employed on the work are qualified in conformity with the requirements of this standard and/or sample welds to verify the qualifications of the welders. Before testing, field welded joints shall be coated with the same material as used for coating its pipe in accordance with the requirements of AWWA.

5. Flanged joints shall be made up by installing the gasket between the flanges. The threads of the bolts and the faces of the gaskets shall be coated with a suitable lubricant immediately before installation.

6. Use of perforated band iron (plumber's strap), wire or chain as pipe hangers will not be acceptable. Supports for pipe less than 1-1/2 inches nominal size shall not be more than 9-feet on centers and pipe 2-inches

nominal size and larger shall be supported at not more than 10-feet on centers, unless otherwise indicated. Supports for PVC pipe shall be spaced one-half the distance specified above unless otherwise indicated. Any noticeable sagging shall be corrected by the addition of extra supports at the Contractor's expense.

3.4 EXCAVATION AND BACKFILL

A. Excavation and backfill on all potable water lines and where otherwise noted, shall be in accordance with Section 01230 of these Specifications.

3.5 TRENCH SURFACE RESTORATION

A. The surface of the backfilled trench shall be restored to match the previous conditions. This shall include final grading, placement of topsoil and seeding, placement of sod, or other prepared or unprepared surfaces. Existing above grade items shall be replaced in-kind, including but not limited to fencing, concrete/asphalt surfaces, curbing, vegetation (shrubs, plantings, trees, etc.) mailboxes, signage, etc.

3.6 FIELD QUALITY CONTROL

A. All water mains shall be flushed to remove all sand, debris, rock, and other foreign matter.

B. Dispose of the flushing water without causing a nuisance or property damage.

C. Pressure and Leakage Testing: All pumps, piping and gauges shall be furnished, installed, and operated by the Contractor and all such equipment and devices and their installation shall be approved by the Engineer.

D. Pump shall be of a non-pulsating type suitable for this application and gauge accuracy certification may be required at the Engineer's discretion. All pressure and leakage testing shall be done in the presence of a representative of the Owner as a condition precedent to the approval and acceptance of the system.

3.7 HYDROTESTING AND DISINFECTION

A. Hydro testing and disinfection shall be in accordance with Section 01350 of these Specifications.

3.8 TRENCH EXCAVATION SAFETY

A. Trench and excavation safety shall be in accordance with Section 01240 of these Specifications.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot for each size diameter of ductile iron pipe installed regardless of trench depth and as accepted by the Owner.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for furnishing and installing the ductile iron pipe per linear foot of the various diameter sizes using the open cut method regardless of trench depth as per the Drawings and as specified within. This item shall also include, but not necessarily be limited to: all types and sizes of ductile iron pipe; marker tape; water main crossing marker; compaction; polyethylene sleeves and wraps; hydro testing and disinfection; project staking; excavation and backfill; dewatering; trenching; all items related to trench safety excavation; and all other work incidental to the installation of the ductile iron pipe complete and in place and in reliable service.

END OF SECTION

SECTION 02665
HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 – GENERAL

1.1 SCOPE

A. The Work included in this Section consists of all material, equipment, testing, labor and performing all operations necessary for the installation of High-Density Polyethylene (HDPE) pipe as shown in the Drawings and specified herein.

B. Where references are made to other standards or codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of 5 years of experience producing HDPE pipe and shall show evidence of at least 5 installations in satisfactory operation.

B. HDPE pipe shall be the product of one Manufacturer.

1.3 RELATED SECTIONS

A. Section 01230, Excavation and Backfill

B. Section 01240, Trench Excavation Safety

C. Section 01350, Hydrotesting and Disinfection

D. Section 02670, Ductile Iron Fittings

E. Section 0280, Joint Restraints and Thrust Blocking

1.4 REFERENCE STANDARDS

A. AWWA C651-14 – Disinfection Water Mains

B. AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, 3/4 In. (19 mm) Through 3 In. (76 mm), for Water Services.

C. AWWA C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm) for Waterworks.

D. ASTM D2239 – Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

E. ASTM D2737 – Standard Specification for Polyethylene (PE) Plastic Tubing.

F. ASTM D3035 – Standard Specification for Polyethylene (DR-PR) Based on Controlled Outside Diameter.

G. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

H. ASTM F714 – Standard Specification for Polyethylene (DR-PR) Based on Outside Diameter.

1.5 SUBMITTALS

A. Submit Manufacturer's certificate of conformance.

B. Contractor shall submit Manufacturer's drawings and data sheets for materials to be supplied under this Section. Indicate sizes and types to be installed.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Pipe shall be unloaded and inspected in accordance with the Manufacturer's instructions.

B. Pipe and fittings stored on the site shall be stored in the protective unit packages provided by the Manufacturer. If packages need to be opened, the pipe shall be stored on a flat surface and not in direct contact with the ground. Do not stack higher than four (4) feet. Keep inside of pipe and fittings free from dirt and debris. Care shall be exercised to avoid compression damage or deformation to the pipe.

