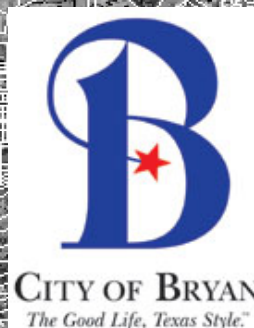




B/CS
Unified Technical
Specifications



Generals
2012



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SECTION 01 30 00

DIGITAL CONSTRUCTION PICTURES

(Sentences and/or paragraphs that are double underlined indicate revisions that were made from the 2009 specification.)

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. The Contractor is required to photographically document site conditions prior to the start and during construction operations. Provide monthly, and within one month of the completion of work, photographs, 1200x800 pixels, 360dpi true color minimum resolution in JPEG file format showing the sequence and progress of work, devices, equipment, material and fitting installations.

1.2 MEASUREMENT AND PAYMENT

- A. The digital photographs serve as one of the methods of documentation of the work performed each month and the associated monthly invoice will not be processed without them. Photographs shall be provided for unrestricted use by the City.

1.3 SUBMITTALS

- A. Take a minimum of 20 digital photographs each week (more may be required to accurately document work). Photographs for each month shall be in a separate monthly directory with the orientation and location of the valves, manholes, pipe connections and other appurtenances annotated on the construction drawings and the photograph. The view in each photograph shall include a sign showing the date, name of project, station designation, name of item being photographed, and direction camera is facing. The sign shall not block the important areas of the view and shall be legible in a three and one half inch by five inch (3-1/2" x 5") print. All prints shall show good details in both shadow and sunlit areas. Submit digital photographs and associated construction drawing with the monthly invoice on a CD-R, cumulative of all photos to date.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION

SECTION 01 55 26
TRAFFIC CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Specification includes the general description of the “TRAFFIC CONTROL” and the requirements of that plan. This specification applies to the furnishing of all labor, equipment, and materials and in performing all operations in connection with the “TRAFFIC CONTROL” in accordance with the plans and these specifications.

1.2 MEASUREMENT AND PAYMENT

The work and materials as prescribed by this item will be paid on the following schedule:

- A. 50% of the bid value shall be paid when the traffic control plan is fully implemented, and all of the initial traffic control devices have been installed and are in working order.
- B. 25% of the value will be prorated for the installation and maintenance of traffic control devices during the course of construction as a percent of the total contract value.
- C. 25% will be paid at the completion of construction and all traffic control devices are removed from the site.

1.3 SUBMITTALS

- A. The contractor shall submit a “TRAFFIC CONTROL PLAN” or modifications to the plan provided in the construction documents prior to commencing construction. All plans must be in accordance with the Texas Manual of Uniform Traffic Control Devices requirements. No plan may be implemented until approved by the Engineer.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

3.1 CONSTRUCTION METHODS

- A. The “TRAFFIC CONTROL PLAN” and the installation of all devices should be continuously reviewed and updated to reflect the current stage of construction. The inspector may review minor changes; the engineer shall review major changes. The construction foreman shall provide the current “TRAFFIC CONTROL PLAN” to the inspector upon request on the site at any time during the construction of the project.

END OF SECTION

SECTION 01 58 00

**PROJECT IDENTIFICATION
(CITY OF BRYAN ONLY)****PART 1 - GENERAL****1.1 REFERENCES**

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA C1 (2003) All Timber Products – Preservative Treatments by Pressure Processes

AWPA C2 (2003) Lumber, Timber, Bridge Ties and Mine Ties – Preservative Treatment by Pressure Processes

1.2 PROJECT IDENTIFICATION SIGNBOARD

A project identification signboard shall be provided in accordance with attached drawing. An image of indicating appearance of required signboard is provided in this specification section. The signboard shall be provided at a conspicuous location on the job site, city easement or right-of-way where directed by the City Engineer.

- a. The field of the sign shall consist of a 4 by 8 foot sheet of grade B-B medium density overlaid exterior plywood.
- b. Lumber shall be B or better Southern pine, pressure preservative treated in accordance with AWPA C1 and AWPA C2. Nails shall be aluminum or galvanized steel. The sign should be mounted using rectangular-timber signposts, No. 2 SYP or equivalent, 4x4 or 4x6. If 4x6 post is used, 1-1/2 inch weakening holes shall be drilled through the wide face at 4 and 18 inches above the ground. The wide face of the post shall be installed parallel with traffic. No more than 2 posts shall be mounted within a 7-foot span. The post shall be embedded into the ground a minimum of 36 inches. This support may be used in both weak and strong soils. The post may be directly embedded or may be embedded in premixed concrete, soilcrete, or approve expanding closed-cell polyurethane foam. (TxDOT Complaint Work Zone Traffic Control Devices J.2.b)
- c. The entire signboard and supports shall be given one coat of exterior alkyd primer and two coats of exterior alkyd enamel paint. The lettering and sign work shall be performed by a skilled sign painter using paint known in the trade as bulletin colors. The colors, lettering sizes, and lettering styles shall be indicated by the City Engineer. Where preservative-treated lumber is required, utilize only cured pressure-treated wood which has had the chemicals leached from the surface of the wood prior to painting.
- d. Use spray applied automotive quality high gloss acrylic enamel paint as background for the City of Bryan logo. The City of Bryan logo shall be an applied 2 millimeter film sticker/decal with background as indicated on image provided in this specification section. The weather resistant sticker/decal film shall be rated for a minimum of 2-year exterior vertical exposure. The self-adhering sticker shall be mounted to the sign with pressure sensitive, permanent acrylic adhesive.


- e. Sign paint colors (manufacturer’s numbers/types listed below for color identification only)
 - 1) Blue = Pantone 661C
 - 2) White = Bright White
 - 3) Red = Pantone 485C
- f. City of Bryan logo must retain proportions and design integrity. City of Bryan logos in electronic format may be obtained from the City of Bryan.

3" Radius, 1.25" Border, 0.75" Indent, Blue on White;
 [City of Bryan Logo] 32" x 38" (see Logo Detail)
 [OLD RELIANCE] Series D
 [RD WIDENING] Series D
 [PROJECT NO. 332-D3-0734] Series D
 [2008 CIP PROGRAM] Series D
 [For Information Call: 979-209-5030] Series D
 [www.bryantx.gov] Series D

Colors:
 [B symbol] blue
 [star symbol] red
 [CITY OF BRYAN] black (font)
 [The Good Life, Texas Style.] black (font)

NOT FOR CONSTRUCTION BIDDING OR PERMIT PURPOSES
 DALE L. PICHA, P.E., PTOE
 SERIAL NO. TX 85552

NOTE: ALL DIMENSIONS ARE IN INCHES

CIP Sign Details		 CITY OF BRYAN <small>The Good Life, Texas Style.</small>	This seal appearing on this document was authorized by Dale L. Picha, P.E., PTOE. Alteration of a sealed document without proper notification to the responsible engineer is an offense under the Texas Engineering Practice Act.	SHEET <div style="font-size: 2em; font-weight: bold; margin: 0;">1</div> of 1
DRAWN BY:	DATE:			SCALE:
Old Reliance Rd Widening CITY JOB NO. 332-D3-0734				

Example of Prescribed Image for CIP Project Identification Signs

SECTION 01 71 13

MOBILIZATION

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This item shall govern for the establishment of office and other facilities at the project site and the movement of personnel, construction equipment and supplies to the project site or to the vicinity of the project site in order to enable the Contractor to begin work on the other contract items that will be performed by the Contractor. The cost of the payment bond and performance bond on projects that cannot begin because of a closed construction season or for the convenience of the City will be considered part of the mobilization item under this contract.

1.2 MEASUREMENT AND PAYMENT

- A. This Item will be measured by the "Lump Sum", as the work progresses.
- B. Partial payments of the "Lump Sum" bid for mobilization will be as follows. The adjusted contract amount for construction items as used below is defined as the total contract amount less the lump sum bid for Mobilization.
 - 1. Upon presentation of a paid invoice for the payment bond, performance bond and/or required insurance, the Contractor will be paid that cost from the amount bid for mobilization.
 - 2. When 1% of the adjusted contract amount for construction items is earned, 50% of the mobilization lump sum bid or 5% of the total contract amount, whichever is less, will be paid. Previous payments under this Item will be deducted from this amount.
 - 3. When 5% of the adjusted contract amount for construction items is earned, 75% of the mobilization lump sum bid or 10% of the total contract amount, whichever is less, will be paid. Previous payments under this Item will be deducted from this amount.
 - 4. When 10% of the adjusted contract amount for construction items is earned, 90% of the mobilization lump sum bid or 10% of the total contract amount, whichever is less, will be paid. Previous payments under this Item will be deducted from this amount.
 - 5. Payment for the remainder of the lump sum bid for "Mobilization" will be made on the next monthly estimate cycle after the retainage estimate.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

N/A

END OF SECTION

SECTION 01 71 23

CONSTRUCTION SURVEYING

PART 1 - GENERAL

1.1 DESCRIPTION

This item shall govern the performance of construction staking including all labor, materials, submittals, tools and equipment necessary to perform all construction layout, control and reference staking for satisfactory completion of the project.

1.2 SURVEY REFERENCE POINTS

- A. Known basic horizontal and vertical control points for the Project are indicated.
- B. Locate and protect survey control points prior to starting site work, and preserve all permanent reference points during construction.
- C. Notify ENGINEER in writing within 24-hours of any survey work changes or clarifications required for Project. Secure written authorization prior to making any changes or relocations.
- D. Report in writing when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- E. Replace construction stakes damaged or destroyed by CONTRACTOR at no additional cost to OWNER.

1.3 MEASUREMENT AND PAYMENT

Measurement and payment for this item shall be based on a lump sum for construction staking completed in accordance with these specifications and shall include all labor, materials, testing, submittals, tools and equipment necessary to complete the work as specified. Partial payments will be made for this item based on the percentage completed of the overall work, as determined by the Engineer.

---OR---

All costs associated with surveying shall be subsidiary to the various bid items.

1.4 SUBMITTALS

- A. Prior to contract closeout submit:
 - 1. Documentation to verify accuracy of survey work.
 - 2. When required by Laws and Regulations, submit a certificate signed by a licensed professional certifying that elevations and locations of improvements conform with the Contract Documents.
 - 3. All survey data, survey information showing dimensions, location angles and elevations of construction are shown on contract record documents.

PART 2 - PRODUCTS

Hubs shall be 1-1/2 inch x 1-1/2 inch x 16 inch oak and witness stakes shall be 1 inch x 1 inch x 36 inch oak or other hardwood.

---OR---

N/A

PART 3 - EXECUTION**3.1 PROJECT SURVEY REQUIREMENTS**

- A. Any work done without line and grade established by CONTRACTOR is at CONTRACTOR's own risk.
- B. Hubs with tacks shall be used for all control points, centerline or baseline offsets and structure stakeout and shall be accompanied by witness stakes marked with the pertinent information. For supplemental stakeout only, witness stakes alone may be used. For laser grade control and the verification of the laser elevation a hub with witness shall be provided.
- C. All staking shall be performed under the direct supervision of a Registered Public Land Surveyor licensed by the State of Texas.
- D. The surveyor shall submit certified cut sheets to the City Engineer within twenty (24) hours of performing staking. All stakes shall be set on an offset that will be clear of the excavation of the intended facility. All cut sheets shall identify benchmarks used, benchmark elevations, actual hub elevations, proposed elevations and cuts or fills for all entries. The Contractor and Project Representative for the City shall have cut sheets in hand prior to construction.
- E. If impacted during construction activities, each removed marker shall be re-established by the Contractor's surveyor.
- F. Minimum staking requirements are as follows:
 - a. Rough Grade Stakes for Lot Grading – Provide stakes at all corners.
 - b. Sanitary Sewer Lines
 - i. Line and grade stakes shall be set every 25' for the first 100' out of the downstream manhole, and every 100' thereafter to the next manhole. Stakes shall be set on centerline stationing.
 - ii. A line reference stake shall be set for each manhole location.
 - iii. Wye locations, stationed from the downstream manhole, shall be staked and the stationing shown on the cut sheets.
 - iv. Proposed elevations of service inverts at 15' past the right-of-way line or end of service shall be staked and shown on the cut sheets.
 - v. Proposed structure top elevation and upstream and downstream invert elevations shall be shown on the cut sheets (manhole castings shall be set 0.05' below finished street grade).
 - c. Water Mains
 - i. Line and grade stakes shall be set every 100' on centerline stationing.
 - ii. Fitting locations shall be staked and the stationing shown on the cut sheets.

- iii. Line and grade stakes shall be set for all hydrants (normally, the top of the operating nut shall be set 18”-24” above the top of curb). A line reference stake shall be set for each hydrant location.
 - iv. Proposed elevations of the tops of curb boxes shall be staked and shown on the cut sheets. Line reference stakes shall be set for curb box locations.
- d. Storm Sewer
- i. Line and grade stakes shall be set every 25’ for the first 100’ out of the downstream manhole, and every 100’ thereafter to the next manhole or catch basin.
 - ii. An offset hub and line reference stake to back of curb shall be set for all catch basins and catch basin manholes.
 - iii. Catch basin top, invert elevations, manhole top elevation and upstream & downstream invert elevations shall be shown on the cut sheets.
 - iv. Line and grade shall be set every 25’ from the downstream structure for all drain tile.
 - v. Wye locations, cleanouts stationed from downstream structure shall be staked.
 - vi. An offset hub and line reference stake to end of drain tile service stub.
- e. Streets
- i. Set stakes to roadway centerline and edge of pavement at 50’ intervals, all grade breaks, and at ¼ points on vertical curves for roadway subgrade.
 - ii. When centerline stakes are set for grading subgrade, cut sheets shall be provided (unless blue tops are set).
 - iii. Set stakes at finish rock grade at 50’ intervals on center of the roadway. For roadways with a raised median island, stakes are required for the roadway on each side of the median.
 - iv. Line and grade stakes shall be set every 25’ and for all begin, mid and end rad points at all street intersections.
 - v. Set stakes at 25’ intervals, at BC and EC for all curvilinear alignment and at midpoint of curb returns.
 - vi. Cut sheets shall be provided for all curb and gutter construction.
- f. Retaining/Sound Walls
- i. Set stakes at 50’ intervals on centerline stationing. At all top and bottom of steps in the footing and wall.

END OF SECTION

SECTION 02 41 13.13

REMOVAL OF EXISTING CONCRETE**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This item shall consist of breaking up, removing and satisfactorily disposing of existing pavement along the right-of-way or at locations shown on the Plans.

1.2 MEASUREMENT AND PAYMENT

- A. Existing pavement, concrete sidewalk and driveways, removed as prescribed above will be measured by the square yard in its original position, regardless of its thickness or the depth of covering.
- B. Existing combined concrete curb and gutter and concrete curb, removed as prescribed above, will be measured by the linear foot in its original position, regardless of its thickness or the dimensions of same.
- C. The work performed as prescribed by this item and measured as provided under "Measurement", will be paid for at the unit price bid for "Removal of Existing Concrete" (of the type specified), which price shall be full compensation for breaking up of the concrete, loading, hauling, unloading and satisfactorily storing or disposing of the material. Payment shall include all labor, tools and equipment to complete the work. Payment will not be made for unauthorized work.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION**3.1 CONSTRUCTION METHODS**

- A. Existing pavement (with or without bituminous top), sidewalk, driveway, curb, or combined curb and gutter shall be broken up into pieces not greater than eighteen (18) inches in any dimension by air-driven machinery or other suitable means. The use of explosives will not be permitted.
- B. Where only a portion of the existing concrete is to be removed, special care shall be exercised to avoid damage to that portion of the concrete to remain in place. The existing concrete shall be cut to the neat lines shown on the Plans or established by the Engineer. Any existing concrete beyond the neat lines so established which is damaged or destroyed by these operations shall be replaced at the Contractor's expense.
- C. Existing pavement, which is to be removed, shall be loaded, hauled and neatly stored at designated sites, or otherwise disposed of as directed by the Engineer. Work performed under this item shall be inaugurated at such times and prosecuted in such manner as to cause minimum inconvenience to traffic or to the owners of adjacent property.

END OF SECTION

SECTION 03 30 00**CONCRETE**

(Sentences and/or paragraphs that are double underlined indicate revisions that were made from the 2009 specification.)

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. This specification shall govern for Portland cement concrete to be used in concrete pavement, concrete structures and other concrete construction. All concrete shall be from a NRMCA certified plant.

1.2 MEASUREMENT AND PAYMENT

- A. In general and unless otherwise specified, no separate payment will be made for concrete as an item. The cost of concrete including all materials and equipment, furnishing and placing all reinforcing steel, and performing all labor for the manufacturing, transporting, placing, finishing, and curing of concrete will be included in the unit price bid for specific items as set forth in the Proposal. Payment will not be made for unauthorized work.