C. All pipe, fittings, and adaptors that are stored shall be covered to provide protection from the sunlight.

D. Handle all material carefully at all times. Any pipe or fitting having gouges or cracks, or which has received a severe blow shall be marked rejected and immediately be removed from the work.

PART 2 - PRODUCTS

2.1 HIGH-DENSITY POLYETHYLENE (HDPE) PIPE

A. Materials

1. Pipe shall be a high density, extra high molecular weight polyethylene manufactured from first-quality high density polyethylene resin containing no additives, fillers, or extenders. The HDPE pipe shall have an ASTM D3350 cell classification of PE 345434C and shall meet or exceed the properties listed in table below.

2. The HDPE pipe shall be SDR-11 DriscoPlex 4000 (blue stripe) for 4-inch or larger water mains or approved alternate and shall bear the seal of approval of the National Sanitation Foundation (NSF).

3. The HDPE pipe shall be SDR-11 DriscoPlex 4100 (blue stripe) for 3-inch or smaller water mains or approved alternate and shall bear the seal of approval of the National Sanitation Foundation (NSF).

Property	Specification	Unit	Nominal Value
Material Designation			PE 4710
Material	ASTM D-1248		III C 5 P34
Cell Classification	ASTM D-3350		445574C
Density	ASTM D-1505	gm/cm^3	0.960
Melt Index	ASTM D-1238	gm/10 min.	0.08
Flex Modulus	ASTM D-790	Psi	120,000
Tensile Strength	ASTM D-638	Psi	3,500

Compressive Strength	ASTM D-695	Psi	1,600
Tensile Strength @ Yield (Type VI Spec.)	ASTM D-638 (2"/min.)	Psi	3,500
Elongation @ Yield	ASTM D-638	%, minimum	8
Tensile Strength @ Break (Type VI	ASTM D-638	Psi	5,000
Elongation @ Break	ASTM D-638	%, minimum	800
Modulus of Elasticity	ASTM D-638	Psi	175,000

B. The inside and the outside surface of each length of pipe shall be free from nicks, scratches, and other surface defects and blemishes. The pipe shall be homogeneous throughout, free of any bubbles, voids, or inclusions.

C. The jointing areas of the barrel of each length of pipe shall be free from dents and gouges.

2.2 PIPE ADAPTORS

A. HDPE to PVC - Mechanical Compression Coupling with restraint – HDPE shall be restrained by electrofusion flex restraints; PVC pipe restrained using a tapered gripping ring. Stiffener inserts in the pipe bore are required for both HDPE and PVC pipes.

2.3 PIPE TRACER WIRE

A. Tracer wire shall be installed for future use in locating pipe. Tracer wire shall be No. 12 AWG copper-clad steel, extra high-strength with minimum 1,150-lb break load and 30 mil HDPE insulation.

B. Tracer wire shall be taped or zip-tied to the main pipeline in a minimum of 60-inch increments.

C. Tracer wire shall be placed on all new HDPE pipe whether it is installed by open trench, slick bore or jack and bore method.

D. A conductivity test shall be made on all wire installed. Tests and visual inspection shall be made at each valve box, meter box and listening port as applicable. Conductivity may be tested by using as electrical conductivity meter by attaching underground locating equipment and tracing the signal to each valve box and meter box. No acceptance or payment will be made on any section or reach of pipe installed that does not have a conductive electrical locator wire installed in accordance with the Drawings.

2.4 MARKER TAPE

A. Marker tape shall be installed as an additional pipe identification device when pipe is installed by open trench method only.

B. During the backfilling process, all water mains, service lines and system appurtenances shall have a continuous warning tape placed immediately above them and throughout their length at a depth of eighteen (18) inches above the utility line surface. The tape shall be six (6) inches wide. Tape material shall be formulated

from 100 percent virgin polyolefin resins. Resins shall be pigmental for chemical stability and resistance to sulfide staining (color fastness). Tape shall be constructed by the mechanical (non-adhesive) lamination of two piles of three layers blown film in such a manner as to produce a bi-axially oriented structure. The tape shall be able to provide a 700 percent elongation prior to rupture as per ASTM-D882.

C. The warning tape shall be manufactured with a permanent American Public Works Administration (APWA) blue color pigment and at a maximum of every thirty (30) inches along its length, be imprinted with a continuous warning message as follows: "CAUTION: POTABLE WATER LINE BURIED BELOW."

2.5 WATER MAIN CROSSING MARKER

A. The Contractor shall install the water main crossing marker in accordance with the Marker Standard Detail drawing as shown within the Drawings.

B. The water main crossing marker shall be placed on Right-of-Way or fence line at all road crossings.

C. The water main crossing marker detail shall be used for water main detecting services.

PART 3 - EXECUTION

3.1 PIPE UNLOADING AT THE SITE

A. Inspect each shipment of pipe and fittings and make provision for a timely replacement of any damaged material. Unload by hand or use canvas slings to avoid scratching the pipe. Do not slide or drag HDPE pipe over an abrasive surface. Pipe with deep scratches shall be replaced with new pipe and removed from the site.

B. Pipe stockpiled for more than thirty (30) days shall be covered to protect it from the sun's rays. Provide for air circulation through the stockpile.

3.2 ASSEMBLING THE PIPE

A. Closely follow the Manufacturer's recommended procedure for cleaning, installing, and assembling the pipe.

3.3 MAKING HEAT FUSED JOINTS

A. Follow Manufacturer's recommended procedure and use only the recommended tools for prepping piping for heat fusion. All joints shall be made in strict conformance to ASTM F2620 - Standard Practice for Heat Fusion Jointing of Polyethylene Pipe and Fittings and ASTM D3261 – Standard Specification for Butt Heat Fusion Polyethylene Plastic Fittings for Polyethylene Plastic Pipe and Tubing.

3.4 PREVENTING TRENCH WATER FROM ENTERING PIPE

A. When pipe laying is not in progress, close the open ends of pipe with a watertight plug and allow no water or other objectionable materials to enter the pipe.

3.5 HYDROTESTING AND DISINFECTION

A. Hydrotesting and disinfection of HDPE pipe shall be completed in accordance with Section 01350 of these Specifications.

3.6 TRENCH EXCAVATION AND SAFETY

A. Trench excavation safety shall be provided by the Contractor in accordance with Section 01240 of these Specifications.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot for each size diameter of HDPE installed regardless of trench depth and as accepted by the Owner.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for furnishing and installing the HDPE per linear foot of the various diameter sizes using the open cut method regardless of trench depth as per the Drawings and as specified within, unless otherwise paid for by another pay item. This item shall also include, but not necessarily be limited to: all types and sizes of HDPE; tracer wire; marker tape; adaptors; water main crossing markers; hydro testing and disinfection; project staking; excavation and backfill; dewatering; trenching; selected embedment; compaction; all items related to trench excavation safety; and all other work incidental to the installation of the HDPE pipe complete and in place and in reliable service.

END OF SECTION

SECTION 02670
DUCTILE IRON FITTINGS

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all labor, materials, equipment and incidentals for performing operations necessary to furnish and install ductile iron fittings designed and manufactured to be used with ductile iron-pipe for potable water and wastewater as shown on the Drawings and as specified herein.

B. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of stated standard or code shall govern.

1.2 QUALITY ASSURANCE

A. The Owner/Engineer may inspect materials for conformance to the Drawings and Specifications herein.

1.3 RELATED SECTIONS

A. Section 02680, Joint Restraint and Thrust Blocking

B. Section 01350, Hydrotesting and Disinfection

1.4 REFERENCE STANDARDS

A. AWWA C110 – Ductile-Iron and Gray-Iron Fittings.

B. AWWA C116 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings.

C. AWWA C153 – Ductile-Iron Compact Fittings.

D. ASTM F1674 – Standard Test Method for Joint Restraint Products for Use with PVC Pipe.

E. ASTM D4976 – Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

F. ASTM A536 – Standard Specification for Ductile Iron Castings.

1.5 SUBMITTALS

A. Shop Drawings

1. Submit Manufacturer's certificate of conformance with referenced standards.

2. Submit Manufacturer's drawings and data sheets for materials to be supplied under this Section. Indicate dimensions, materials, size, and weight.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the Work.

B. Handle all fittings and accessories carefully with approved handling devices. Do not drop or roll material off trucks.

C. Unload fittings and accessories to or as close to the place where they are to be installed as is practical to avoid unnecessary handling. Keep pipe interiors completely free from dirt and foreign matter.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON FITTINGS

A. Fittings shall be push-on, flanged, or mechanical joint as indicated on the Drawings.

B. Full body fittings shall conform with AWWA C110 for 3 inch through 48 inch for Water and other Liquids.

C. Compact fittings shall conform with AWWA C153.

D. Fittings shall be manufactured conforming to the requirements of ASTM A536.

E. Fittings designated for raw water or wastewater service shall be fusion bonded epoxy coated inside and outside meeting all the requirements of AWWA C116.

F. Fittings, including the joints and restraint systems, shall have a minimum pressure rating of 350 psi for 3-inch through 24-inch in diameter fittings. Minimum pressure ratings of 250 psi for all fittings of size greater than 24-inches in diameter. Testing shall be done in accordance with the procedures found in ASTM F1674.

G. The exterior of all fittings designated for finished or potable water service shall be provided with a petroleum asphaltic coating in accordance with the latest revision of AWWA C110 and AWWA C153 standards. The interior of all fittings designated for finished or potable water service shall be cement mortar lined in accordance with the latest revision of AWWA C104.

H. Fittings for 2-inch size shall be of manufacturers' standard design in accordance with applicable design standards of AWWA C110 and AWWA C153.