1.3 SUBMITTALS

List of Admixtures proposed
 Concrete Mix Designs and three sets of tests on the mix designs submitted.
 Certification for cement conformance to specification
 Test reports for all required concrete tests
 Mill report/Certifications for all Reinforcing Bar.
 Material Data on Control, Expansion and Contraction Joint materials and sealants.
Provide a current NRMCA plant certification

PART 2 – PRODUCTS**2.1 MATERIALS****A. PORTLAND CEMENT:**

Cement shall be Type I, II or III Portland Cement conforming to ASTM C150, or Type IA, IIA or IIIA, conforming to ASTM C175 except as noted below.

1. Different types of cement, as prescribed above may be used in the same structure, but all cement used in any one monolithic placement shall be of the same type and brand.
2. Type III cement shall not be used when the anticipated air temperature for the succeeding 12 hours will exceed 60° F.

B. FLY ASH:

Fly Ash shall be Type C or F Fly Ash in accordance with ASTM C618. When fly ash is used, “cement” shall be defined as “cement plus fly ash”. “Cement plus fly ash” shall be composed of Type I, II or III Portland cement up to 25 percent fly ash by weight of cementitious materials.

C. AGGREGATE:

1. Concrete aggregate shall conform to all requirements of Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (2004) Section 421.2 E 1, 2 and 3, and ASTM C33.
2. The maximum size of aggregate shall not be larger than one-fifth of the narrowest dimension between forms of the member for which concrete is to be used nor larger than three-fourths of the minimum clear spacing between reinforcing bars.

D. WATER:

Water for use in concrete and for curing shall be from municipal supplies approved by the Texas Commission on Environmental Quality and Texas Department of Health or shall have a maximum concentration of 50,000 ppm of total suspended solids according to AASHTO T26 for quality of water and conform to ASTM 1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

E. REINFORCING STEEL:

1. The reinforcing steel shall be Grade 60.
2. Steel reinforcing bars as required, shall be of the type and size as shown on Plans and shall be open hearth new billet steel of structural, intermediate, or hard grade, or shall be rail steel concrete reinforcement bars. All steel shall be bent cold.
3. New billet steel shall conform to the requirements of the Standard Specifications for Billet-Steel Concrete Reinforcement Bars, ASTM Designation A-15.
4. When fabricated steel bar or rod mats are specified, the mats shall meet the current requirements of specifications for Fabricated Steel Bar or Rod Mats for Concrete Reinforcement ASTM Designation A-184.
5. In the event reinforcing bars manufactured outside of the Continental United States or its territories are used, two sets of tests from an independent testing laboratory acceptable to the Engineer shall be submitted showing that the steel meets the ASTM Standards for tensile strength, phosphorus content, bend, deformations and such other requirements outlined in the ASTM Standards for the grade used. These tests shall be made by and independent testing laboratory at the Contractor's expense and shall be submitted for each 25 tons of steel supplied from each individual mill.
6. At the time of placement in the concrete, reinforcing steel shall be free of dirt, loose rust, mill scale, paint, grease, oil or other deleterious materials that would impair the bonding of the concrete to the steel.
7. Reinforcement shall be accurately positioned and, unless otherwise shown or specified, shall be secured against displacement by using at intersection, annealed iron wire of not less than No. 18 gauge or suitable metal clips. It shall be supported by plastic or metal chairs or spacers. In general, reinforcement shall be placed, spliced, lapped, located, etc., in accordance with the recommendations of the Concrete Reinforcement Steel Institute or Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (2004) Section 440.

8. Under no circumstances shall reinforcing steel or dowel bars be “stabbed” into fresh concrete. When reinforcing steel or dowel bars are required to extend beyond the slip-formed surface, holes shall be drilled and the steel shall be epoxyed into place using a pre-approved epoxy.

F. STORAGE OF MATERIALS:

1. All cement, fly ash and mineral filler shall be stored in well-ventilated weatherproof buildings or pre-approved bins, which will protect them from dampness or absorption of moisture.
2. The method of handling and storing concrete aggregates shall prevent contamination with foreign materials. To assure uniform concrete, aggregate stockpiles shall be maintained at reasonably uniform moisture content.

2.2 TESTING REQUIREMENTS

A. CONCRETE QUALITY AND ALLOWABLE STRESSES

1. Concrete Quality:

Concrete mixes will be designed and made in sufficient number to represent the required water-cement ratios. These mixes shall comply with the requirements prescribed for strength and consistency as shown below. The Contractor shall furnish the results on trial mixes from a testing laboratory pre-approved by the Engineer.

Minimum Compressive Strength, psi at 28 days	Minimum Cement Content Sack/cubic yard	Maximum Water Content Gal/sack of cement	General Usage
1,500	3.0	11.0	Riprap
3,000	4.5	6.0	Drilled <u>Pier</u> , Inlets; Manholes; Headwalls; Sidewalks; Driveways;
3,500	5.0	6.0	Concrete Pavement; curb and gutters
4,000	5.5	5.0	Bridge slab; Culverts

The slump of concrete mixtures shall be within the following limits when measured according to "Test for Slump of Portland Cement Concrete" (ASTM C142). When admixtures are used to increase the workability, the mix design shall indicate the slump before and after its introduction into the mix.

TYPE OF CONSTRUCTION	COMPRESSIVE STRENGTH OF CONCRETE, psi	MAXIMUM SLUMP (before admixtures)
Concrete Pavement	3,500	3"
Curb and Gutter	3,500	3"
Sidewalk	3,000	5"
Drilled <u>Piers</u>	3,000	7"
Thin Walled Sections (9" or less)	3,000	5"
Thick Walls	By Special Design	

B. TESTS ON CONCRETE

1. During the progress of the work, compression test specimens shall be made and cured in accordance with "Standard Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field" (ASTM C31). Not less than three specimens shall be made for each test, nor less than one test for each 50 cubic yards or fraction thereof of concrete placed or for each day's pour. These tests shall be made by an independent testing laboratory at the Owner's expense.
2. Specimens shall be tested in accordance with "Standard Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C39).
3. The standard age of test shall be 7 days and 28 days.
4. If the average strength of the control cylinders for any portion of the structure falls below the specified compressive strength, the Engineer shall have the right to order changes in the proportions or the cement content for the remaining portion of the structure. If the concrete minimum 28 day strength is not achieved the Engineer shall have the right to order its removal.
5. An air-entraining admixture may be used with Type I, II, or III Portland Cement in lieu of an Air-Entraining Portland Cement. The admixture shall meet the requirements of "Specifications for Air-Entraining Admixtures for Concrete" (ASTM C260). Concrete produced from either Type IA, IIA, or IIIA cement or the use of air-entraining admixtures shall have an air content from 3 to 5 percent when determined by means of the test for air-content, ASTM C231.

C. TEST CYLINDERS

Preparation of test cylinders and tests on concrete cylinders shall be made at the expense of the Owner. The cost of all failed tests shall be charged to the Contractor.

PART 3 – EXECUTION

3.1 CONSTRUCTION METHODS

A. PREPARATION OF EQUIPMENT AND PLACE OF DEPOSIT:

1. Before placing concrete, all equipment for mixing and transporting the concrete shall be cleaned. All debris shall be removed from the place to be occupied by the concrete.
2. Water shall be removed from place of deposit before concrete is placed unless otherwise permitted by the Engineer.

B. MIXING OF CONCRETE

1. The concrete shall be mixed until there is a uniform distribution of materials and shall be discharged completely, before the mixer is recharged.
2. For job-mixed concrete, the mixer shall be rotated at a speed recommended by the manufacturer. Mixing shall be continued at least one (1) minute after all materials are in the mixer. Job-mixed concrete shall be rejected and disposed of as directed if not placed as prescribed within thirty (30) minutes after beginning of mixing. Job-mixed concrete is only allowed with written approval from the City Engineer 72-hours prior to the pour.
3. Ready-mixed concrete shall be measured, mixed and delivered in accordance with the requirements set forth in "Standard Specifications for Ready-Mixed Concrete" (ASTM C-94).

C. CONVEYING

1. Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of the materials.
2. Equipment for chuting, pumping, and pneumatically conveying concrete shall be of a size and design to insure a continuous flow of the concrete at the delivery point, without separation of the materials.

D. TRANSPORTATION EQUIPMENT

Transportation of concrete mixed completely in a stationary mixer, from the mixer to the point of placement, shall be by truck agitator, or in a truck mixer operating at agitator speed, or in non-agitating equipment conforming to ASTM Standard C-94 except as modified herein. Truck agitators, truck mixers, and non-agitating equipment shall be capable of delivering concrete without segregation in transit. Slump tests of individual samples taken at approximately the one-quarter and three-quarter points of the load during discharge shall not vary by more than 1 inch. Vehicles transporting concrete mixed partially or completely in stationary mixers shall be equipped with discharge chutes or other devices when operating outside of the prepared subgrade, or shall be supplemented by additional transfer equipment capable of discharging or transferring the concrete from the transporting vehicle to its final position in the form without segregation.

E. FACILITIES FOR SAMPLING

Suitable facilities shall be provided for readily obtaining representative samples of aggregate from each of the bins or compartments for test purposes. Suitable facilities shall be provided for obtaining representative samples of concrete for uniformity tests. All necessary platforms, tools, and equipment for obtaining samples shall be furnished by the Contractor.

F. PLACING CONCRETE

1. The Contractor shall give the Engineer a minimum 24 hours advance notice before placing concrete to permit the inspection of forms, reinforcing steel placement and other preparations.
2. Concrete placement will not be permitted when impending weather conditions would impair the quality of the finished work.
3. Transporting Time: The maximum time interval between the addition of cement to the batch and the placing of concrete in the forms shall conform to the requirements below:

Concrete Temp (at point of placement)	Max Time (No Retarding Agent Minutes)	Max Time (with Retarding Agent) Minutes
Non-Agitated Concrete		
Above 80 F	15	30
80 F and Below	30	45
Agitated Concrete		
Above 90 F	45	75
Above 75 F thru 90 F	60	90
75 F and Below	90	120

4. All forms, sub grade and steel shall be dampened before placement of concrete to assist with retaining moisture in the concrete.
5. Cold Weather Precautions:

Concrete shall not be placed when the ambient temperature is below 40° F and falling. Concrete may be placed when the ambient temperature is above 35° F and rising, the ambient temperature being taken in the shade and away from artificial heat. Concrete shall not be placed when the forecast predicts 72 continuous hours of temperatures less than 32° F.

The Contractor shall have available a sufficient supply of pre-approved cotton mats, polyethylene sheeting or other pre-approved covering materials to immediately protect concrete if the air temperature falls to 32° F, or below, before concrete has been in place for less than four (4) hours. Such protection shall remain in place during the period the temperature continues below 32° F, or for a period of not more than five (5) days. Neither salt nor other chemical admixtures shall be added to the concrete to prevent freezing. The Contractor shall be responsible for the quality and strength of concrete under cold weather conditions and any concrete damaged by freezing shall be removed and replaced at the Contractor's expense.

The surface of all concrete in bents, piers, culvert walls, retaining walls, bottom of slabs, and similar formed concrete shall be maintained at 40° F or above for a period of 72 hours from the time of placements. The temperature of all concrete, including the bottom slabs (footings) of culverts placed on or in the ground, shall be maintained above 32° F for a period of 72 hours from time of placement.

Protection shall consist of providing additional covering, insulated forms or other means, and if necessary, supplementing such coverings with artificial heating.

6. Warm Weather Precautions

The following precautions shall be taken in placing, curing, and protecting the concrete when local weather records show that the maximum daily temperature is likely to exceed 95° F. The forms and the subgrade, subbase or base course shall be sprinkled with water immediately before placing the concrete. The concrete shall be placed at the coolest temperature practicable, and in no case shall the temperature of the concrete exceed 95° F when deposited on the subgrade, subbase or base course. The temperature of the concrete shall not exceed 85° F for bridge slabs or in the top slab of direct-traffic culverts. The aggregates and/or mixing water will be cooled as necessary to maintain the concrete temperature within the specified maximum. Concrete shall be placed in the forms continuously and rapidly at a rate of not less than 100 feet of paving lane per hour. The surface of the newly laid pavement shall be kept damp by means of a water fog or mist applied with pre-approved spraying equipment until the pavement is covered by the pre-approved curing medium.

7. Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. The deposition shall be at a rate that allows the concrete to be plastic at all times and permits flow readily into the space between the rebar. Retempered concrete shall not be used and concrete shall not have a free fall of more than five (5) feet, except in the case of thin walls such as in culverts or as specified in other items. Any hardened concrete spatter ahead of the plastic concrete shall be removed.
8. Concrete deposition shall be a continuous operation until completed at the panel or section. Cold joints in a monolithic placement shall be avoided. The sequence of successive layers or adjacent portions of concrete shall be such that they can be vibrated into a homogeneous mass with the previously placed concrete. Not more than one (1) hour shall elapse between adjacent or successive placements of concrete.
9. Concrete shall be thoroughly consolidated and vibrated in the forms with pre-approved mechanical vibrators of a type considered in the design of forms.

G. FINISHING

Unless noted otherwise, apply an ordinary surface finish as the final finish to the following exposed surfaces:

- inside and top of inlets,
- inside and top of manholes,
- inside of sewer appurtenances,
- inside of culvert barrels, bottom of bridge slabs between girders and beams, and
- vertical and bottom surfaces of interior concrete beams or girders.

An ordinary surface finish shall be as follows:

- Chip away all loose or broken material to sound concrete where porous, spalled, or honeycombed areas are visible after form removal.
- Repair spalls by saw-cutting and chipping at least 1/2 in. deep, perpendicular to the surface to eliminate feather edges. Repair shallow cavities using a latex adhesive grout, cement mortar, or epoxy mortar as pre-approved. Repair large areas using concrete as directed or pre-approved.
- Clean and fill holes or spalls caused by the removal of form ties, etc., with latex grout, cement grout, or epoxy grout as pre-approved. Fill only the holes. Do not blend the

patch with the surrounding concrete. On surfaces to receive a rub finish in accordance with Item 427, “Surface Finishes for Concrete,” chip out exposed parts of metal chairs to a depth of 1/2 in. and repair the surface.

- Remove all fins, runs, drips, or mortar from surfaces that will be exposed. Smooth all form marks and chamfer edges by grinding or dry-rubbing.
- Ensure that all repairs are dense, well bonded, and properly cured. Finish exposed large repairs to blend with the surrounding concrete where a higher class of finish is not specified.

Finish of Bridge Slabs and related features shall be in compliance with TxDOT Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (2004) Section 420.4.

F. CURING

The concrete shall be kept wet by spraying with water after attaining its final set and before removing the forms. Bottom forms supporting floor or roof slabs shall remain in place for not less than seven (7) days. The concrete shall have attained a compressive strength of not less than 2,000 psi prior to removal of bottom forms. All other forms may be removed twenty-four hours after completion of concrete placement, providing the weather has allowed the concrete to attain its final set in less than five (5) hours. The forms shall be left on for forty-eight (48) hours whenever the temperature of the air in the shade during pouring is 90° F or over. Curing shall be continued for five days after placement of concrete. This may be done with wet mats, with two applications of Type II (White in color) Liquid-Membrane-Forming Compound meeting requirements of ASTM C309, or with waterproof curing paper meeting the requirements of ASTM C171.

G. CONSTRUCTION JOINTS

Construction joints will be made only at locations shown on the Plans unless written permission is granted by the Engineer to make additional joints. Unless otherwise required, make construction joints square and normal to the forms. Use bulkheads in the forms for all vertical joints. Thoroughly roughen the top surface of a concrete placement terminating at a horizontal construction joint as soon as practical after initial set is attained. Thoroughly clean the hardened concrete surface of all loose material, laitance, dirt, and foreign matter. The surface is to be dampened just prior to casting of concrete against the joint.

END OF SECTION

SECTION 03 30 01

CONCRETE BLOCKING OR ANCHORAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section covers the manufacture of materials and installation of concrete blocking or anchorage for thrust resistance. Concrete blocking shall be placed at bends, tees, crosses, fire hydrants, plugs, etc. in the supply line. Blocking shall also be installed for blow-offs as shown on the plans or as directed by the Engineer.

1.2 MEASUREMENT AND PAYMENT

- A. Restrained joints, fittings, and concrete blocking shall not be a separate bid item. Cost for work herein specified, including the furnishing of all materials, equipment, labor, and incidentals necessary to complete the work, shall be included in the unit price for water or sanitary sewer lines in place.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Cement shall conform to the current ASTM C150 standard and be Type I.
- B. Aggregates shall conform to the current ASTM C33 standard.
- C. Concrete strength shall be at least 2,000 psi at twenty-eight (28) days, unless otherwise shown on the plans. Concrete for blocking shall be of a quality and placed in accordance with SECTION 03 30 00 – CONCRETE. The concrete for blocking shall be class 2,000 psi concrete (class “C”).
- D. 3,000 psi sack-crete may be used but must be hydrated prior to placement.