PART 3 - EXECUTION

3.1 DUCTILE IRON FITTINGS

A. Joint restraints and thrust blocking for ductile iron fittings shall be provided in accordance with Section 02680 of these Project Specifications.

B. Anti-corrosion protection consisting of polyethylene sleeve and asphaltic material for ferrous surfaces shall be applied to exterior surfaces of all fittings installed.

C. Approved adapters shall be used when necessary to provide a transition between pipes and/or fittings of different diameters.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity determined for payment shall be as measured by the total fittings weight in tons for the various sizes of fittings installed and as specified in the Drawings.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, testing, and equipment necessary for furnishing and installing various sizes of fittings made at the unit price bid for each ton of fittings to the nearest one-hundredth of a ton of fitting weight installed. Subsidiary items at no separate cost shall include, but not necessarily be limited to the following: weights of glands, bolts, nuts, washers, gaskets (all types). These are considered subsidiary to the installation of fittings and no separate payment will be made for anti-corrosion protection; select anti-corrosion embedment material; joint restraints and thrust blocking; hydrotesting and disinfection, and all other work incidental to the installation various sizes of fittings in place and in reliable service.

END OF SECTION

SECTION 02675

PIPE ENCASEMENT

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all material, equipment, labor, and performing all operations necessary to install casing pipe and carrier pipe by the method of jack and bore or open trench, as shown on the Construction Drawings and specified herein.

B. Casing pipe for carrier pipe shall be provided and installed in accordance with the Casing Standard Detail drawing as shown within the Drawings.

C. Where references are made to other standards or codes, unless specific date references are indicated, the latest edition of said standard or code shall govern.

1.2 RELATED SECTIONS

A. Section 01140, Dewatering

B. Section 01220, Exploratory Excavation

C. Section 01230, Excavation and Backfill

D. Section 02650, PVC Pipe for Water Mains

E. Section 02680, Joint Restraints and Thrust Blocking

1.3 REFERENCED STANDARDS

A. AWWA C206 – Field Welding of Steel Water Pipe

B. AWWA C210 – Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines

C. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-In. Through 60-In. (100 mm Through 1,500 mm)

D. ASTM A36 – Standard Specification for Carbon Structural Steel

E. ASTM A135 - Standard Specification for Electric-Resistance-Welded Steel Pipe

F. ASTM A139 – Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)

1.4 SUBMITTALS

A. Shop Drawings

1. Submit Manufacturer's certificate of conformance with referenced standards.

2. Submit Manufacturer's drawings and product data sheets for the materials to be supplied under this Section. Indicate sizes and types to be installed.

3. Submit Manufacturer's specifications for tracer wire and marker tape.

PART 2 – MATERIALS

2.1 CARRIER PIPE

A. Polyvinyl Chloride (PVC) carrier pipe shall be Certa-Lok C900/RJ (DR 18) for all pipe diameter sizes.

B. High-Density Polyethylene (HDPE) carrier pipe as specified on the Construction Drawings for all pipe diameter sizes.

2.2 STEEL CASING

A. Steel casing shall be new or used pipe in good condition, and acceptable to the Owner and to the governing roadway authority.

B. Casing pipe shall extend a minimum of 10 linear feet, past the edge of pavement along TxDOT roadways, and a minimum of 5 linear feet, past the edge of pavement along all other roadways, unless otherwise directed by the Engineer or regulatory authority.

C. Steel casing pipe shall be standard weight or heavier conforming to ASTM A36, ASTM A135, ASTM A139, or other acceptable standard specification.

D. Pipe joints shall be welded together in accordance with AWWA C206.

2.3 PVC CASING

A. PVC casing shall be new or used pipe in good condition, and acceptable to the Owner and governing authority.

B. The diameter of the PVC casing shall be per Casing Standard Detail under steel casing minimum nominal size (in) in correspondence to the pipe nominal size (in) specified or otherwise noted in the Construction Drawings.

2.4 CASING SPACERS

A. Casing spacers are required for all carrier pipe lines 4-inch and larger in diameter.

B. Casing spacers shall be placed within 2 feet of the ends of casing pipe. Subsequent spacers shall be placed a maximum of 10 feet apart within the casing, with at least 3 spacers per joint of pipe.

C. Casing spacers shall be made from T-304 stainless steel of a minimum 14-gauge thickness.

D. Casing spacers shall have a synthetic rubber or PVC liner to insulate the carrier pipeline from the spacer.

E. Casing spacers shall have 1.5-inch-wide glass reinforced plastic or UHMW polymer runners to insulate the spacer from the casing pipe interior.

2.5 PIPE TRACER WIRE AND MARKER TAPE

A. Tracer wire shall be installed for future use in locating pipe. Tracer wire shall be No.12 AWG copper-clad steel, extra high-strength with minimum 1,150-lb break load and 30 mil HDPE insulation.

B. Tracer wire shall be taped or zip-tied to the main pipeline in a minimum of 60-inch increments.

C. Tracer wire shall be installed by open trench, slick bore, and jack and bore method.

D. Marker tape shall be installed as an additional buried pipe identification device when pipe is installed by open trench method only.

E. During the backfilling process, all water mains, service lines and system appurtenances shall have a continuous warning tape placed immediately above them and throughout their length at a depth of eighteen (18) inches above the utility line surface. The tape shall be six (6) inches wide. Tape material shall be formulated from 100 percent virgin polyolefin resins. Resins shall be pigmental for chemical stability and resistance to sulfide staining (color fastness). Tape shall be constructed by the mechanical (non-adhesive) lamination of two piles of three layers blown film in such a manner as to produce a bi-axially oriented structure. The tape shall be able to provide a 700 percent elongation prior to rupture as per ASTM-D882.

F. The warning tape shall be manufactured with a permanent American Public Works Administration (APWA) green color pigment and at a max of every thirty (30) inches along its length, be imprinted with the applicable continuous warning message as follows:

1. CAUTION: BURIED FORCE MAIN BELOW
2. CAUTION: BURIED FORCE MAIN BELOW
3. CAUTION: SANITARY SEWER LINE BELOW
4. CAUTION: BURIED STORM SEWER MAIN LINE BELOW
5. CAUTION: STORM DRAIN LINE BELOW

2.6 WATER MAIN CROSSING MARKER

A. The Contractor shall install the water main crossing marker in accordance with the Marker Standard Detail drawing as shown within the Construction Drawings.

B. The water main crossing marker shall be placed on Right-of-Way or fence line at all roads and gas pipeline crossings.

C. The water main crossing marker detail shall be used for water main detecting services.

2.7 HYDROTESTING AND DISINFECTION

A. Hydrotesting and disinfection of carrier pipe shall be completed in accordance with Section 01350 of these Specifications.

PART 3 – CONSTRUCTION

3.1 JACKING

A. Suitable bore pits or trenches shall be excavated on each side of the roadway for the purpose of jacking operations, and for placing end joints of the pipe.

B. Bore and receiving pits shall be sheeted, shored, and braced according to OSHA minimum requirements. All excavations shall be adequately dewatered.

C. Jacking work should in no way interfere with the operation of streets, highways, railroads, and other facilities. Jacking operations shall not damage or weaken such facilities.

D. The pipe to be jacked shall be set on guides to support the section of the pipe being jacked, and to direct it in the proper line and grade.

E. Generally, the pipe shall be jacked from the downstream end towards the upstream end.

F. Any pipe that cannot be repaired to its original condition or is damaged in jacking operations shall be removed and replaced at the Contractor's expense.

G. Jacking pits shall be backfilled and compacted immediately upon completion of jacking operations.

3.2 EXCAVATION AND BACKFILL

A. Excavation and backfill shall be completed in accordance with Section 01230 of the Specifications.

B. Boring operations may include creating of a pilot hole which shall be bored for the entire length of roadway crossing. This shall be used as a guide for the larger hole to be bored. Water or drilling fluid may be used to lubricate cuttings.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity measured for payment shall be per linear foot of casing pipe and carrier pipe installed with jack and bore or open trench method as accepted by Owner. Jack and bore method shall be measured from face to face of jacking pits.

4.2 PAYMENT: Payment shall be full compensation for all labor, materials, tools, and equipment necessary for jacking and boring operations, and furnishing pipe casing and carrier pipe as per the Construction Drawings and as specified within. This item shall include, but not necessarily limited to: jack and bore (if method used); carrier pipe; casing pipe; casing spacers; liners; end seals; pipe tracer wire; marker tape; water main crossing marker; excavation and backfilling; bracing, sheeting, and shoring; grout; compaction; hydrotesting and disinfection; and all other incidental work for furnishing and installing pipe casing and carrier pipe in reliable service.

END OF SECTION

SECTION 02680
JOINT RESTRAINTS AND THRUST BLOCKING

PART 1 - GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all labor, materials, equipment and incidentals for thrust blocking installation and adjustment, as shown on the Drawings and as specified herein.

B. Water pipe joint restraints system components shall be installed as shown on the Drawings and as specified herein.

C. Where references are made to other standards and codes, unless specific date references are indicated, the latest edition of stated standard or code shall govern.

1.2 DESCRIPTIONS OF REQUIREMENTS

A. The Contractor shall furnish and install thrust blocking and anchorage in accordance with the Thrust Block Anchoring standard detail shown within the Drawings.

B. Underwriter Laboratories (U.L.) and Factory Mutual (F.M.) certifications are required on all restraint systems.

C. Unless otherwise noted, restraint systems to be used on Polyvinyl Chloride (PVC) pipes (AWWA C900 and C905) shall meet or exceed the ASTM Standard F1674, “Standard Test Methods for Joint Restraint Products for Use with PVC Pipe,” or the latest revision thereof. Restraint system used on ductile iron pipe shall meet or exceed AWWA Standard C111.