PART 3 – EXECUTION

3.1 CONSTRUCTION METHODS

A. THRUST RESTRAINT

1. Hydrants

The bowl of each hydrant shall be well braced against a sufficient area of unexcavated earth at the end of the trench with concrete blocking, or it shall be tied to the pipe with restrained joints as shown or directed by the City.

Tie rods, clamps, or other components of dissimilar metal shall be protected against corrosion by encasement of the entire assembly with 8-mil thick, loose polyethylene film in accordance with AWWA C105.

Thrust restraint design pressure should be equal to 200 psi.

2. Fittings

The contractor shall install concrete blocking **and** retaining glands to all tees, Y-branches, bends deflecting eleven and one-fourth degrees ($11\frac{1}{4}^{\circ}$) or more, and plugs which are subject to internal pressure in excess of 10 psi. to preclude separation of joints.

If stainless steel is not used, the contractor shall protect from corrosion all steel clamps, rods, and other metal accessories used in reaction anchorages, or joint harnesses subject to submergence, or in direct contact with earth and not encased in concrete with epoxy coating or wrapped with 8 mil. polyethylene film. All bolts and nuts shall be 316 Stainless Steel.

3. Restraint Materials

Vertical and horizontal reaction blocking shall be made of concrete having a compressive strength of not less than 2,000 psi after twenty-eight (28) days.

Blocking shall be placed between solid ground and the fitting to be anchored; the area of bearing in the pipe and on the ground in each instance shall be that shown on the plans or directed by the City. The blocking shall, unless otherwise shown or directed, be so located as to contain the resultant thrust force, and so that the pipe and fitting joints will be accessible for repair.

Mechanical joints utilizing set-screw retainer glands (DIP only, use Megalug or pre-approved equal for PVC), or metal harness of tie rods or clamps shall be used **in addition to** concrete blocking. Components of dissimilar metal shall be protected against corrosion by encasement of the entire assembly with 8-mil thick, loose polyethylene film in accordance with AWWA C105.

B. PLACING CONCRETE BLOCKING

Extend 2,000 psi concrete blocking from the fitting to solid, undisturbed earth and install so that all joints are accessible for repair. The bearing area shall be as shown on the plans. If no details regarding blocking are shown on the plans, provide enough concrete bearing against the ditch to limit soil loading to 200 psf from the thrust produced at an internal pressure in the pipe of 200 psi.

Concrete shall not be placed unless all pipes, valves, fittings, forms, and reinforcement have been inspected.

Handle all concrete in such a manner to avoid segregation, separation, or loss of ingredient, or the displacement of piping, etc.

Place concrete in continuous horizontal layers not exceeding 24". Place each layer quickly enough so that the previously placed concrete is still plastic when the next layer is placed. Provide any construction joints that are necessary.

Before beginning the placement of concrete, inspect all forms, pipes, fittings, valves, etc. for alignment and rigidity. Tighten all supports and make corrections to alignment as required. Inspect all reinforcement, if any, for placement and rigidity.

Do not begin placing concrete until all forms and reinforcement have been inspected by the Engineer.

Clean all loose dirt, mud, water, and debris from the trench and forms. All surface encrusted with hardened concrete from previous placement operations shall be clean.

Clean all pipe, fittings, valves, etc. projecting from previously placed concrete before placing new concrete.

Accurately and securely place all embedded items.

END OF SECTION

SECTION 03 34 00

FLOWABLE FILL EXISTING LINE

(Sentences and/or paragraphs that are double underlined indicate revisions that were made from the 2009 specification.)

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. This item shall govern the flowable mortar filling of existing lines where specified and/or shown on the Plans. All work shall conform to this specification

1.2 MEASUREMENT AND PAYMENT

- A. Where “Flowable Fill Existing Line” is measured for payment the unit of measurement will be linear feet of line grouted, complete and in place. Payment shall be at the unit price bid in the Proposal. Unless otherwise specified or directed, flowable mortar will not be measured as pay quantities but will be included in the unit price bid for the specific item or items into which they are incorporated as set forth in the bid Proposal. The price for this item shall be full compensation for furnishing all equipment, labor, materials, tools and incidentals necessary to complete the work.

1.3 SUBMITTALS

- A. Mix Design
B. Work Plan

PART 2 – PRODUCTS**2.1 MATERIALS**

- A. Materials shall conform to SECTION 04 05 12 - MORTAR AND GROUT

PART 3 – EXECUTION**3.1 CONSTRUCTION METHODS****A. EXECUTION**

Prior to filling the line with flowable fill material, the Contractor shall verify that no live services remain connected to the line. Services found during this procedure shall be paid for using the “Sanitary Sewer Service” item. All live services shall be reconnected to an adjoining main line.

“Flowable Fill Existing Line” shall require that an existing underground conduit (pipe, waterline, sewer line, storm drain line, etc.) be completely filled with a low strength flowable mortar. In order to achieve this, the flowable mortar to be pumped into the line shall have a consistency that will permit forced flow into the entire length of line. Blocking the line by intermediate excavation and gravity flow concrete or grout is NOT acceptable. The existing

line to be filled with flowable mortar shall be exposed and plugged with concrete bulkheads at both ends. In some cases this will require the excavation of the existing line and that the pipe be broken open. 3" Schedule 40 PVC shall extend through the bulkhead and using a 90 degree elbow extend up to the surface on both ends of the line to be grouted. The flowable mortar shall be pumped through the 3" PVC until the flowable mortar is visible at the other end of the conduit through the 3" PVC. No more than 15 psi shall be used to pump the flowable mortar mixture, and care should be used to avoid filling adjoining voids with the flowable fill material.

B. ALTERNATE EXECUTION

At the option of the Contractor, the existing line may be removed from the ground and disposed of properly. Hazardous materials removed from the ground shall require a receipt from a site certified to accept hazardous material. When this option is used, the surface must be restored to existing or better condition per the drawing details for trench embedment. Restoration of the trench and surface is subsidiary to the price of "Flowable Fill Existing Line."

C. COMPOSITION

The proportions by volume or weight of cement, fine aggregate and water shall produce a plastic mixture. The degree of workability shall be consistent with the use to which the mixture is placed, and shall be pre-approved by the Engineer. The mix shall contain no coarse or medium aggregates and shall contain at least two sacks of cement per cubic yard of grout.

D. EQUIPMENT

All equipment, tools and machinery used in handling and mixing flowable mortar shall meet the approval of the Engineer. Flowable mortar shall be machine mixed in a batch type mixer.

E. REJECTION

"Flowable Fill Existing Line" may be rejected for failure to meet any of the requirements of the Specifications, and specifically for:

1. Failure to successfully pump flowable mortar to the other end of the line.
2. Flowable mortar attaining initial set before use.
3. Improper mixing.

If the flowable mortar is rejected because of "A", all line not filled shall be removed from the ground and the trench repaired per the drawing details for trench embedment at the Contractor's expense.

END OF SECTION

SECTION 04 05 12
MORTAR AND GROUT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Mortar and grout where specified and/or shown on the Plans shall conform to this section of the Specifications. Mortar and grout shall be designated by type as set forth. The uses and purposes of said types shall be consistent with the uses and purposes as designated. For grout filling existing lines please refer to SECTION 03 34 00 – GROUT FILL EXISTING LINE.

1.2 MEASUREMENT AND PAYMENT

- A. Where mortar and/or grout are measured for payment the unit of measurement will be cubic yards of mortar and/or grout, complete and in place. Payment shall be at the unit price bid in the Proposal. However, unless otherwise specified or directed, mortar and/or grout will not be measured as pay quantities but will be included in the unit price bid for the specific item or items into which they are incorporated as set forth in the bid proposal.

1.3 SUBMITTALS

- A. Mix Design

PART 2 – PRODUCTS

2.1 MATERIALS

- A. MASONRY MORTAR shall be composed of fine aggregate thoroughly mixed with cement and water. The mixture produced shall be homogeneous with a consistency required for ease of handling and spreading by a trowel.
- B. STANDARD GROUT shall have a consistency that will permit flow into the joints, completely filling them.
- C. PIPE JOINT MORTAR shall have consistency and workability for use as dictated by accepted practices and/or as required for specific job conditions.
- D. NEAT CEMENT GROUT shall be composed of Portland Cement and water mixed to the consistency required for specific job conditions.

2.2 TESTING REQUIRMENTS

Mortar and grout may be rejected for failure to meet any of the requirements of the Specifications, and specifically for:

- A. Retempered mortar and/or grout.
- B. Mortar and grout attaining initial set before use.
- C. Improper mixing.
- D. Mortar and grout containing frozen aggregates.

- E. Mortar and grout subjected to freezing within three (3) days after being placed in the work.

PART 3 – EXECUTION

3.1 CONSTRUCTION METHODS

The proportions by volume or weight of cement, fine aggregate and water shall produce a plastic mixture. The degree of workability shall be consistent with the use to which the mixture is placed, and shall be pre-approved by the Engineer.

- A. **CEMENT:** Cement used in mortar and grout shall be Type I or Type III Portland Cement which shall conform to the current ASTM Designation C-150.

- B. **FINE AGGREGATE:** Fine aggregate to be used in mortar and grout shall consist of sand or a mixture of sands, with or without a mineral filler. The sand or mixture of sands in fine aggregate shall consist of clean, hard, durable, uncoated grains, free from lumps. Fine aggregate shall not contain deleterious substances in excess of the following percentages by weight:

- Material removed by decantation 3.0%
- Clay lumps..... 0.5%
- Other deleterious substances 2.0%
- (such as coal, shale, coated grains, and soft, flaky particles)

Fine aggregate shall be free from an excess of harmful salts or alkali. When subjected to the color test for organic impurities the sand or mixture of sands shall not show a color darker than the standard color. The fine aggregate shall be well graded from coarse to fine, and when tested by laboratory methods shall meet the following requirements for percentages by weight:

- Retained on 3/8 inch screen 0%
- Retained on 1/4 inch screen 0 - 5%
- Retained on No. 20 mesh sieve 15 - 50%
- Retained on No. 100 mesh sieve..... 85 - 100%

Combining two sands of different gradations may be the most economical way to meet these specifications. If this is done, each sand shall be separately and accurately measured by volume or weight in such proportions as the Engineer may direct. Sands and mineral filler shall not be mixed prior to batching. Mineral filler and the use of it shall be pre-approved by the Engineer. In no case shall the added amount of mineral filler exceed ten (10) percent of the weight of the fine aggregate. The mineral filler, when tested by laboratory methods, shall meet the following percentages by weight:

- Retained on No. 20 mesh sieve 0%
- Retained on No. 30 mesh sieve 0 - 5%
- Retained on No. 100 mesh sieve..... 0 - 30%

- C. **WATER:** Water for use in mortar and grout shall be reasonably clean and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances. Water suitable for drinking or ordinary household uses may be considered acceptable for use in mortar and grout.

D. EQUIPMENT

All equipment, tools and machinery used in handling and mixing mortar and grout shall meet the approval of the Engineer. Mortar and grout shall be machine mixed when the amount required justifies machine mixing. Machine mixers shall be of the batch type.

E. MIXING

Mortar and grout shall be mixed only in the quantities required for immediate use. Where machine mixing is indicated or directed, the fine aggregate along with the cement and water shall be measured separately, introduced into the mixer, and mixed for a period of time of not less than one and one-half (1 1/2) minutes. This is the time measured from the entry of the last aggregate into the drum until the discharging of mortar or grout. The required water shall be introduced into the mixing drum during the first fifteen (15) seconds of mixing. The entire contents of the drum shall be discharged before introducing any materials for the succeeding batch. Any hand mixing as pre-approved by the Engineer shall be done in a pre-approved watertight box, and the sequence of mixing operations shall be as follows:

1. The box shall first be filled with the required amount of sand; the sand shall be leveled with the required amount of cement spread uniformly on top of the sand; the materials shall then be dry mixed by turning not less than three (3) times with a mortar hoe; the required amount of water shall then be added and the hoe mixing continued until the batch is of uniform color and consistency.
2. All mortar and grout shall be used within one (1) hour after mixing or before any visible signs of setting become discernible. Retempering of mortar or grout will not be permitted.

The types, uses and proportions of mortar and grout shall be as follows:

TYPES	USES	SACKS OF CEMENT	CUBIC FEET OF FINE AGGREGATE
"A"	Masonry mortar	1	2
"B"	Standard grout	1	3
"C"	Pipe joint mortar	1	1
"D"	Neat cement grout	1	none

F. ADMIXTURES

Lime may be added to increase workability in an amount not to exceed ten (10) percent of the cement content of the masonry mortar. Admixtures for the purposes of curing, accelerating the setting, or lowering the freezing point will not be permitted.

END OF SECTION

SECTION 09 03 12

**CONDUCTIVE TRACE WIRE FOR
WATER PIPE AND SEWER FORCE MAIN INSTALLATION**

(Sentences and/or paragraphs that are double underlined indicate revisions that were made from the 2009 specification.)

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. Install electrically continuous trace wire with access points as described herein to be used for locating pipe with an electronic pipe locator after installation.

1.2 MEASUREMENT

- A. There is no separate payment for the supply and installation of tracer wire on any construction or installation of water main and/or sewer force main by the Contractor. The Contractor shall consider the supply and installation of the tracer wire incidental to all construction of water main and/or sewer force main.

1.3 SUBMITTALS

- A. Submit manufacturer's data on materials furnished that indicate compliance with the specifications regarding materials used.
- B. Indicate on plans location of each trace wire test station.

PART 2 – PRODUCTS**2.1 MATERIALS**

- A. Trace wire to be fourteen (14) gauge minimum solid copper with thermoplastic insulation recommended for direct burial. Each trace wire access point to be composed of one Copperhead® SnakePit® Magnetized Tracer Box, Traffic Rated, Test and Monitoring Station or pre-approved equal installed in each proposed 24"x24"x6" concrete pad.

2.2 TESTING REQUIREMENTS

- A. Contractor shall perform a continuity test on all trace wire in the presence of the Engineer or the Engineers' representative. If the trace wire is found to be not continuous after testing, Contractor shall repair or replace the failed segment of the wire.

PART 3 – EXECUTION

- A. Trace wire shall be installed on all water mains and/or sewer force mains. The wire shall be installed in such a manner as to be able to properly trace all water mains and/or sewer force mains without loss or deterioration of signal or without the transmitted signal migrating off the tracer wire.

- B. Trace wire shall be installed in the same trench and inside bored holes and casing with pipe during pipe installation. It shall be secured to the pipe as required to insure that the wire remains adjacent to the pipe.
- C. Trace wire access points shall in general be no more than five-hundred (500) feet and at every proposed 24" x 24" x 6" concrete valve box collar. Concentrations of multiple proposed valves near pipe intersections, i.e. tees or crosses, may require more than one access point assembly in each concrete valve box collar. Trace wire access points shall be within public right-of-way or public utility easements.
- D. Tracer wire shall be laid flat. The wire shall be protected from damage during the execution of the works. No breaks or cuts in the tracer wire or tracer wire insulation shall be permitted. At water service saddles, the tracer wire shall not be allowed to be placed between the saddle and the water main.

END OF SECTION

SECTION 31 11 00
CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section governs the furnishing of all labor, equipment, tools, and materials, and the performance of all work for clearing, grubbing, and disposal of material within the work site required for construction of a site in accordance with specification requirements.

1.2 DEFINITIONS

- A. Clearing consists of cutting off trees and brush vegetative growth to not more than a specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- B. Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
- C. Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- D. Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of all fallen timber and surface debris.
- E. Grubbing consists of excavation and disposal of stumps and roots boulders and rock fragments of specified size to not less than a specified depth below existing ground surface.

1.3 MEASUREMENT AND PAYMENT

- A. This item will be measured by the acre unless otherwise shown on the bid documents.
- B. For “acre” measurement, the work performed in accordance with this item and measured as provided under “measurement” will be paid for at the unit price bid for “Clearing and Grubbing.” This price is full compensation for pruning of designated trees, and shrubs; removal and disposal of structures and obstruction; backfilling of holes; furnishing and placing concrete for plugs; and equipment, labor, tools and incidentals.

1.4 SUBMITTALS

- A. Burn permits shall be submitted to the owner prior to burning of vegetation.
- B. Notice of Intent (NOI) and Stormwater Pollution Prevention Plan (SWPPP) or cause for exemption.
- C. Proof of legal disposal of all hazardous material shall be required when hazardous material is involved.

1.5 STORAGE AND PROTECTION

- A. Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, root systems of trees which are to remain.
- B. Repair any damaged items to approval of Engineer/Architect. Replace any trees designated to remain, if damaged, as directed by Engineer /Architect.
- C. When shown on the plans, treat cuts on trees with an approved tree wound dressing within 20 minutes of making a pruning cut or otherwise causing damage to the tree.

1.6 WASTE MANAGEMENT AND DISPOSAL

- A. Follow all local and state regulations when burning, if burning of brush is approved, pile and burn at approved locations.
- B. Testing, removal and disposal of hazardous materials will be in accordance with the contract.