D. Each restraint system shall be packaged individually and include installation instructions.

1.3 QUALITY ASSURANCE

A. The Owner/Engineer may inspect materials of conformance to the Drawings specifications herein.

1.4 RELATED SECTIONS

A. Section 02670, Ductile Iron Fittings

1.5 REFERENCE STANDARDS

A. AWWA C105 – Polyethylene Encasement for Ductile-Iron Pipe Systems.

B. AWWA C110 – Ductile-Iron and Gray-Iron Fittings.

C. AWWA C111 – Rubber-Gasket Joints for Ductile – Iron Pressure Pipe and Fittings.

D. AWWA C116 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings.

E. ASTM A536 – Standard Specification for Ductile Iron Castings.

F. ASTM F1674 – Standard Test Method for Joint Restraint Products for Use with PVC Pipe.

1.6 SUBMITTALS

A. Shop Drawings

1. Pipe joint restraint system.

2. Polyethylene wrapping.

3. Poly tape.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Joint restraints, gaskets, glands, bolts, nuts, and accessories shall be shipped in suitable protective containers.

B. Handle all joint restraints and accessories carefully with approved handling devices. Do not drop or roll material off trucks.

C. Unload joint restraints and accessories to or as close to the place where they are to be installed as is practical to avoid unnecessary handling. Keep all items completely free from dirt and foreign matter.

PART 2 - PRODUCTS

2.1 PIPE JOINT RESTRAINT SYSTEM AND THRUST BLOCKING

A. Suitable thrust blocking and anchorage or joint restraints shall be provided at all the following water main locations: plugs, caps, tees, crosses, valves, bends, reducers, dead ends, and as specified in the Drawings.

B. All mechanical (joint) restraints shall be bidirectional.

C. Restraining joint types shall be as manufactured by EBAA Iron Sales, Inc. as listed on the Approved Equipment List (AEL).

D. Restraint rings for PVC pipe bells (AWWA C900 and C905) shall be made of ductile iron components. All ductile iron shall conform to ASTM A536. A split ring shall be used behind the bell and a serrated restraint ring shall be used to grip the pipe. A sufficient number of bolts shall be used to connect the bell ring and the pipe ring. The combination shall have a minimum working pressure rating of 150 psi.

E. Pipe four (4) inches in diameter or larger shall have an integral bell formed with a race designated to accept the gasket in accordance with AWWA C900 and C905. The spigot end shall have a bevel and a stop mark on the outside diameter to indicate insertion depth. Provisions shall be made for expansion and contraction at each joint. All surfaces of the joint upon or against which the gasket may bear shall be smooth, free of cracks, fractures, or imperfections that could adversely affect the performance of the joint.

F. The gasket shall be molded to a circular form and to the proper cross section and shall consist of a vulcanized high grade elastomeric compound conforming to ASTM F4777.

1. Quality Control Test Requirements

a. The Manufacturer shall take adequate measures in the production of PVC and couplings to assure product compliance with the requirements of AWWA C900 and C905.

b. All of the tests specified in AWWA C900 and C905 shall be performed at the intervals indicated therein.

G. Underground mechanical joint or push-on joint applications may not be used above grade or as substitute for flanged joints. Any above grade applications will require submission of shop drawings of the piping system where they are utilized, reasoning for use, and approval from both the Owner and Engineer.

H. Push-on Type Joints (Single Gasket and Single Gasket with Gasket Restraint)

1. Push-on joints shall conform to AWWA C111, except that the gaskets for pipe and fittings shall be neoprene where so specified.

2. The required number of gaskets for each push-on joint pipe plus one extra for every 50 joints or fraction thereof, shall be furnished with each order. The gaskets shall be shipped in suitable protective containers.

2.2 POLYETHYLENE WRAPPING

A. Polyethylene wrapping shall conform to the material requirements of the latest revisions of AWWA C105 and ASTM D4976.

B. The following physical properties shall be met

1. Wrapping film shall be a nominal thickness of 8 mils.

2. Tensile strength shall meet or exceed 3600 psi in accordance with ASTM D882.

3. Minimum elongation shall not be less than 800% of the test strip minimum test per the latest ASTM D882 test.

4. Minimum dielectric strength shall be 800V/mil thickness minimum in accordance with ASTM D149.

5. Minimum impact resistance shall be 600 grams in accordance with ASTM D1709 Method B.

6. Minimum propagation tear resistance shall be 2550 gf machine and transverse direction in accordance with ASTM D1922.

C. POLY TAPE

1. Poly tape shall consist of an elastomeric film backing of either polyethylene or plasticize polyvinyl chloride, coated on one side with a homogenous pressure-sensitive adhesive. Tape shall conform to Federal Specifications L-T-1512a and AWWAA C209.

PART 3 - EXECUTION

3.1 RESTRAINER FOR PVC PIPE (C900 and C905) AND DUCTILE IRON PUSH-ON TYPE CONNECTIONS

A. Mechanical pipe joint restraints shall include strapping logs, tie rods, retainer glands, joint harnesses, split clamping rings, threaded flanges and other mechanical restraints as approved by the Owner.