PART 2 – PRODUCTS

N/A

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspect site and verify with Engineer/Architect, items designated to remain.
- B. Locate and protect utility lines. Preserve in operating condition active utilities traversing site:
 - 1. Notify Engineer/Architect immediately of damage to or when unknown existing utility lines are encountered.
 - 2. When utility lines which are to be removed are encountered within area of operations, notify Engineer/Architect in ample time to minimize interruption of service.
- C. Notify utility authorities before starting clearing and grubbing.
- D. Keep roads and walks free of dirt and debris.

3.2 CLEARING

- A. Clear areas shown on the plans of all obstructions, except those landscape features that are to be preserved. Such obstructions include but are not limited to remains of houses and other structures, foundations, floor slabs, concrete, brick, lumber, plaster, septic tank drain fields, basements, abandoned utility pipes or conduits, equipment, fences, retaining walls, and other items as specified on the plans. Remove vegetation and other landscape features not designated for preservation, curb and gutter, driveways, paved parking areas, miscellaneous stone, sidewalks, drainage structures, manholes, inlets, abandoned railroad tracks, scrap iron, and debris, whether above or below ground. Removal of live utility facilities is not included in this item. Remove culverts, storm sewers, manholes and inlets in proper sequence to maintain traffic and drainage.

- B. In areas receiving embankment, remove obstructions not designated for preservations to 2 ft. below natural ground. In areas to be excavated, remove obstruction to 2 ft. below the excavation level. In all other areas, remove obstruction to 1 ft. below natural ground. When allowed by the plans or directed, cut trees and stumps off to ground level. Plug the remaining ends of abandoned underground structures over 3 inches in diameter with concrete to form a tight closure. Backfill, compact, and restore areas where obstructions have been removed, unless otherwise directed. Use approved material for backfilling. Accept ownership, unless otherwise directed, and dispose of removed materials and debris at location off the sight in accordance with local, state and federal requirements.

END OF SECTION

SECTION 31 23 23.53

CEMENT STABILIZED SAND BACKFILL

PART 1 – GENERAL

1.1 DESCRIPTION

- A. At the discretion of the Engineer, Cement Stabilized Sand meeting the following specification may be allowed as trench backfill.

1.2 MEASUREMENT AND PAYMENT

- A. Cement-stabilized sand shall be considered a part of the backfill requirement for the unit installed and shall be considered subsidiary to the length of the unit bid. If the cement stabilized sand is indicated to be a separate construction item for bulk backfill then the cement stabilized sand shall be measured per cubic yard as indicated on the plans.

1.3 SUBMITTALS

- A. Mix Design

PART 2 – PRODUCTS

2.1 MATERIALS

- A. CEMENT - Type I Portland Cement conforming to ASTM C150.
- B. SAND - Clean durable sand meeting grading requirements for fine aggregates of ASTM C33, and the following requirements:
 - 1. Classified as SW, SP, or SM by the United Soil Classification System of ASTM D2487.
 - 2. Deleterious materials:
 - a.) Clay lumps, ASTM C142; less than 0.5 percent.
 - b.) Lightweight pieces, ASTM C123; less than 5.0 percent.
 - c.) Organic impurities, ASTM C40; color no darker than standard color.
 - d.) Plasticity index of 4 or less when tested in accordance with ASTM D4318.
 - 3. Water: Potable water, free of oils, acids, alkalis, organic matter, or other deleterious substances, meeting requirements of ASTM C94.

2.2 TESTING REQUIREMENTS

- A. Mixing plant inspections may be performed periodically. Material samples shall be collected and tested for change in material characteristics.
- B. Random samples of delivered product will be taken in the field at point of delivery for each day of placement in the work area. Specimens will be prepared in accordance with ASTM D1632 and tested for compressive strength in accordance with ASTM D1633.
- C. The cement content may be tested at the discretion of the City.

PART 3 – EXECUTION**3.1 CONSTRUCTION METHODS****A. DESIGN REQUIREMENTS**

Design sand-cement mixture to produce a minimum unconfined compressive strength of 50 pounds per square inch in 48 hours and 100 pounds per square inch in 7 days when compacted to 95% in accordance to ASTM D558 and when cured in accordance with ASTM D1632, and tested in accordance with ASTM D1633. Mix for general use shall contain a minimum of 1-½ sacks of cement per cubic yard. Mix for use as sanitary sewer embedment within 9 feet of waterlines shall contain 2 sacks of cement per cubic yard. Compact mix with moisture content between 0% to 2% above optimum.

The maximum compressive strength in 7 days shall be 400 psi. Backfill that exceeds the maximum compressive strength shall be removed by the contractor.

B. MIXING

1. Thoroughly mix sand, cement, and water in proportions specified by the Design Requirements using a pugmill-type mixer. The plant shall be equipped with automatic weight controls to ensure correct mix proportions.
2. Stamp batch ticket at plant with time of loading directly after mixing. Material not placed and compacted within 4 hours after mixing shall be rejected.

C. PLACEMENT

1. Place sand-cement mixture in 8-inch-thick lifts and compact to 95% of ASTM D558 unless other specified by the engineer. The moisture content during compaction shall be between 0% to 2% above optimum. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water at plant.
2. Do not place or compact sand-cement mixture in standing or free water.

END OF SECTION

SECTION 31 23 33

EXCAVATING, TRENCHING, AND BACKFILLING

All excavation will meet the most current OSHA Regulations. See SECTION 31 50 50 – TRENCH SAFETY for trench safety requirements.

(Sentences and/or paragraphs that are double underlined indicate revisions that were made from the 2009 specification.)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work to be performed under this Specification shall consist of furnishing all labor, equipment and materials and performing all operations in connection with the excavating, trenching, and backfilling for pipelines as shown on the plans and as specified herein.

1.2 MEASUREMENT AND PAYMENT

- A. All trench excavation, backfill and compaction are not considered pay items. Payment for these items shall be included in the unit price laid in the Proposal for each size of pipe at their respective depths. This unit price shall be full remuneration for performing the trench and backfill complete including grading, bell holes, sheeting, dewatering, tamping, and water soaking; and including the furnishing of sewer pipe, all equipment, labor, materials, power, teams, tools, and transportation necessary or incidental thereto; but not including tunneling, or boring, all of which will be paid for extra.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Materials for pipe embedment will meet TCEQ Regulations for depth of bury and class of pipe and City of Bryan/City of College Station Unified Embedment Details as shown on the Plans.
- B. Concrete (For encasement or blocking) See SECTION 03 30 00 - CONCRETE.
Material shall conform to ASTM C94. The compressive strength of the concrete shall be at least 2,000 psi and shall contain at least four (4) sacks of cement per cubic yard.
- C. Cement stabilized sand. See SECTION 31 23 23.53 – CEMENT STABILIZED SAND BACKFILL.

2.2 TESTING REQUIREMENTS

- A. Compaction tests for all backfill may be required for every 200 linear feet of trench and for each twelve-inches (12”) vertically. Density tests, shall be measured as one unit for each test. The Owner shall pay for Geotechnical tests ordered that meet the requirements of the plans and specifications. Failed tests shall be charged to the Contractor. Refer to City Standard Trench Detail for compaction effort requirements.

PART 3 – EXECUTION**3.1 CONSTRUCTION METHODS****A. CONTROL OF WATER**

Provide sufficient pumping equipment, in good working order, available at all times to remove any water that accumulates in excavations. When the excavation crosses a drainage pathway, the contractor shall provide for means of alternate drainage. The discharge of dewatering equipment shall not cause damage to private or public property.

B. SHEETING, SHORING, AND BRACING

See SECTION 31 50 50 – TRENCH SAFETY.

In caving ground, or in wet, saturated, or flowing materials, the contractor shall sheet, shore, or brace the sides of the trench so as to maintain the excavation properly in place. When excavations are made adjacent to existing building or other structures or in paved streets, particular care must be taken to adequately sheet, shore, and brace the sides of the excavation to prevent undermining of, or settlement beneath, the structures or pavement. Underpinning of adjacent structures or pavement shall be done by the Contractor at his own cost and expense, in a manner satisfactory to the Engineer and when required by the Engineer. The pavement shall be removed, the void satisfactorily refilled and compacted, and the pavement replaced by the Contractor. The entire expense of such removal and subsequent replacement thereof shall be borne by the Contractor. Sheeting, shoring, and bracing shall not be left in place, unless otherwise provided for in the contract or authorized by the Engineer. The removal of sheeting, shoring and bracing shall be done in such a manner as not to endanger or damage either new or existing structure, private or public properties, and so as to avoid cave-ins or sliding of the banks. All holes or voids left by the removal of the sheeting, shoring, or bracing shall be immediately and completely filled and compacted with suitable materials.

C. GUARANTEE

1. Guarantee the backfilling of excavation and trenches against settlement for a period of one (1) year after the final completion of the contract under which the work is performed.
2. Make all repairs or replacements made necessary by settlement, including refilling, compacting, and reseeding or resodding the upper portion of the ditch and repairing broken or settled pavements, driveways, and sidewalks within five (5) days after notice from the Engineer.

D. PREPARATION**1. Site Preparation**

Prepare the construction site for construction operations by removing and disposing of all obstructions and objectionable materials in accordance with contract documents.

2. Alignment, Grade and Minimum Cover**a. General**

The water and sewer mains shall be laid and maintained to lines and grades established by the plans and specifications with fittings, valves, hydrants,

manholes and clean-outs at the required locations, unless otherwise pre-approved by the Engineer. Valve-operating stems shall be oriented in a manner to allow proper operation. Hydrants shall be installed plumb.

- b. Cut sheets shall be provided to the City's Inspector. The contractor shall determine the alignment and grade or elevation of the pipeline from offset stakes. Offset stakes shall be placed every 100 feet. The contractor shall also provide a continuous chalk line along the alignment of the trench for use by the operator of the excavating equipment. The contractor shall provide a laser beam and grade pole to assist in grading the ditch to the proper elevation.
- c. Should the ditch be graded below the required elevation, bring subgrade to the required elevation with cement stabilized sand or rounded pea gravel. The use of excavating materials for this application will not be allowed.
- d. Where pipe grades or elevations are not definitely fixed by contract drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the pipe. Greater pipe cover depths may be necessary for clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevations.

3. Prior Investigation

Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care should be exercised by the Contractor during excavation avoid damage to existing structures.

4. Unforeseen Obstructions

When obstructions that are not shown on the plans are encountered during the progress of work and interfere so that an alteration of the plans is required, the Engineer will alter the plans or order a deviation in line and grade or arrange for removal, relocation or reconstruction of the obstructions.

5. Clearance

When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the Engineer, to provide clearance as required by federal, state or local regulations or as deemed necessary by the Engineer to prevent future damage or contamination of either structure.

E. EXCAVATION

All excavation shall meet the most current OSHA regulations.

1. Classification

Excavation of trenches for pipelines is unclassified. Soils will be classified utilizing OSHA Standards and Regulations. The Contractor shall assume that the site contains the worse type of soils and make provisions for shoring the work area.

2. Trench Excavation

a. General

The trench shall be excavated to the required alignment, depth and width and in conformance with all federal, state and local regulations for the protection of the workmen.

b. Trench Preparation

- i) Trench preparation shall proceed in advance of pipe installation for only as far as pipe will be laid that day.
- ii) The contractor shall keep the trench dry from both storm water and seepage from the sides of the trench. Discharge from any trench dewatering pumps shall be conducted to natural drainage channels, storm sewers or a pre-approved reservoir. Do not discharge into any municipal sewer system without municipal approval. The contractor shall be responsible for cleaning any storm drain system, which was used for dewatering discharge.
- iii) Excavated material shall be placed in a manner that will not obstruct the work nor endanger the workmen, obstruct sidewalks, driveways, or other structures and shall be done in compliance with federal, state, or local regulations.

3. Pavement Removal

Removal of pavement and road surfaces shall be a part of the trench excavation, and the amount removed shall depend upon the width of trench required for installation of the pipe and the dimensions of area required for the installation of valves, hydrants, specials, manholes or other structures. The dimensions of pavement removed shall not exceed the dimensions of the opening required for installation of pipe, valves, hydrants, specials, manholes and other structures by more than twelve (12") inches in any direction, unless otherwise required or pre-approved by the Engineer.

4. Width

See City Standard Bedding and Trench Detail.

5. Bell Holes

Holes for the bells shall be provided at each joint, but shall be no larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. Other than noted previously, the trench bottom shall be true and even in order to provide support for the full length of the pipe barrel, except that a slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle.

6. Subgrade in Earth

- a. Where a firm and stable foundation for the pipe can be obtained in the natural soil, and where special embedment is not shown on the plans, or specified herein, carefully and accurately trim the bottom of the trench to fit the lower portion of the pipe barrel. The bottom of the trench shall be firm, stable and free of standing water.
- b. If water is allowed to collect in an originally dry trench after a reasonable time has passed to complete the embedment of the pipe, as determined by the Engineer, the contractor shall place a minimum of four (4") inches of clean rounded pea gravel in the ditch and pump out all accumulated water before

placing the pipe. No deleterious materials will be allowed in the gravel. No extra compensation will be allowed for this work.

- c. Where wet, soft, or spongy material is encountered in the excavation at subgrade level, the contractor shall remove such material at the direction of the Engineer and replace it with crushed stone of sufficient quantity such that when fully compacted, the subgrade is firm and stable.

7. Subgrade in Rock

- a. When excavation of rock is encountered, all rock shall be removed to provide a clearance of at least six (6") inches below and on each side of all pipe, valves and fittings for pipe sizes twenty-four (24") inches or smaller, and nine (9") inches for pipe sizes thirty (30") inches and larger. When excavation is completed, the proper embedment material shall be placed on the bottom of the trench to the previously mentioned depths, leveled and tamped.
- b. These clearances and bedding procedures shall also be observed for pieces of concrete or masonry and other debris or subterranean structures, such as masonry walls, piers or foundations that may be encountered during excavation.
- c. The installation procedures specified in this section shall be followed when gravel formations containing loose boulders greater than eight (8") inches in diameter are encountered.
- d. In all cases, the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection or point of rock, boulder or stones of sufficient size and placement, which, in the opinion of the Engineer, could cause a fulcrum point.

F. CONCRETE ENCASEMENT

The Contractor shall place 2,000 psi concrete encasement under and around pipe as shown on the embedment detail, and provide necessary anchors to prevent the pipe from floating out of place. The contractor shall remove and relay any pipes that are floated out of proper position

G. BACKFILLING

1. General

- a. The Contractor shall not begin backfilling until approval has been obtained from the Inspector. Backfilling includes refilling and consolidation of the fill in trenches and excavations up to the natural ground surface or road grade.
- b. Backfill shall be accomplished in accordance with the specified laying condition as shown on the plans.

2. Backfill Material

- a. All backfill material shall meet latest edition of ASTM D2321 unless otherwise specified by the Engineer.
- b. If excavated material is indicated on the drawings or specified for backfill, and there is a deficiency due to a rejection of part thereof, the contractor shall provide the required amount of sand, gravel or other pre-approved material.

3. Do not leave trenches open overnight without backfilling to the natural ground level. Steel plates (1/2" in thickness) may be used to cover open trenches only with the approval of the Engineer.
4. Compaction
Compaction requirements are as specified on the plans.

END OF SECTION

SECTION 31 25 13

EROSION AND SEDIMENTATION CONTROL**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. The work covered by this section consists of the installation and maintenance of all erosion siltation control devices, wash down areas, or seeding and sodding applications necessary to effectively prevent storm water pollution of adjoining or downstream areas that may occur as a direct or indirect result of the construction of this project. The contractor is responsible for creating and maintaining the storm water pollution prevention plan by utilizing the base sheets and narrative provided in the bid documents. The contractor is also responsible for submitting the Notice of Intent (NOI) and Notice of Termination (NOT) and conducting inspections as required by the Texas Commission on Environmental Quality (TCEQ.) The required forms for these activities are included in the bid documents.

The engineer will provide:

1. Base Sheets for Erosion Control Plan (ECP)
2. The Narrative for the Storm Water Pollution Prevention Plan (SWPPP)

The contractor will generate, submit, and maintain the:

1. ECP
2. SWPPP
3. NOI (if required)
4. NOT (if required)

1.2 MEASUREMENT AND PAYMENT

Erosion and Sediment Control is measured as a lump sum item.

The work and materials as prescribed by this item will be paid on the following schedule:

- A. 25% of the bid value shall be paid when the erosion control plan is fully detailed and implemented, the NOI (if required) is submitted to both TCEQ and the City Inspector, and all of the initial erosion control devices have been installed and are in working order.
- B. 50% of the value will be prorated for the installation and maintenance of erosion control devices during the course of construction as a percent of the total contract value. If the sediment trapping devices on the site appear to be un-maintained, no payment of this portion of the item shall be paid.
- C. 25% will be paid at the completion of construction when the site is stabilized, the NOT is submitted to both TCEQ and the City Inspector and all erosion control devices are removed from the site.