B. All mechanical restraint systems shall be capable of preventing movement of the pipe and withstanding the thrust in pounds for various line sized as follows:

Nominal Pipe Diameter (inches)	Thrust (lbs. force)
2	750
3	1,500
4	2,700
6	6,000
8	10,400
10	16,800
12	24,000

C. Bolts and nuts used to attach the split retainer ring shall comply with ANSI B 18.2/18.2.2, SAW Grade 5. Restraining rods and bolts shall be of low alloy corrosion resistant high strength steel conforming to AWWA C111.

D. Pipe restraints shall be utilized to prevent movement for push-on ductile iron or PVC (compression type) bell and spigot pipe connections or where a flexible coupling has been used to join two sections of plain-end pipe ductile iron or PVC pipe. The restrainer may be adapted to connect a plain end ductile iron or PVC pipe to a ductile iron mechanical joint (MJ) bell fitting. The restrainer must not be directionally sensitive.

E. The pipe shall be restrained by a split retainer band. The band shall be cast iron or ductile iron, meeting or exceeding ASTM A536, Grade 65. The inside face or contact surface of the band shall be of sufficient width to incorporate cast or machined non-directionally sensitive serration to grip the outside circumference of the pipe. The serration shall provide full (360 degrees) contact and maintain pipe roundness and avoid any localized points of stress. The split band casting shall be designed to “bottom-out” before clamping bolt forces (110 ft-lb minimum torque) can over-stress the pipe but will not provide full non-directionally sensitive restraint at the rated pressures.

3.2 NON-METALLIC RESTRAINED JOINT PIPE AND COUPLINGS FOR PVC PIPE CONNECTIONS

A. Gaskets for restrained coupling connections shall join two sections of factory grooved PVC (C900 and C905) pipe.

B. The coupling shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F-477 in all applications, meeting or exceeding the performance requirements of AWWA C900 and C905, latest revisions.

C. The inside face or contact surface of the coupling connection shall be of sufficient width to incorporate a factory machined non-directionally sensitive groove in both pipe and coupling the grip the outside circumference of the pipe. The couplings shall provide full (360 degrees) contact and maintain pipe roundness and avoid and localized points of stress. The coupling shall be designed with an internal stop to align the precision-machined grooves in the coupling and pipe prior to installation of a non-metallic thermoplastic restraint spleen and will provide full non-directionally sensitive restraint at the rated pressures.

D. The non-metallic restrained joint pipe and couplings for PVC (C900 and C905) restraint system shall consist of a pipe and couplings system produced by the same Manufacturer meeting the performance qualifications of U.L. and F.M. required on all restraint systems.

3.3 FITTING RESTRAINT FOR DUCTILE IRON PIPE (ONLY)

A. Radial bolt type restrainer systems shall be limited to ductile iron pipe in conjunction with Mechanical Joint (MJ) bell end pipe of fittings. The system shall utilize a standard MJ gasket with a ductile iron replacement gland conforming to Standard MJ bolt circle criteria.

B. The wedge screws shall be compressed to the outside wall of the pipe using a shoulder bolt and twist-off nuts to insure proper actuating of the restraining system.

C. Standard MJ fitting tee-bolts and nuts shall be high strength steel conforming to AWWA C111 and AWWA C153.

D. Standard MJ gasket shall be virgin SBR meeting ASTM D-2000 3 BA 715 or 3 BA 515.

3.4 POLYETHYLENE WRAPPING AND TAPE

A. Polyethylene wrap shall be installed at ductile iron pipe joints as a sleeve 2 feet longer than the pipe joint. The sleeve shall cover the full length of the pipe joint, lap over 1 foot on each end of the adjoining pipe joint, lap over 1 foot on each end of the adjoining pipe joints and be secured with the minimum of two circumferential turns of poly tape.

B. Completely wrap ductile iron fittings and valves with a minimum of 1-foot overlap on each end and appropriately taped using poly tape. No duct tape shall be used.

C. Polyethylene wrap shall be installed on joints and restraint system components for corrosion protection.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: Joint restraints and thrust blocking are considered subsidiary to Section 02670, and no separate measurement will be made by the Contractor for this Work.

4.2 PAYMENT: Joint restraints and thrust blocking are considered subsidiary to Section 02670, and no separate payment will be made to the Contractor for this Work.

END OF SECTION

SECTION 02700
WATER MAIN TIE-INS

PART 1 – GENERAL

1.1 SCOPE

A. The Work included within this Section consists of furnishing all material, equipment, and labor while performing all operations necessary for water main tie-ins as shown within the Drawings and specified herein.