1.3 SUBMITTALS

- A. The contractors shall submit the initial erosion control plan along with the NOI (if required) prior to receiving a notice to proceed.
- B. If required, the Contractor is responsible for filing a “Notice of Intent” (NOI.) The contractor shall comply with all TCEQ and EPA regulations and pay the filing fees associated with the regulations. Fees associated with these regulations are subsidiary to the bid item Storm Water Prevention. The forms are available at:

<http://www.tceq.state.tx.us/assets/public/permitting/waterquality/forms/20022.pdf>
<http://www.tceq.state.tx.us/assets/public/permitting/waterquality/forms/20023.pdf>

- C. Said NOI must be postmarked two days before construction begins. NOI's and NOT's shall be submitted to the address shown on the forms. It is the Contractor's responsibility to file and provide the owner a copy of the Notice of Termination (NOT) at the completion of the project.

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

3.1 GENERAL

- A. It is the responsibility of the Contractor to utilize whatever techniques are necessary to address erosion problems as they occur during construction.
- B. Siltation control and sediment trapping devices shall be installed prior to site clearing, grading or utility construction operations. All devices should be positioned so as to effectively remove silt from storm water before it leaves the site. Of particular concern, are gravel or stone blankets placed at construction traffic exits and entrances. These controls should be closely monitored to see that they trap sediment before it reaches the existing street and drainage system.
- C. Construction activities should be phased to expose a minimum of graded area at one time. Earth exposed by the construction process shall be re-vegetated every two weeks until vegetation is established. Re-vegetation shall require seeding, hydromulching or sodding. Fresh growth of vegetation shall eliminate the need for additional re-vegetation but does not constitute stabilization.
- D. Should a construction process remove any portion of the perimeter controls, the controls should be replaced in accordance with the TCEQ guidelines. Prior to the completion of the project, all bare areas shall be re-vegetated with a cellulose fiber hydromulch seeding process or sodded.
- E. Siltation control devices placed at storm drain inlets and culverts shall be removed by the Contractor once the site has been stabilized.

3.2 MAINTENANCE AND INSPECTION

- A. The contractor shall familiarize himself with the erosion control requirements of TCEQ. The site superintendent, or his representative, shall make a visual inspection of all structural and/or natural controls and newly stabilized areas as required by TCEQ, especially after a rainfall to insure that all controls are maintained and properly functioning. Any damaged controls shall be repaired prior to the end of the work day, including re-seeding and mulching or re-sodding if necessary. All inspections shall be documented with a written report. Reports shall include the effectiveness of erosion control measures, construction activities conducted since the last report and their location. Reports shall be maintained by the Contractor along with the Erosion Control Plan per the TCEQ guidelines.
- B. The contractor is responsible for the ECP. The contractor shall continuously update the plan with all changes. Areas already stabilized shall be noted on the plan. All sediment trapping devices shall be installed as soon as practical after the area has been disturbed (never more than 14 days). All sediment trapping devices shall be cleaned when the sediment level reaches 25% capacity. Sediment shall be disposed of by spreading on site or hauling away if not suitable for fill.

- C. The Contractor shall be responsible for any and all materials, improvements, and maintenance activities necessary to keep dust, silt, and mud from leaving the work zone, including being tracked by vehicles traveling throughout the zone.
- D. Should, in the opinion of the Owner, the Contractor fail to prevent the escape of dust or contain silt and mud within the project, after due notification by the City Representative, Owner forces will be used to clean up those affected areas, and the cost of same will be deducted from the contract.
- E. Prior to Substantial Completion, the Contractor shall verify that no dust, silt, or mud exists within the work zone in deposits deeper than two inches (2”) as a result of the contractor’s containment procedures. Should the Contractor claim final completion without removing such deposits, they will be removed by Owner forces and the cost of which shall be deducted from the contract.

END OF SECTION

SECTION 31 50 00

TRENCH SAFETY**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. The work specified under this section requires the Contractor to provide for the safety of the workmen in strict compliance with 29 CFR Part 1926 1993 (Revised as of July 1, 1996 of latest Edition or Revision to) Excavations and Applicable Subparts. The submission of a “TRENCH SAFETY PLAN” which shall fully satisfy the requirements of this specification is required prior to a notice to proceed to start the project.

1.2 MEASUREMENT**A. MEASUREMENT**

Measure “Trench Safety” as shown on the bid proposal. Shoring of trench at manholes and other unusual structures to be included in this cost.

B. PAYMENT

Pay for “Trench Safety” as shown on the bid proposal. Payment to be full compensation for all work described herein. There will be no increase in the Contract price because of the incorporation of CONTRACTOR’s Trench Safety Plan or CONTRACTOR’s detailed plans and specifications for the trench safety system into the bid documents and the Construction Contract. There will be no increase in the Contract price because of modifications to CONTRACTOR’s plan and/or the CONTRACTOR’s detail plans and specifications for the trench safety system, whether or not the result of unforeseen or differing site or soil conditions.

“Trench Safety Plan” shall be included as part of the “Trench Safety” bid item and shall not be paid for as a separate pay item.

1.3 SUBMITTALS**A. CERTIFICATES**

Submit manufacturer’s “Certificate of Compliance,” stating that the devices (trench boxes, speed shoring, etc.) to be used for trench safety comply with the requirements of this specification. The certificate should show the design assumptions and limitations of the device and should be sealed by an engineer registered and licensed to practice in the state of Texas.

B. TRENCH SAFETY PLAN

Submit a detailed TRENCH SAFETY PLAN for all work areas. Calculations shall be provided for any areas beyond the capacity of the trench box or speed shoring and sealed by an engineer registered and licensed to practice in the state of Texas. This plan shall include evacuation routes for personnel.

C. COMPETENT PERSON

Contractor shall have a “Competent Person” with regard to OSHA standards, on site at all times. Competent person is generally defined as an individual who, by training and experience, is knowledgeable of applicable standards, capable of identifying hazards, is

designated by the employer, and has the authority to take actions as needed. Contractor shall provide written proof showing the competent person(s) for the work being performed.

PART 2 – PRODUCTS

2.2 MATERIALS

A. MATERIALS

1. Timber

Trench sheeting materials shall be full size, a minimum of 2 inches in thickness, solid and sound, free from weakening defects such as loose knots and splits.

2. Sheet Piling

Steel sheet piling shall conform to one or more of ASTM A328/328M, ASTM A572/A572M/ ASTM A690/A690M material requirements.

3. Structural Steel

Steel for stringers (wales) and cross braces shall conform to ASTM A588.

4. Trench Boxes

Steel trench Boxes to be constructed of steel conforming to ASTM A36/A36M. Connecting bolts used to conform to ASTM A307. Welds shall conform to the requirements of AWS D1.1.

5. Miscellaneous

Miscellaneous materials to be utilized shall conform to applicable ASTM standards.

B. REFERENCED SPECIFICATIONS

The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society of Testing and Materials (ASTM)

ASTM A36/A36M	1997 Standard Specification for Carbon Structural Steel
ASTM A307	1997 Revision A-Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile length
ASTM A328/A328M	1996 (REV) Standard Specification for Steel Sheet Piling
ASTM A572/A572M	1997 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality
ASTM A588/A588M	1997 Standard Specification for High-Strength Low-Alloy Structural Steel With 50 ksi (345 MPa) Minimum Yield Point to 4 inch (100 mm) thick
ASTM A690/A690M	1994 Standard Specification for High-Strength Low-Alloy Steel H-Pipes and Sheet Piling for Use in Marine Environments

American Welding Society, Inc. (AWS)

AWS D1.1	1998 Structural Welding Code-Steel
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Occupation Safety And Health Administration (OSHA)

29 CFR Part 1926 1993 (Revised as of July 1, 1996 of latest Edition or Revision to)
Excavations and Applicable Subparts

PART 3 – EXECUTION**3.1 CONSTRUCTION METHODS****A. GENERAL:**

The trench safety system shall be constructed, installed and maintained in accordance with the Trench Safety Plan as outlined in 131.03. Bed and backfill pipe to a point at least one (1) foot above top of pipe or other embedded items prior to removal of any portion of trench safety system. Bedding and backfill shall be in accordance to other applicable Specification Sections. Backfilling and removal of trench supports shall be in accordance with Contractor's Trench Safety Plan. Removal of trench safety system to be accomplished in such a manner to cause no damage to pipe or other embedded items. Remove no braces or trench supports until all personnel have evacuated the trench. The trench shall be backfilled to within 5 feet of natural ground prior to removal of entire trench safety system.

B. SUPERVISION:

Provide competent supervisory personnel at each trench while work is in progress to ensure Contractor's methods, procedures, equipment and materials pertaining to the safety systems in this Section are sufficient to meet requirements of OSHA Standards.

C. INSPECTION:

The CONTRACTOR shall make daily inspection of trench safety system to ensure that the system meets OSHA requirements. Daily inspection shall be made by competent personnel. If evidence of possible cave-ins or slides is apparent, all work in the trench is to cease until necessary precautions have been taken to safeguard personnel entering trench. The CONTRACTOR shall maintain permanent record of daily inspections.

D. TIMBER SHEETING

Timber sheeting and size of uprights, stringers (wales,) and cross bracing to be installed in accordance with the TRENCH SAFETY PLAN. Place cross braces in true horizontal position, spaced vertically, and secure to prevent sliding, falling or kick outs. Cross braces to be placed at each end of stringers (wales) in addition to other locations required. Cross braces and stringers (wales) to be placed at splices of uprights, in addition to other locations required.

E. STEEL SHEET PILING

Steel sheet piling of equal or greater strength may be used in lieu of timber trench shoring shown in the OSHA tables (proposed standards). Drive steel sheet piling to a least minimum depth below trench bottom as recommended by CONTRACTOR's Registered Licensed Professional Engineer providing design. Place cross braces in true horizontal position and spaced vertically. Secure to prevent sliding, falling, or kick outs. Cross braces to be placed at each end of stringers (wales), in addition to other locations required.

F. MAINTENANCE OF SAFETY SYSTEM

The safety system to be maintained in the condition as shown on the Trench Excavation and Shoring Safety Plan as designed by the CONTRACTOR's Registered Licensed Professional ENGINEER. The CONTRACTOR shall take all necessary precaution to ensure the safety systems are not damaged during their use. If at any time during its use a safety system is damaged, personnel to be immediately removed from the trench

excavation area and the safety system repaired. The CONTRACTOR is to take all necessary precautions to ensure no loads, except those provided for in the plan, are imposed upon the trench safety system.

END OF SECTION

SECTION 31 78 00

PIPE BORING, JACKING, TUNNELING AND ENCASEMENT**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. The work to be performed under this Specification shall consist of furnishing and installing all materials and equipment and performing all labor required to install pipelines crossing under highways, railroads, and streets by boring, jacking, and tunneling, as specified herein. **All sewer bores will be accomplished by dry mechanical bore unless otherwise pre-approved by the Engineer.** Water line bores may utilize the wet boring technique. All carrier pipes within the encasement conduit shall be restrained joint pipe of the type specified on the plans, or pre-approved by the Engineer.
- B. When the work per this item falls within a TxDOT or Railroad right of way, the stricter of the applicable standards apply. This requirement includes all insurance, notification, permitting, signage, etc. required by the right of way owner.

1.2 MEASUREMENT AND PAYMENT**A. MEASUREMENT**

- 1. Openings provided by boring, jacking, and tunneling (including carrier pipe) will be measured by the linear foot along the centerline of the opening, as measured from end of pipe to end of pipe placed by boring, jacking and tunneling. There will not be any classification for payment according to depth.
- 2. Concrete support slab in the pits and all other work necessary to meet the requirements of the Texas Department of Transportation, railroad company, County, and City will not be measured.
- 3. Openings provided by boring, jacking and tunneling will be paid for at the unit price bid per linear foot. The unit price bid for boring jacking and tunneling shall be full compensation for furnishing and placing all materials, labor, tools, carrier pipe, carrier pipe restraint, casing spacers, equipment, pits, concrete support slabs and incidentals necessary to complete the work.

1.3 SUBMITTALS

- A. Submit manufacturer's product data on encasement pipe.
- B. Submit manufacturer's "Certificate of Compliance" to this part of the specifications for materials furnished for the project.
- C. The Contractor or subcontractor performing the work described under this section shall demonstrate technical skill and experience in previous work of this nature. Work experience shall be submitted to the Engineer.
- D. Casing spacer data sheets demonstrating compliance with this specification.

PART 2 – PRODUCTS

2.1 MATERIALS

Steel Pipe, Ductile Iron Pipe, Reinforced Concrete Pipe, and PVC Pipe may be used as encasement material, unless otherwise shown on the plans. The nominal inside diameter of the encasement pipe shall be as indicated below, unless otherwise shown on the plans.

A. STEEL PIPE

Encasement pipe shall conform to ASTM Specification A134, Mild Carbon Steel, A139, Grade A, or AWWA C200-91 Grade B, butt-welded joints with entire circumference welded by a certified welder shall be in accordance with AWWA C200-86 Section 3. All steel casing shall have a wall thickness as shown in the table below:

Carrier Pipe Nominal Diameter	Casing Pipe Nominal Diameter	Casing Pipe Minimum Thickness ¹
6"	14"	3/8"
8"	16"	3/8"
10"	18"	3/8"
12"	20"	3/8"
16"	24"	3/8"
18"	30"	1/2"
24"	36"	1/2"

1. Casing Pipe Thickness for Railroad crossings shall be a minimum of 1/2-inch thick regardless of diameter.
2. Nominal diameter of casing pipe may be larger as needed for restrained joint pipe.

B. DUCTILE-IRON PIPE

Encasement pipe shall conform to the current AWWA C150 and C151 standards. Pipe shall be thickness Class 250 or greater, unless otherwise shown on the plans.

C. REINFORCED CONCRETE PIPE

Encasement pipe shall conform to the current ANSI C-76 standards. Pipe shall be Class III or IV, unless otherwise shown on the plans.

D. PVC PIPE

Encasement pipe shall conform to the current ASTM D2241 or AWWA C905 standards. Pipe shall be DR 26 or SDR 26, unless otherwise shown on the plans. PVC pipe shall be used only when specified on the plans.

E. GROUT

Grout shall be in accordance with SECTION 04 05 12 – MORTAR AND GROUT.

F. CASING SPACERS

Stainless Steel casing spacers shall be required in all casing pipes and shall be manufactured by Cascade Products, Advance Products & Systems, Inc model no. SSI8 or approved equal. The casing spacers shall be affixed to the carrier pipe at a spacing of 6'8" or per the manufacturers recommendations if less than 6'8".

G. END SEALS

End seals shall be 1/8" thick synthetic rubber secured with stainless steel banding straps. Other end seals shall be constructed only as pre-approved by the engineering inspector.

2.2 TESTING REQUIREMENTS**A. ALLOWABLE TOLERANCES**

Where grades or elevations are shown on the plans for the pipeline to be installed by boring, jacking, and tunneling operations, maximum deviation of plan elevation shall be 0.2 foot. The maximum deviation of alignment over the length of the bore shall be 0.2 foot. The Engineer shall determine the corrective action to be taken for tolerances above those stated in this specification.

PART 3 – EXECUTION**3.1 CONSTRUCTION METHODS****A. ENCASEMENT REQUIREMENTS**

Encasement pipe shall be required for all water mains crossing major collector and arterial street crossings. Encasement pipe for sewer mains shall be placed as required by the City Engineer. The casing pipe shall extend two feet (2') beyond the back of curb. Encasement pipes may be installed by open cut with the approval of the engineer.

B. BORE AND TUNNEL PITS

Unless more stringent requirements regarding location of bore and tunnel pits are noted on the plans, or are required by TXDOT, Railroad, County, or City, to conform to the requirements that follow:

1. The Conduit to be installed by boring, jacking and tunneling shall extend to distances as shown in the Standard Details.
2. If necessary to prevent cave-ins, sheet, shore, or brace the pit in accordance with OSHA regulations. All pits shall be covered with 1/2" thick steel plates. Steel plates shall be on-site prior to excavating the pit. If bore pits are too big to cover with steel plates, Contractor shall install chain link fence, completely and securely, around exposed pit to a height of 6 feet.
3. General: Unless otherwise noted, extend auger hole 10 feet beyond edge of pavement, railroad tie, or other structure. The hole is to be bored mechanically, using a pilot hole. An approximate 2-inch hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit. This pilot hole shall serve as the centerline of the larger diameter hole to be bored. The use of water or other fluids in connection with the boring operation will be permitted only to the extent to lubricate cuttings, jetting will not be permitted. In unconsolidated soil formations, a gel-forming colloidal drilling fluid consisting of at least 10 percent of high-grade carefully processed bentonite may be used to consolidate cuttings of the bit, seal the walls of the hole, and furnish lubrication for subsequent removal of cuttings and installation of the pipe immediately thereafter. Overcutting in excess of one inch shall be remedied by pressure grouting the entire length of the installation.

3.2 CONSTRUCTION METHODS FOR DRY BORING

- A. All sewer bores will be accomplished by dry mechanical bore unless otherwise pre-approved by the Engineer.
- B. Only workmen experienced in boring operations shall perform the work.
- C. The use of water or other fluids in connection with the boring operation will NOT be permitted except for a minor required amount of bentonite solution for cutting head.
- D. The casing pipe shall be placed in the bore hole simultaneously while boring is being performed. Installing the encasement conduit immediately by pulling it in place from opposite the boring machine or by jacking the conduit through the bore is not acceptable. Take proper care to secure the joints of the conduit as subsequent sections are installed by welding joints. Provide a steel rail or timber cradle in the pit to support and guide the conduit in its installation.
- E. If after completion of the installation of the conduit, there is more than one inch (1") clearance between the outside of the barrel of the conduit and the wall of the bore, grouting of these voids will be required. If during construction of the bore, a cave-in occurs within the bore, grouting of the voids between the conduit and the walls of the bore will be required throughout the length of the bore.
- F. Conform to the requirements of the Texas Department of Transportation, Railroad Company, County, or City having jurisdiction over the right-of-way involved, as to details of construction methods and time of construction. All work necessary to meet the requirements of the Texas Department of Transportation, Railroad Company, County, or City will be considered incidental to the installation of the pipeline in the right-of-way. The Contractor shall abide by the more stringent of these specifications, or the specifications of the regulatory agencies.

3.3 CONSTRUCTION METHODS FOR WET BORING

- A. All sewer bores will be accomplished by dry mechanical bore unless otherwise pre-approved by the Engineer. (see above)
- B. Only workmen experienced in boring operations shall perform the work. A pilot hole must be successfully completed to the satisfaction of the engineer prior back reaming the bore.
- C. The use of water or other fluids in connection with the boring operation will be permitted only to lubricate cuttings. Jetting will not be permitted. In consolidated soil formations, a gel-forming colloidal drilling fluid consisting of at least ten (10%) percent of high-grade bentonite may be used to consolidate cuttings of the bit, seal the walls of the hole, and lubricate removal of cuttings and installation of the pipe immediately thereafter.
- D. While boring is being performed, install the encasement conduit immediately by pulling it in place from opposite the boring machine or by jacking the conduit through the bore. Encasement conduit may be placed after the boring operation is complete, if permission is obtained from TXDOT, the railroad company, the City, or the County. Take proper care to secure the joints of the conduit as subsequent sections are installed, by use of cables or welding joints. Provide a steel rail or timber cradle in the pit to support and guide the conduit in its installation.
- E. If after completion of the installation of the conduit, there is more than one inch (1") clearance between the outside of the barrel of the conduit and the wall of the bore, grouting of these voids will be required. If during construction of the bore, a cave-in occurs within the bore, grouting of the voids between the conduit and the walls of the bore will be required throughout the length of the bore.

- F. Grouting material and equipment shall be on the jobsite before beginning installation of the conduit, in order that the grouting around the encasement conduit is to be started immediately after pipe is in place.
- G. Conform to the requirements of the Texas Department of Transportation, Railroad Company, County, or City having jurisdiction over the right-of-way involved, as to details of construction methods and time of construction. All work necessary to meet the requirements of the Texas Department of Transportation, Railroad Company, County, or City will be considered incidental to the installation of the pipeline in the right-of-way. The Contractor shall abide by the more stringent of these specifications, or the specifications of the regulatory agencies.

3.4 CONSTRUCTION METHODS FOR JACKING

- A. Unless otherwise specified, the methods and equipment used in jacking conduit shall be the Contractor's option, provided that the proposed method is pre-approved by the Engineer. Such approval, however, shall in no way relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein.
- B. If, after completion of the installation of the conduit, there is more than one (1") inch clearance between the outside of the barrel of the conduit and the wall of the tunnel, the Contractor shall completely grout the conduit in place throughout its entire length. If, during the jacking operation, a cave-in occurs, the Contractor shall grout the entire conduit in place throughout its entire length.

3.5 CONSTRUCTION METHODS FOR TUNNELING

- A. Excavate the tunnel in such a manner and to such dimensions that will permit placing of the proper supports **in accordance with OSHA Regulations** necessary to protect the excavation. Make adequate provisions for the safety and health of the workmen. Use only air or electric powered equipment in the tunnel. Provide adequate illumination and ventilation.
- B. Excavate only enough earth to allow installation of the tunnel liner plate. Remove earth from within tunnel and install the next section of tunnel liner plates.
- C. After completion of the tunnel, or at intervals directed by the Engineer, grout the entire void between the tunnel lining. If after completion of the tunnel there are sags in invert of the liner that exceed 0.2 feet of a straight line projected through the tunnel, grout the invert to eliminate the sags.

3.6 SPECIAL PROVISIONS FOR BELL & SPIGOT ENCASEMENT PIPE

- A. Where pipe using bell and spigot joints is installed as encasement pipe, completely grout the voids between the outside of the encasement pipe and the inner wall of the bore or tunnel throughout the length of the pipe. If directed by the City Engineer, the joints shall be welded to prevent the joints from slipping with respect to each other.

3.7 SUPPORT OF PIPES ACROSS BORE OR TUNNEL PITS

- A. After completion of the bore or tunnel and installation of the carrier pipe with the bore or tunnel, remove all loose earth and debris from the pit down to undisturbed earth. Pour a continuous 2,000 psi concrete or cement stabilized sand support under the carrier pipe from the edge of the bore or tunnel to the first joint in the trench past the end of the pit. The concrete support shall be brought up to the horizontal centerline of the pipe.

3.8 CARRIER PIPE

- A. Carrier pipe may be pushed or pulled through the completed encasement pipe. Casing spacers by Cascade Waterworks or pre-approved equivalent should be placed on the carrier pipe to insure approximate centering within the encasement pipe and to prevent damage during installation. Care must be exercised in order to avoid metal-to-metal contact. The ends of the encasement pipe will be sealed with rubber seals and stainless steel bands. In order to avoid the transfer of earth and live loads to the carrier pipe, the space between the carrier pipe and encasement pipes shall not be filled completely.
- B. All carrier pipe installed within a casing shall be restrained. The restrained section shall extend at least five feet (5') beyond both ends of the casing pipe. Lock joint pipe, retainer glands, or restrainer gaskets may be used for this application.
- C. When ductile iron pipe is used for the carrier pipe, all ductile iron pipe shall be poly-wrapped per the specifications.

3.9 SPOILS

- A. Spoil locations shall be pre-approved by the engineering inspector. When no suitable location for spoil can be found on site, the contractor shall be required to haul and dispose of this material at no extra cost. Where spoils are to be placed on parking areas (asphalt or concrete), sidewalks, or other paved surfaces, the spoils shall be placed on a barrier to prevent the soil from embedding into the paved surface.

END OF SECTION

SECTION 32 92 13

HYDRO-MULCH SEEDING

(Sentences and/or paragraphs that are double underlined indicate revisions that were made from the 2009 specification.)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work covered by this section consists of furnishing all plant, labor, materials, equipment, supplies, supervision and tools and performing all work necessary to top soiling, smoothing, seeding, fertilizing, watering, maintenance and cleanups of side slopes, all in accordance with these specifications.
- B. The hydro-mulch seeding operations, together with all necessary related work, shall conform to the requirements specified in this section. The area(s) to be hydro-mulch seeded shall be as shown on the construction drawings.

1.2 MEASUREMENT AND PAYMENT

- A. The unit of measurement for all work performed and materials furnished, as described herein, will be the acre or per station as indicated in the bid documents. Measurement shall be done upon completion of the work performed within the limits shown on the drawings and as described herein. The area measured for payment will be computed to the nearest 1/10-acre or station.
- B. Payment for hydro-mulch seeding will be made at the contract unit price per acre or per station and includes topsoil (when specified), smoothing, mulch, seed fertilizer, watering, maintenance and clean-up. Additional payment shall not be made for those areas that are replanted.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. All seed must meet the requirements of the U.S. Department of Agriculture Rules & Regulations as set forth in the Federal Seed Act and the Texas Seed Law.
- B. Type of seed, purity and germination requirements, rate of application and planting dates are as follows:

TABLE 1
Application
Rate-Pounds

<u>TYPE/COMBINATION</u>	PER ACRE	PLANTING DATE
Hulled Common Bermuda Grass 98/88 <u>and</u> ,	40	Jan. 1 to Apr. 15
Unhulled Common Bermuda Grass 98/88 <u>and</u> ,	40	
Annual Rye Grass, including Gulf	50	

<u>TYPE/COMBINATION</u>	PER ACRE	PLANTING DATE
Hulled Common Bermuda Grass 98/88	40	Apr. 15 to Oct. 1
Hulled Common Bermuda Grass 98/88 and , Unhulled Common Bermuda Grass 98/88	40 40	Oct. 1 to Jan. 1

- C. Fertilizer shall be water soluble with an analysis of 10 percent nitrogen, 20 percent phosphoric acid and 10 percent potash. Rate of application shall be 500 pounds per acre, except during the period of April 15 through September 1, when the rate shall be reduced to 400 pounds per acre. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable State Fertilizer Laws and bearing the name and warranty of the producer.
- D. Mulch shall be virgin wood cellulose fiber made from whole wood chips. Within the fiber mulch material, at least 20 percent of the fibers will be 10.7 mm in length and 0.27 mm in diameter. Rate of application shall be 2000 pounds per acre. Soil stabilizers such as Terra Type III (or pre-approved equal) shall be applied at a rate of 40 pounds per acre on side slopes and Terra Tack I (or pre-approved equal) shall be applied at a rate of 40 pounds per acre on flatter portions.
- E. Wood cellulose fiber mulch, for use in the grass seed and fertilizer, shall be processed in such a manner that it will not contain germination or growth inhibiting factors. It shall be dyed an appropriate color to allow visual metering of its application. The wood cellulose fibers shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like ground cover, which readily absorbs water and allows infiltration to the underlying soil. Weight specifications from suppliers for all applications shall refer only to the underlying soil. Weight specifications from suppliers, shall refer only to the air dry weight of the fiber. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds and must be marked by the manufacturer to show the dry weight content. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished and that it meets all of the foregoing requirements.
- F. Water shall be free from oil, acid, alkali, salt and other substances harmful to the growth of grass. The water source shall be subject to approval, prior to use.

PART 3 – EXECUTION

3.1 CONSTRUCTION METHODS

- A. **EXECUTION:** Immediately after the finished grade has been approved, begin hydro-mulching operations to reduce erosion and excessive weed growth.

Hydraulic equipment used for the application of fertilizer, seed and slurry of prepared wood fiber mulch shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend and homogeneously mix a slurry containing up to forty (40) pounds of fiber plus a combined total of 70 pounds of fertilizer solids for each 100 gallons

of water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which provide even distribution of the slurry on the area to be seeded. The slurry tank shall have a minimum capacity of 800 gallons and shall be mounted on a traveling unit, which may either be self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded, so as to provide uniform distribution without waste. The Engineer may authorize equipment with a smaller tank capacity, provided the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.

Care shall be taken that the slurry preparation takes place on the site of the work. The slurry preparation should begin by adding water to the tank when the engine is at half throttle. When the water level has reached the height of the agitator shaft, good recirculation shall be established and seed shall be added. Fertilizer shall then be added, followed by wood pulp mulch. The wood pulp mulch shall only be added to the mixture after the seed and when the tank is at least one-third filled with water. The engine throttle shall be opened to full speed when the tank is half filled with water. All the wood pulp mulch shall be added by the time the tank is two-thirds to three-fourths full. Spraying shall commence immediately when the tank is full. The operator shall spray the area with a uniform visible coat, by using the green color of the wood pulp as a guide.

- B. APPLICATION: The contractor shall obtain approval of hydro-mulch area preparation from the Engineer prior to application.

Operators of hydro-mulching equipment shall be thoroughly experienced in this type of application. Apply the specified slurry mix in a motion to form a uniform mat at the specified rate. Operators shall keep the hydro-mulch within the areas designated and keep from contact with other plant material. Immediately after application, thoroughly wash off any plant material, planting areas or paved areas not intended to receive slurry mix.

Keep all paved and planting areas clean during maintenance operations. Contractor shall keep hydro-mulching within the areas designated and keep from contact with other plant material. If in the opinion of the Engineer, unplanted skips and areas are noted after hydro-mulching, the contractor shall be required to seed the unplanted areas with the grasses that were to have been planted at no additional cost to owner.

- C. CONTRACTOR'S MAINTENANCE & GUARANTEE PERIOD: The hydro-mulch seeding shall be adequately watered until established. Any areas damaged by erosion or areas that do not have an acceptable turfing shall be redone to the satisfaction of the Engineer. Maintenance of grass areas shall be for 60 days after the completion of the project and shall consist of watering, weeding, repair of all erosion and reseeding, as necessary to establish a uniform stand of the specified grasses. Contractor shall guarantee growth and coverage of hydro-mulch planting under this contract to the effect that a minimum of 95% of the area planted will be covered with the specified planting after 60 days.

The Contractor shall be responsible for one (1) mowing every two weeks between the months of April to October. The Contractor shall also be responsible for one (1) mowing every three (3) weeks between the months of November to March. In addition, the Contractor shall water the entire sodded and hydro-mulched areas to a saturated depth of one (1) inch at least once a week between the months of April to September and at least once a month between the months of October to March.

The Contractor shall make a second application of specified hydromulch planting those bare areas not meeting specified coverage as determined by the Engineer. Such replanting is to be performed within 60 days of initial application and upon notification by the Engineer to replant.

The Contractor shall apply top dress fertilizer (delayed action), at the rate of 10 pounds per 1000 square feet at 25 days after hydro-mulching of all new lawn areas.

Top dress fertilizer shall be 16-6-8.

Prior to final inspection, the Contractor shall mow the entire right-of-way within the project limits, including weeding around existing structures.

END OF SECTION

SECTION 32 92 19

SEEDING FOR EROSION CONTROL**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. Seeding shall consist of preparing ground, providing for sowing of seeds, mulching with straw, hay or cellulose fiber and other management practices along and across such areas as are designated on the plans and in accordance with these specifications. Note that a bid item for "SEEDING" does not constitute the requirement for fertilizer, mulch, and/or mesh unless the additional requirements are stated on the plans or special conditions.

1.2 MEASUREMENT AND PAYMENT

- A. FERTILIZING: Measure by the acre or as indicated in the proposal. Payment for work under this item will be made at the contract price bid for "Fertilizing for Erosion Control", which price is full compensation for all fertilizer, equipment, materials and labor necessary for fertilizing.
- B. SEEDING: Measure by the acre or as indicated in the proposal. Payment for work under this item will be made at the contract price bid for "Seeding for Erosion Control", which price is full compensation for all seeding, watering, equipment, materials and labor necessary for seeding.
- C. STRAW MULCH SEEDING: Measure by the square yard or as indicated in the proposal. Payment for work under this item to be made at the contract price for "Straw Mulch Seeding", which price to be full compensation for all fertilizer, seed, straw mulch, equipment, watering, materials and labor necessary for fertilizing and seeding.
- D. FIBER MAT SEEDING: Measure by the square yard or as indicated in the proposal. Payment for work under this item to be made at the contract price for "Fiber Mat Seeding", which price to be full compensation for all fertilizer, seed, fiber mat, watering, equipment, materials and labor necessary for fertilizing and seeding.
- E. PAPER MESH SEEDING: Measure by the square yard or as indicated in the proposal. Payment for work under this item is to be made at the contract price for "Paper Mesh Seeding", which price to be full compensation for all fertilizer, seed, paper mesh, watering, equipment, materials and labor necessary for fertilizing and seeding.

1.3 SUBMITTALS

- A. Source of seeds
- B. Seed Mix
- C. Fertilizer
- D. Manufacturer's data on Mulch Material
- E. Manufacturer's data on Fiber Mat
- F. Manufacturer's data on Paper Mesh

PART 2 – PRODUCTS

2.1 MATERIALS

- A. **GRASS SEED:** All seed must meet the requirements of the U.S. Department of Agriculture as set forth in the Rules and Regulations of the Federal Seed Act and the Texas Seed Law, including the labeling requirements for showing pure live seed, (PLS=purity x germination), name and type of seed. Seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within nine months of the time of use on the project. Each variety of seed shall be furnished and delivered in separate bags or containers. A sample of each variety of seed shall be furnished and delivered when directed by the Engineer. Seed which has been become wet, moldy or otherwise damaged in transit or storage will not be accepted. The amount of seed planted per acre, the type and the planting date shall be as indicated in the table below.