1.2 RELATED SECTIONS

A. Section 01140, Dewatering

B. Section 01230, Excavation and Backfill

C. Section 01350, Hydrotesting and Disinfection

D. Section 02400, Valves and Appurtenances

E. Section 02650, PVC Pipe for Water Mains

F. Section 02660, Ductile Iron Pipe

G. Section 02665, HDPE Pipe

H. Section 02670, Ductile Iron Fittings

I. Section 02690, Tapping Sleeves and Valves

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.1 WATER MAIN TIE-INS

A. The Contractor shall make a water main tie-in from the new water main to the existing water main as shown within the Drawings or as directed by the Engineer.

B. The Contractor shall be responsible for all shutdowns and isolation of the existing water mains, and this includes the following:

1. Customer notification of service shutdown.
2. Dewatering the excavation.
3. Cutting the pipe for connections.
4. Any other requirements as recommended by the Inspector or Engineer in order to safely and accurately complete this effort.

C. All water main tie-ins shall be completed during normal work hours from 8 A.M.-5 P.M., unless the Contractor is otherwise directed by the Owner or the Engineer.

D. During construction, the planned shutdown and tie-in work shall be coordinated through and approved by the Inspector or Engineer with a minimum of two weeks prior notice of such activity and accomplished at a time where it will be the least inconvenient for the customers.

E. No additional compensation will be provided to the Contractor for tie-ins that must be accomplished after normal working hours.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT: The quantity that is measured, "per each," for payment shall be the actual number of water main connection of each class, type, and size that are furnished and installed by the Contractor for acceptance by the Owner.

4.2 PAYMENT: Payment shall be full compensation for all labor, equipment, and materials required for completing the water main connections of varying size as indicated within the Construction Drawings and described within the Technical Specifications. This item shall also include all items related to trench excavation and safety; and all other work incidental to the water main connections complete in place and in reliable service.

END OF SECTION

SECTION 02710
WATER SERVICES

PART 1 – GENERAL

1.1 SCOPE

A. The Work included in this Section consists of furnishing all material, equipment, labor, and performing all operations that consist of water service supply lines adjustment and installation as shown within the Construction Drawings and specified herein.

B. Water services shall be installed in accordance with the Service Standard Detail drawing as shown within the Construction Drawings.

C. Where references are made to other standards or codes, unless date references are indicated, the latest edition of said standard or code shall govern.

1.2 SUBMITTALS

A. Not Included.

1.3 RELATED SECTIONS

A. Texas Department of Transportation (TxDOT) Item 00340, Dense-Graded Hot-Mix Asphalt (Small Quantity)

B. Section 01230, Excavation and Backfill

PART 2 – PRODUCTS

2.1 SERVICE SADDLES

A. Service Saddle shall have an epoxy coated body with double stainless-steel straps and nuts with a pressure rating of not less than that of the pipe to which it is to be connected.

B. Saddle shall have a rubber gasket cemented to the body, with compatible threading between the saddle and corporation stop.

C. Saddle shall conform to AWWA C800 standards. The service saddle shall provide full support around the circumference of the outside diameter pipe size, providing a bearing area of sufficient width to ensure that the pipe will not distort when the saddle is tightened.

D. Single strap saddles are not acceptable for use of this application.

E. Approved Manufacturer, also shown within the Approved Equipment List (AEL), are listed below:

1. Smith - Blair.
2. The Ford Meter Box Company, Inc.
3. Mueller Water Products, Inc.

4. Or Approved Equivalent.

2.2 CORPORATION STOPS

A. Corporation stops shall be 1-inch or 2-inch brass, equipped with connections compatible with the polyethylene (or copper) tubing and threaded in accordance with Specifications in AWWA C901.

B. The outlet shall be composed of a compression joint.

C. The corporation stop shall be pressure rated at 150 psi.

D. Approved corporation stop shall be ¾-inch (I.P. x Comp) Ford #F-1100-3G-NL, or approved equivalent.

2.3 METER (CURB) STOPS

A. A curb stop shall be installed at the end of every customer service pipe at the customer's property line.

B. Meter (curb) stop brand shall be Ford as the approved Manufacturer, or approved equivalent.

C. Meter (curb) stops shall be angle style, ball type, with full port, tee handle, meter nut and lock wing without drain.

D. Pipe connections shall be suitable for the type of service pipe used.

E. All parts shall be brass with female iron pipe size connections or compression-pattern and shall be designed for a hydrostatic test pressure not less than 150 psi.

F. Curb stops shall be sized to match the meter size and conform to AWWA C800 and AWWA C901.

2.4 POLYETHYLENE (OR COPPER) TUBING

A. Polyethylene tubing shall be provided in compliance with AWWA C901. Copper tubing shall be provided in compliance with ASTM B88.

B. All polyethylene and copper tubing shall be rated at 200 psi working pressure.

2.5 WATER METERS

A. Water meters shall be provided by the Owner.

2.6 METER BOXES

A. Meter boxes shall be as manufactured by DFW Plastics, Model No. DFW1300.12.1C or DFW 1600X.12.1C, or approved equivalent.

2.7 METER BOX LIDS

A. Meter box lids shall be Model No. DFW1200.1C.LID or DFW1500.1C.LID, or approved equivalent.