TABLE I

<u>Type</u>	<u>Rate of Application</u> <u>Type in Pounds per Acre</u>	<u>Planting Date</u>
Unhulled Bermuda Grass	20	Jan. 1 to Apr. 1
Hulled Bermuda Grass	12	Apr. 1 to Oct. 1
Mix Bermuda & Rye in the following Proportions:		
Unhulled Bermuda Grass	12	
Rye Grass	50	Oct. 1 to Jan. 1

- B. **FERTILIZER:** Use pellet or granular fertilizer with analysis of 16 percent nitrogen, 20 percent phosphoric acid and zero percent potash (or 10-10-5), unless otherwise required. The container labels shall show the analysis. Powdered or caked fertilizers shall not be permitted. Unless otherwise indicated on the plans, fertilizer shall be applied uniformly at an average rate of 400 pounds per acre.
- C. **STRAW MULCH:** Straw mulch shall be oat, wheat, or rice straw. Hay mulch shall be prairie grass, bermuda grass, oat, wheat or rice stems or other hay as pre-approved by the Engineer. Do not use straw containing Johnson grass or other noxious weeds and foreign materials. It shall be kept in a dry condition and shall not be molded or rotted. 164.5 Fiber Mat. Fiber mat to consist of machine produced mat of wood fibers, with consistent thickness throughout blanket. Use blanket with top side of netted twisted Kraft paper having high wet strength, or biodegradable extruded plastic mesh. Use blanket with a weight from 0.7 pounds per square yard to 1.0 pound per square yard.
- D. **PAPER MESH:** Use paper mesh consisting of Knitted construction of yarn with uniform openings interwoven with strips of biodegradable paper, furnished in rolls for suitable protection for outdoor storage. Use paper mesh of weight from 0.2 pounds per square yard to approximately 0.5 pounds per square yard.

PART 3 – EXECUTION**3.1 CONSTRUCTION METHODS**

- A. **GENERAL: Fertilizing & Seeding.** After areas to receive fertilizing and seeding has been completed to the lines, grades and sections shown on the plans, apply fertilizer at the uniform average rate of 400 pounds per acre. Thoroughly mix upper 3 inches of top soil with fertilizer until a uniform mixture of fertilizer and top soil is obtained. Sprinkle areas to be seeded with water, using fine spray to avoid washing or erosion of soil. Broadcast seed with sowing equipment at the rate specified above, using care to obtain uniform distribution. After broadcasting, lightly rake seeds into soil to a depth not to exceed 1/2 inch. Complete seeding by rolling with roller developing 15 to 25 pounds per inch of tread. Keep seeded areas moist for a period of 10 days immediately following placement. When watering seeded areas, use fine spray to prevent erosion of seeds or soil. Reseed any areas damaged by erosion.
- B. **STRAW MULCH SOIL RETENTION BLANKET:**
1. Fertilizing & Seeding: After ditch or slope has been completed to lines, grades and cross-sections shown on the plans, apply fertilizer and seed in accordance with the above. When seed and fertilizer are to be distributed as water slurry, mixture is to be applied within 30 minutes after all components are placed in the equipment.
 2. Mulch Application: Immediately upon completion of planting of seed and fertilizing, spray straw mulch uniformly over the area at the rate of 1 1/2 to 2 tons of hay or 2 1/2 tons of straw per acre. Mulching machine shall inject asphaltic material into straw uniformly as it leaves the equipment at the rate of 0.05 to 0.10 gallons of asphalt per square yard of mulched area. When watering seeded areas, use fine spray to prevent erosion of seeds or soil. Reseed any areas damaged by erosion for any reason. The mulching operation shall immediately follow seeding and fertilizing as a continuous operation.
- C. **FIBER MAT OR PAPER MESH SOIL RETENTION BLANKET:**
1. Fertilizing and seeding shall be in accordance with the above.
 2. Fiber Mat or Paper Mesh Installation: Place fiber mat or paper mesh within 24 hours after seeding operations have been completed. Prior to placing, clear the area to be covered of all rocks or clods over 1 1/2 inches in diameter and all sticks or other foreign material which will prevent close contact of the blanket with the soil. Area shall be smooth and free of ruts or other depressions. If as a result of a rain, prepared seed bed becomes crusted or eroded, or if eroded places, ruts or depressions exist for any reason, rework soil until smooth and reseed such areas. After area has been properly prepared, lay fiber mat or paper mesh flat, smooth and loosely without stretching or crimping material. Apply materials with lengths running parallel to the flow of water. When more than one width is required, butt or overlap edges as required by the manufacturer. Hold the material in place by means of a wire staple driven into the soil at an angle to the surface. Staple material along each edge and in a grid pattern with minimum 3 foot centers each way. In ditches and on slopes, provided additional stapling as recommended by the manufacturer.
- D. **CONTRACTOR MAINTENANCE & GUARANTEE PERIOD:** Maintenance of seeded areas shall be 60 days after successful completion of punch list items and shall consist of water and weeding, repair of all erosion and any reseeding as necessary to establish a uniform stand of the specified grasses. Contractor shall guarantee growth and coverage of seeding under this contract to the effect that a minimum of 95% of the area planted will be

covered with the specified grass after 60 days with no bare spots greater than 10 square feet. The Contractor shall be responsible for one (1) mowing every 2 weeks between the months of April to October. The Contractor shall also be responsible for one (1) mowing every three (3) weeks between the months of November to March. In addition, the Contractor shall water the entire sodded and hydro-mulched areas to a saturated depth of one (1) inch at least once a week between the months of April to September and at least once a month between the months of October to March. Contractor shall make a second application of seeding to bare areas not meeting specified coverage as determined by the Engineer. Such replanting is to be performed within 90 days of initial application and immediately upon notification by the Engineer to replant.

END OF SECTION

SECTION 32 92 23

SODDING FOR EROSION CONTROL (BLOCK SODDING)**PART 1 – GENERAL****1.1 DESCRIPTION**

- A. Sodding for erosion control shall consist of providing and planting Bermuda grass, San Augustine grass, or other acceptable sod along or across such areas as are designated on the drawings and in accordance with the specification requirements herein outlined.

1.2 MEASUREMENT AND PAYMENT

- A. Work and acceptable material for block sodding will be measured by the square yard, complete and in place.
- B. Work performed and material furnished under “Measurement” will be paid for at the unit price bid for “Block Sodding”, which price shall be full compensation for furnishing materials, preparation of ground for planting, planting, raking, fertilizing, watering, sprinkling, maintenance, and for labor, tools, equipment and incidentals necessary to complete the work.

1.3 SUBMITTALS

- A. Contractor shall submit material data on the source of the sod including the date the sod was cut.

PART 2 – PRODUCTS**2.1 MATERIALS**

- A. The sod shall consist of live, growing Bermuda grass, San Augustine grass, or other acceptable sod, (ninety-five percent pure), secured from sources where the soil is fertile and has been fumigated. The sod shall have a healthy virile root system of dense, thickly matted roots throughout. The sod shall be cut from the field so that there is a minimum of one-half inch of soil on the roots of the sod, and so that no roots show on the bottom of the soil. Sod shall be dense, with the grass having been mowed to 1 inch height before lifting from field. Sod shall be in a vigorous condition, dark green in color, free of disease and harmful insects. The contractor shall not use sod from areas where the grass is thinned out, nor where the grass roots have been dried out by exposure to the air and sun to such an extent as to damage its ability to grow when transplanted. The sod shall be free from obnoxious weeds or other grasses and shall not contain any matter deleterious to its growth or which might affect its subsistence or hardiness when transplanted. Unless the area has been closely pastured, it shall be closely mowed and raked to remove all weeds and long-standing stems.
- B. Care shall be taken at all times to retain the native soil on the roots of the sod during the process of excavation, hauling and planting. Sod material shall be kept moist from the time it is dug, until planted. When so directed by the Engineer, the sod existing at the source shall be watered to the extent required, prior to excavating. Do not stack sod for more than 36 hours between the time of cutting and the time of installation. The Engineer reserves the right to reject any sod deemed unacceptable for installation.

- C. All plantings shall be done between the average date of the last freeze in the spring and six weeks prior to the average date for the first freeze in the fall, according to the U.S. Weather Bureau.
- D. Fertilizer shall conform to the requirements of the Item, “Fertilizer” and shall be applied at the rate of 480-pounds per acre.

PART 3 – EXECUTION

3.1 CONSTRUCTION METHODS

- A. Immediately after the finished grade has been approved, begin sodding operations to reduce excessive weed growth. If the sod bed is dry, immediately prior to sod installation, dampen the surface with a fine mist of water.
- B. Grass shall be turf sod, cut into 16 inch by 24 inch strips.
- C. All areas to be sodded shall be raked to true lines, free from all unsightly variations, bumps ridges or depressions. All sticks, stones, roots or other objectionable material which might interfere with the formation of a finely pulverized seed bed, shall be removed from the soil.
- D. Lay sod so that adjacent strips butt tightly, with no spaces between strips. Lay sod on mounds and slopes, with strips parallel to contours. Stagger joints. Sodded areas shall be flush with adjoining seeded areas. All sod shall, of course, be laid green side up. Tamp and roll the sod thoroughly to make contact with the sod bed, or as directed by the Engineer.
- E. Peg sod on slopes three to one or steeper with pegs driven through sod into soil, until pegs are flush with the turf. Space pegs 18 inches on center. Pegs to be 1 inch square, 6 inches long or, 6 inch lengths of lath. Commercial fertilizer as outlined in the Item, “Fertilizer” shall be applied to the entire sodded area at the prescribed rates, immediately following laying of the sod. Immediately after fertilizing, water the entire area to a saturated depth of 2-inches.
- F. Immediately after installation of the sod, remove sod clumps on soil, wash off any plant materials and pavements not to have sod. Edges along curbs and drives, walkways, etc., shall be carefully trimmed and maintained until accepted.

3.2 CONTRACTOR’S MAINTENANCE & GUARANTEE PERIOD

- A. Maintenance of sodded areas shall be for 60 days after completion of the project and shall consist of watering, weeding, repair of all erosion and resodding as necessary to establish a uniform growth of the specified grass. Contractor shall guarantee growth and coverage of the sod planted under this contract to the effect that a minimum of 95% of the area planted will be covered with the specified planting after 60 days. Sod panels that are dead or dying shall be replaced.
- B. The Contractor shall be responsible for one (1) mowing every two weeks between the months of April to October. The Contractor shall also be responsible for one (1) mowing every three (3) weeks between the months of November to March. In addition, the Contractor shall water the entire sodded and hydro-mulched areas to a saturated depth of one (1) inch at least once a week between the months of April to September and a least once a month between the months of October to March.
- C. Contractor shall make a second planting to those bare areas not meeting specified planting as determined by the Engineer. Such replanting is to be performed within 90 days of initial application and upon notification by the Engineer to replant.

END OF SECTION

SECTION 33 05 01

POLYVINYLCHLORIDE PIPE AND FITTINGS

(Sentences and/or paragraphs that are double underlined indicate revisions that were made from the 2009 specification.)

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. The work specified under this section includes the manufacture, construction and installation of Polyvinylchloride (PVC) pipe and fittings for Water Lines and for Gravity and Pressure Sanitary Sewers.

1.2 REFERENCES

The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D1784	Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds (Latest Edition)
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe (Latest Edition)
ASTM F 1483	Standard Specification for Oriented Poly (Vinyl Chloride), (PVCO) Pressure Pipe (Latest Edition)
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C150	Standard Specification for Portland Cement
ASTM D1598	Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
ASTM D1599	Standard Test Method for Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
ASTM D2122	Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
ASTM D2152	Standard Test Method for Adequacy of Fusion of Extruded Poly (Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
ASTM D2241	Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2564	Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM F679	Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM D2672	Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement

ASTM D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3139	Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4-Inch Through 12- Inch for Water Distribution (Latest Edition)
AWWA C909	Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe. 4-Inch Through 12-Inch for Water Distribution (Latest Edition)
AWWA C104	ANSI Standard for Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water
AWWA C105	ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C111	ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C116	Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service
AWWA C153	Ductile Iron Compact Fittings, 3 in. through 24 in. and 54 in. through 64 in. for Water Service
AWWA C905	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In.- 48 In.

1.3 MEASUREMENT AND PAYMENT

- A. Payment shall be made at the price bid per unit length per the specification SECTION 33 11 13.1 - WATER MAIN CONSTRUCTION or SECTION 33 31 13 - SANITARY SEWAGE SYSTEM.

1.4 SUBMITTALS

- A. Submit manufacturer's data on pipe furnished, indicating compliance with the specifications regarding dimensions, thickness, weights, and materials.
- B. Submit manufacturer's "Certificate of Compliance," stating that the materials furnished comply with this specification.

1.5 STORAGE AND HANDLING

A. UNLOADING - COLD WEATHER HANDLING

As the temperature approaches and drops below freezing extra care should be used in handling during cold weather. Pipe at the bottom of a stack may become out-of-round due to the weight of material above it. Allow the pipe to recover to full initial roundness before installation. Pipe may be unloaded by hand, either by passing over the side or off the truck

end. Sliding one length on another is permissible in unloading pipe, but lengths in the bottom layer shall be lifted off of the rough surface of the truck body to avoid abrasion. Compact shipping units (palletized bundles in a wood frame) may be unloaded by conventional fork lifts.

B. STOCKPILES

Store pipe on a flat surface so as to support the barrel evenly with bell ends overhanging. Store random lengths separately where they will be readily available. Individual lengths of pipe should be stacked in piles no higher than 5 feet. Pipe shall be protected during long exposures (over 3 months) to sunlight. Do not use clear plastic sheets. Provide for air circulation under sheet.

C. STORING RUBBER RINGS

Store all rubber rings at a central point and distribute them as needed. Keep them clean, away from oil, grease, excessive heat and electric motors which produce ozone. If rubber rings are not to be used immediately, store them in their cartons, as shipped, in a cool dark place out of the direct rays of the sun.

PART 2 – PRODUCTS

2.1 MATERIALS

A. WATER LINES

1. Pipe

- a. Blue colored Polyvinyl chloride (PVC) pressure pipe, six inch (6") through twelve inch (12") , shall conform to the current AWWA – C900 DR 14, be UL listed, be approved by the Texas State Board of Insurance and the National Sanitation Foundation. The outside diameter shall be identical to ductile-iron pipe (CIOD Standard, Table 2, AWWA – C900). All pipe shall be new and have the AWWA designation, pressure class, DR pressure rating and size of pipe stamped on the outside of each joint (follow requirements of C900 2.5.2 Markings). All piping shall be new. Partial pieces from other projects shall not be approved for installation. Metal detector tape shall be installed above all PVC pipe at an elevation of 2 feet below natural ground.
- b. Blue colored DR 14 (meeting current AWWA C-905 standards) for pipe sizes greater than 12 inches.
- c. PVC Pressure Pipe shall be designed and tested in accordance with ASTM D1598, D1599, and D2152.
- d. Fittings for PVC water pipe shall be ductile-iron, and shall conform to AWWA C153, unless otherwise specified.

Fitting joints shall be mechanical joints. Bolts and nuts for mechanical joints, or flanged ends will be of a high strength corrosion resistant low-alloy steel and shall conform to AWWA C111. Flange bolts and nuts for above ground installation shall conform to Appendix A of AWWA C115. Flange bolts and nuts for below ground installation shall be 316 stainless steel. All fittings shall be epoxy coated and lined unless stainless steel is used.

Where joints are to be restrained, use mega-lug type fitting for pipe six (6") inches in size and larger. Mega-lug type mechanical restraints with less than 6 contact points will not be allowed for six (6") inch pipe sizes and larger.

Polyethylene wrap or encasement of metal fittings shall conform to AWWA C105. Joint tape shall be self sticking PVC or 8-mil-thick polyethylene.

- e. Joints: PVC water pipe shall be furnished with an elastomeric gasket at each joint and an integral thickened bell as part of each joint. Pipe and fittings must be assembled with a non-toxic lubricant. Provisions must be made at each joint for expansion and contraction. Refer to ASTM F477, D3139 and D3212.

B. GRAVITY SANITARY SEWER

1. Pipe

Flexible pipe and fittings shall be unplasticized polyvinyl chloride gravity sewer pipe shall be green in color, made from clean, virgin, NSF approved Class 12454-B PVC conforming to ASTM D1784. All pipe shall be new and have the ASTM designation, SDR, pressure rating and size stamped on the outside of each joint. All markings shall follow requirements of ASTM D3034.

Polyvinyl chloride (PVC) gravity pipe and fittings in sizes six inch (6") through twelve inch (12") shall conform to ASTM D3034 and be UL listed and approved by the National Sanitation Foundation. Pipe and fittings shall be SDR-26. Eighteen inch (18") pipe and fittings shall be SDR-26 and conform to ASTM F-679, be UL listed and approved by the National Sanitation Foundation.

C. SEWER FORCE MAIN AND PRESSURE PIPE

1. Pipe

- a. Polyvinyl chloride (PVC) pressure pipe, four (4) inch through eight (8) inch, shall be white in color and shall conform to the current ASTM D2241, AWWA – C900, or AWWA C909 standard, be UL listed, be approved by the Texas State Board of Insurance and the National Sanitation Foundation. PVC pipe pressure class shall be equal to or greater than twice the maximum calculated pressure of the force main.
- b. Polyvinyl chloride (PVC) pressure pipe shall be SDR-21 Class 200 and conform to the ASTM D2241 standard, be UL listed and approved by the National Sanitation Foundation, and shall be white in color. The outside diameter shall be identical to steel pipe.
- c. PVC Pressure Pipe shall be designed and tested in accordance with ASTM D1598, D1599, and D2152.
- d. Fittings for PVC pressure pipe shall be ductile-iron, and shall conform to AWWA C153, unless otherwise specified. Fitting joints shall be mechanical joints. Bolts and nuts for mechanical joints, or flanged ends will be of a high strength corrosion resistant low-alloy steel and shall conform to AWWA C111. Flange bolts and nuts for above ground installation shall conform to Appendix A of AWWA C115. Flange bolts and nuts for below ground installation shall be 316 stainless steel. All fittings shall be epoxy coated and lined unless stainless steel is used. Polyethylene wrap or encasement of metal fittings shall conform to

AWWA C105. Joint tape shall be self sticking PVC or 10-mil-thick polyethylene.

Where joints are to be restrained, use mega-lug type fitting.

- e. Joints: PVC water pipe shall be furnished with an elastomeric gasket at each joint and an integral thickened bell as part of each joint. Pipe and fittings must be assembled with a non-toxic lubricant. Provisions must be made at each joint for expansion and contraction. Refer to ASTM F477, D3139 and D3212.

2.2 TESTING REQUIREMENTS

See: SECTION 33 01 30 - TESTING OF GRAVITY SEWER SYSTEMS
SECTION 33 13 10 - HYDROSTATIC TESTING (Used for Waterlines & Sanitary Sewer Force Mains)
SECTION 33 13 00 - DISINFECTION OF WATERLINES

PART 3 – EXECUTION

3.1 TRENCHING

- A. See Standard Details.

3.2 JOINT ASSEMBLY

- A. Push-on joints shall be assembled as follows:
 1. Thoroughly clean the groove and bell and insert the gasket, making sure that it faces the proper direction and that it is correctly seated.
 2. Dirt or foreign material shall be cleaned from the spigot end to a point one inch (1") beyond the reference mark. A joint lubricant shall be used and applicable recommendations of the manufacturer shall be followed.
 3. Be sure that the spigot end is beveled, as square or sharp edges may damage or dislodge the gasket and cause a leak. Push the spigot end into the bell of the pipe while keeping the joint straight. Brace the bell while the beveled end is pushed under the ring, so that previously completed joints in the line will not be closed up. Make deflection after the joint is assembled.
 4. Push the spigot end in until the reference mark on the spigot end is flush with the end of the bell. If excessive resistance to insertion of the beveled end is encountered or the reference mark does not reach the flush position, disassemble the joint, and check the position of the ring. If it is twisted or pushed out of its seat, clean the ring, bell and beveled end and repeat assembly. Be sure both lengths are in proper alignment. If the ring was not out of position, measure the distance between the reference mark and beveled end, and check it against correct values from the manufacturer. Relocate the reference mark if it is out of position.
 5. Small pipe can be pushed into the bell end with a long bar. Large pipe requires additional power, such as a jack, lever puller, or backhoe. A timber header should be used between the pipe and jack or backhoe bucket to avoid damage to the pipe.
 6. At times when pipe laying is not in progress, the open ends of pipe shall be closed by watertight plug or other means pre-approved by the Engineer. The plug shall remain

in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation should the trench fill with water.

B. Mechanical joints shall be assembled as follows:

1. Wipe clean the bell and spigot end. The spigot end, bell, and gasket should be washed with a soap solution to improve gasket seating.
2. Place the gland on the spigot end with the lip extension toward the spigot end, followed by the gasket with the narrow edge of the gasket toward the spigot end of the pipe.
3. Insert the pipe into the bell and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly. Make deflection after joint assembly but before tightening the bolts.
4. Push the gland toward the bell and center it around the pipe with the gland lip against the gasket.
5. Align bolt holes and insert bolts, with bolt heads behind the bell flange, and tighten opposite nuts to keep the gland square with the bell.
6. Tighten the nuts in accordance with manufacturer’s recommendations.

C. When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, or where long radius curves are permitted, the amount of deflection shall not exceed that shown in Table 1. Pipes greater than twelve-inches (12”) in diameter shall not be deflected.

TABLE 1 Maximum Deflection Full Length Pipe Push-on Type Joint		
Pipe Diameter in.	Deflection Angle Deg.	Minimum Radius of Curve ft. *
6	2.5	230
8	1.9	300
12	1.3	450

* All curvature results from the bending of pipe lengths. There is no deflection at the joint.

D. Cutting and Beveling

1. A square cut is essential to insure proper assembly. Use either a tubing cutter or a miter box and carpenter's fine-toothed hand saw or hacksaw. (Do not use standard pipe cutters. The cutting wheel will crush or damage the pipe.)
2. Use a factory-finished beveled end as a guide to determine the angle and length of taper. The end may be beveled using a Pilot beveling tool which will cut the correct taper automatically or a thin steel, "cheese-grater" type of hand tool, Stanley "Sureform" No. 399.
3. With a pencil or crayon, locate the reference mark at the proper distance from the bevel end as indicated by the manufacturer.

3.3 POLYETHYLENE TUBE PROTECTION

- A. All cast iron and ductile iron fittings shall be provided with 8 mil polyethylene tube protection. Completely cover all fittings and connections with polyethylene film held securely in place with joint tape or strapping according to the provisions of AWWA C105.

3.4 EMBEDMENT

- A. Install embedment as shown on the Plans and in accordance with SECTION 31 23 33 - EXCAVATING, TRENCHING, AND BACKFILLING.

3.5 TAPPING WATER LINES

- A. Where a tap occurs within a deflected section of pipe, utilize a fitting (ie: 8” x 1” tapped tee) in lieu of tapping the pipe.
- B. The tapping sleeve specified will be the Smith-Blair 662 or the Ford FTSS_ Stainless Steel Tapping Sleeve with Epoxy Coated Flange for pipe sizes 6"-24".

3.6 GRAVITY SANITARY SEWER DEFLECTION TEST

- A. The sewer line shall be tested for deflection in accordance with SECTION 33 01 30 - TESTING FOR SANITARY SEWAGE GRAVITY SYSTEM.

END OF SECTION

SECTION 33 05 02
DUCTILE IRON PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work specified under this section includes furnishing all labor, tools, equipment, materials, and supplies for the installation of Ductile Iron Pipe for Water Lines or Sanitary Sewers.

1.2 REFERENCES

The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A746 Standard Specifications for Ductile Iron Gravity Sewer Pipe (Latest Revision)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104 Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water (Latest Edition)

AWWA C105 Polyethylene Encasement for Ductile Iron Pipe Systems (Latest Edition)

AWWA C111 Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings (Latest Edition)

AWWA C115 Flanged Ductile Iron Pipe with Threaded Flanges (Latest Edition)

AWWA C116 Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service

AWWA C151 Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids (Latest Edition)

AWWA C150 Thickness Design of Ductile Iron Pipe (Latest Edition)

AWWA C153 Ductile Iron Compact Fittings, 3 in. through 24 in. and 54 in. through 64 in. for Water Service

AWWA C600 Ductile Iron Water Mains (Latest Edition)

1.3 MEASUREMENT

- A. Payment shall be made at the price bid per unit length per the specification SECTION 33 11 13.1 - WATER MAIN CONSTRUCTION or SECTION 33 31 13 - SANITARY SEWAGE SYSTEM.

1.4 SUBMITTALS

- A. Submit manufacturer's data on pipe furnished, indicating compliance with the specifications regarding dimensions, thickness, weights, and materials.

- B. Submit manufacturer’s “Certificate of Compliance,” stating that the materials furnished comply with this specification.

1.5 STORAGE AND HANDLING

- A. Pipe to be shipped in accordance with the pipe manufacturer’s recommendations and stored in a manner that the pipe is not damaged. The Contractor will replace damaged piping at no additional cost to the City.
- B. Pipe shall not be stacked higher than manufacturer’s recommendations. The bottom tier shall be kept off the ground on timbers, rails, or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two (2) rows of 4” x 4” timbers shall be placed between tiers and chocks affixed to each end in order to prevent movement.
- C. Gaskets for mechanical joints to be stored shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.
- D. Mechanical joint bolts shall be handled and stored in such a manner that will ensure proper use with respect to types and sizes.

PART 2 – PRODUCTS

2.1 MATERIALS

A. WATER LINES

1. Pipe

Ductile iron pressure pipe shall conform to the current AWWA C151 (ANSI A21.51) standard. All pipe shall be new, and shall have the AWWA or ASTM designation, pressure class and size of pipe stamped on the outside of each joint. Ductile iron pipe shall be approved by the Underwriter’s Laboratory and shall be accepted by the State Fire Insurance Board for use in water distribution systems without penalty. Ductile iron pipe less than six (6”) inches in diameter will not be allowed. Ductile iron thickness shall conform in all respects to the current AWWA C150 standard based on a minimum of 200 psi working pressure. A special design shall be provided for large diameters or deep embedments.

Flanged pipe shall conform to AWWA C115 and be based upon a minimum of 200 psi working pressure.

Foreign made pipe shall not be accepted.

2. Joints And Gaskets

All ductile iron pressure pipe shall be furnished with one of the following types of joints, and as described in the Proposal, or shown on the Plans.

<u>Type Joint</u>	<u>Standard</u>
Mechanical Joint	AWWA C111
Flanged Ends	AWWA C115

Flange gaskets shall be full faced and conform to Appendix A of AWWA C115.

3. Fittings

Fittings for ductile iron pipe shall be of cast iron, or ductile iron, and shall conform to AWWA C153, unless otherwise specified in the proposal, special specification, or on the plans.

Fitting joints shall be mechanical, flanged, or special internally locked joint with body thickness and radii of curvature conforming to AWWA C153.

All screwed flanges shall be ductile iron.

4. Bolts And Nuts

Bolts and nuts for mechanical joints shall be of a high strength corrosion resistant low alloy steel and conform to AWWA C111. Flange bolts and nuts for above ground installation shall conform to Appendix A of AWWA C115. Flange bolts and nuts for below ground installation shall be 316 stainless steel.

5. Polyethylene Encasement

Polyethylene encasement of 8 mils thickness shall conform to AWWA C105. Joint tape shall be self sticking PVC or polyethylene, 8 mils thick.

6. Restraint

See SECTION 03 30 01 - CONCRETE BLOCKING OR ANCHORAGE.

7. Coatings

Pipe exterior to be bituminous coated and in accordance with the requirements of AWWA C151 Section 4.3. Coating and Lining or epoxy coated in accordance with AWWA C116.

8. Lining

Unless otherwise noted, all pipe shall be cement-mortar lined inside with seal coat all in accordance with AWWA C104 or epoxy coated in accordance with AWWA C116.

B. GRAVITY SANITARY SEWER LINES

1. Pipe

a. Ductile iron gravity and pressure pipe shall conform to the current ASTM, A746, and AWWA C111 and C151 (ANSI A21.51) standard. All pipe shall be new, and shall have the AWWA or ASTM designation, pressure class and size of pipe stamped on the outside of each joint. Ductile iron pipe less than eight (8”) inches in diameter will not be allowed for sewer mains.

b. Ductile iron thickness shall conform in all respects to the current AWWA C150/C151 standard, based on a minimum of 200 psi working pressure.

c. Pipe to be shipped in accordance with the pipe manufacturer’s recommendations and stored in a manner that the pipe is not damaged. The Contractor will replace damaged piping at no additional cost to the City.

d. Flanged pipe shall conform to AWWA C115, and be based upon a minimum of 200 psi working pressure.

2. Joints And Gaskets

All ductile iron pressure pipe shall be furnished with one of the following types of joints, and as described in the Proposal or shown on the Plans. Flange gaskets shall be full faced, and conform to Appendix A of AWWA C115.

<u>Type Joint</u>	<u>Standard</u>
Mechanical Joint	AWWA C111
Flanged Ends	AWWA C115

- a. All screwed flanges shall be ductile iron.
- b. Gaskets for mechanical joints to be stored shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

3. Fittings

- a. Fittings for ductile iron pipe shall be of ductile iron, and shall conform to AWWA C153.
- b. Fitting joints shall be mechanical, flanged, or special internally locked joint with body thickness and radii of curvature conforming to AWWA C153.

4. Bolts And Nuts

Bolts and nuts for mechanical joints shall be high-strength corrosion resistant low alloy steel, and conform to AWWA C111. Flange bolts and nuts for above ground installation shall conform to Appendix A of AWWA C115. Flange bolts and nuts shall be 316 stainless steel.

Mechanical joint bolts shall be handled and stored in such a manner that will ensure proper use with respect to types and sizes.

5. Polyethylene Encasement

Polyethylene encasement shall conform to AWWA C105. Joint tape shall be self-sticking PVC or polyethylene, 8 mils thick.

6. Coatings/ Linings

All pipe and fittings shall be bituminous or epoxy coated outside and inside, all in accordance with AWWA C104 or AWWA C116. Interior lining for ductile iron sewer pipe shall conform to manufacturer's recommendations. Minimum lining thickness shall be 40 mils, regardless of material recommended.

Other acceptable lining materials are "Protecto 401" Ceramic Epoxy by Vulcan Group or pre-approved equal.

C. FORCE MAIN

Force mains shall comply with of all requirements of SECTION 33 11 13.1 – WATERLINE MAIN CONSTRUCTION.

2.2 TESTING REQUIREMENTS

See: SECTION 33 11 13.1 - WATER MAIN CONSTRUCTION or SECTION 33 31 13 - SANITARY SEWAGE SYSTEM for testing requirements.

PART 3 – EXECUTION

3.1 TRENCHING

- A. See Standard Details.

3.2 PIPE INSTALLATION

- A. All pipe fittings, services, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the material. All rejected material must be removed from the project immediately at the sole expense of the Contractor.
- B. All lumps, blisters, and excess coating shall be removed from the socket and plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit or any foreign material before the pipe is laid.
- C. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.
- D. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with pre-approved backfill material.
- E. At times when pipe laying is not in progress, the open ends of pipe shall be closed by watertight plug, or other means pre-approved by the Engineer. The plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation should the trench fill with water.

3.3 MECHANICAL JOINT ASSEMBLY

- A. Wipe clean the socket and plain end. The plain end, socket and gasket should be washed with a soap solution to improve gasket seating.
- B. Place the gland on the plain end, with the lip extension toward the plain end, followed by the gasket, with the narrow edge of the gasket toward the plain end of the pipe.
- C. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly. Make deflection after joint assembly, but before tightening the bolts.
- D. Push the gland toward the bell, and center it around the pipe with the gland lip against the gasket.
- E. Align bolt holes and insert bolts, with bolt heads behind the bell flange, and tighten opposite nuts to keep the gland square with the socket.
- F. Tighten the nuts in accordance with the manufacturer's recommendations.

- G. When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, or where long radius curves are permitted, the amount of deflection shall not exceed manufacturer's recommendations.

3.4 PIPE CUTTING

- A. Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner, without creating damage to the pipe or lining. Seal-coat bare surfaces and cut ends per manufacturer's recommendations.
- B. Cut ends and rough edges shall be ground smooth.

3.5 POLYETHYLENE TUBE PROTECTION

A. GENERAL

1. All cast iron & ductile iron pipe and fittings shall be provided with polyethylene tube protection according to the provisions of AWWA C105. Completely cover all fittings and connections with polyethylene film held securely in place with joint tape or strapping. The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material.
2. Where polyethylene-wrapped pipe joints an adjacent pipe that is not wrapped, extend the polyethylene wrap to cover the adjacent pipe for a distance of at least two (2') feet. Secure the end with circumferential turns of tape.

3.6 EMBEDMENT

- A. Install embedment as shown on the Plans and in accordance with SECTION 31 23 33, Excavating, Trenching, and Backfilling.

3.7 REACTION ANCHORAGE AND BLOCKING

- A. The contractor shall install concrete blocking and retaining glands to all unlugged bell and spigot or all-bell tees, Y-branches, bends deflecting eleven and one-fourth degrees ($11\frac{1}{4}^\circ$) or more, and plugs which are subject to internal pressure in excess of 10 psi. to preclude separation of joints. See SECTION 03 30 01 - CONCRETE BLOCKING OR ANCHORAGE for additional details.

3.8 MINIMUM COVER

- A. See SECTION 33 11 13.1 - WATER MAIN CONSTRUCTION or SECTION 33 31 13 - SANITARY SEWAGE SYSTEM for cover requirements.

END OF SECTION