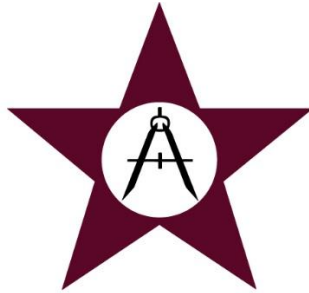




US 181 SEWER EXTENSION

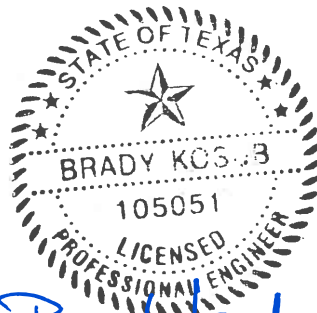
Technical Specifications

By:



M&S ENGINEERING
POWER & UTILITY ENGINEERS

Texas Registered Engineering Firm F-1394



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Main Office:

P.O. Box 970
6477 FM 311 (Physical)
Spring Branch, Texas 78070
830.228.5446
Fax 830.885.2170
Web: www.msengr.com

Branch Office:

376 Landa Street (Mailing)
New Braunfels, Texas 78130

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The Technical Specifications and Details have been adopted from the San Antonio Water System (SAWS) by the City of Floresville (City). Any reference to the following terms in the Technical Specifications and Details are to be replaced with the following definitions:

- A. *San Antonio Water System (SAWS)* – Replace this term with the “City of Floresville (City)”
- B. *SAWS Representative* – Replace this term with “City Engineer”
- C. *SAWS Inspector* – Replace this term with “City Inspector”
- D. *City of San Antonio (COSA)* – Any reference to this term shall be omitted.
- E. *Edwards Aquifer Recharge Zone (EARZ)* – Any reference to this term shall be omitted.
- F. *Products Standard Committee* – Any reference to this term shall be omitted.

List of Technical Specifications

SAWS ITEM NO. 100 – Mobilization
SAWS ITEM NO. 101 – Preparing Right-Of-Way
SAWS ITEM NO. 299 – Flowable Fill
SAWS ITEM NO. 300 – Concrete (Natural Aggregate)
SAWS ITEM NO. 307 – Concrete Structures
SAWS ITEM NO. 550 – Trench Excavation Safety Protection
SAWS ITEM NO. 804 – Excavation Trenching and Backfill
SAWS ITEM NO. 818 – Water Pipe Installation PVC (C-900 and C-909) Pipe 4 in-24 in
SAWS ITEM NO. 836 – Grey Iron and Ductile-Iron Fittings
SAWS ITEM NO. 839 – Anchorage Thrust Blocking and Joint Restraint
SAWS ITEM NO. 846 – Air Release Assemblies
SAWS ITEM NO. 848 – Sanitary Sewer
SAWS ITEM NO. 849 – Sanitary Sewer Testing
SAWS ITEM NO. 852 – Sanitary Sewer Manholes
SAWS ITEM NO. 856 – Pipe Jacking
SAWS ITEM NO. 858 – Concrete Encasement Cradles Saddles and Collars
SAWS ITEM NO. 860 – Vertical Stacks
SAWS ITEM NO. 865 – Bypass Pumping Small Diameter Sanitary Sewer Mains
SAWS ITEM NO. 866 – Sanitary Sewer Main Television Inspection
SAWS ITEM NO. 868 – Sanitary Sewer System Cleaning
SAWS ITEM NO. 904 – Construction Phase Procedures
SAWS ITEM NO. 1110 – Progress Schedule
SAWS ITEM NO. 1112 – Project Record Documents
SAWS ITEM NO. 1114 – Pre-Construction Video
SAWS ITEM NO. 3001 – Pole Bracing
TXDOT ITEM No. 164 – Seeding for Erosion Control
TXDOT ITEM No. 506 – Temporary Erosion, Sedimentation, and Environmental Controls
COSA ITEM No. 530 – Barricades, Signs, and Traffic Handling

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ITEM NO. 100

Mobilization

100.1 DESCRIPTION: This item shall govern the mobilization of personnel, equipment, and supplies at the project site in preparation for beginning work on other contract items that will be performed by the Contractor. Mobilization shall include, but is not limited to, the movement of equipment, personnel, material, supplies, etc. to the project site, application fees, permit fees for all necessary permits and the establishment of the Contractor's office and other facilities prior to beginning the work. The cost of required insurance and bonds shall be include in this item.

100.2 MEASUREMENT: Measurement of the Item No. 100, Mobilization, as specified herein, will be by the "Lump Sum," (LS) as the work progresses

100.3 PAYMENTS: Payment shall be compensation for all work including the furnishing of all materials, equipment, tools, labor, and incidentals necessary to complete the work. Payment earned for this line item will be withheld, until said documents are submitted and approved by SAWS: all material submittals, Specification Item No. 902 Safety and Health Program, Specification Item No. 903 Construction QC/QA Program, Specification Item No. 1114 Pre-Construction Videos, and Specification Item No. 1110 Progress Schedule. 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 and Preparing Right-Of-Way).

1. When 1% of the adjusted contract amount for construction items is earned, 50% of the "Lump Sum" bid or 5% of the total contract amount, whichever is less, will be paid.
2. When 5% of the adjusted contract amount for construction items is earned, 75% of the "remainder of the Lump Sum" bid or 10% of the total contract amount, whichever is less, will be deducted from the above amount.
3. When 10% of the adjusted contract amount for construction items is earned, 90% of the "remainder of the Lump Sum" bid or 15% of the total contract amount, whichever is less, will be paid. Previous payments under this item will be deducted from the above amount.

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4. Upon completion of all work under this contract, payment for the remainder of the “Lump Sum” bid for Mobilization will be made on the final pay estimate.
5. SAWS General Conditions (GCs) ARTICLE 7.2 states payments shall be made by the Inspector for approved materials stored on the project site that are deemed necessary and required for the “PROJECT WORK”. Materials considered as “on-site” material must be stored on the project site and/or within off-site facilities either owned or leased (signed by both parties) by the Contractor. Materials On-Site are limited to the items listed in Table 1.

Table 1	
“Materials On-Site” Payment Guidelines	
<u>“Materials On-Site” Application</u>	
<i>Water, Recycle, Re-Use or Wastewater Pressure Main</i>	
Pipe	4-inch diameter or greater (rounded down to the nearest whole foot)
Valves	4-inch diameter or greater (only when bid as a separate line item)
Fire Hydrants	Includes all items for complete assembly
<i>Wastewater Gravity Main Facilities</i>	
Pipe	6-inch. diameter or greater (rounded down to the nearest whole foot)
Manholes	Includes base and cone section, risers, rings and covers. Excludes risers for FRP unless proper stations are provided noting location.
Wet wells	Excludes covers

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<u>“Materials On-Site” Limitations</u>	
SAWS will <i>not</i> pay “Materials On-Site” for:	Quantities that exceed plan quantities
	Items that are not specifically listed as individual lines items (example: 6-in. valves that are included in the unit price of a fire hydrant assembly)
	Fittings, flanges, small diameter pipe or valves, cleanouts, meter boxes or incidentals.
	Materials stored at a supplier’s yard or facility.
	Materials that are stored at an excessive distance from the project site (based solely on the judgment of the SAWS Inspector)
	Any other items not specifically included in the “application” section of <i>Table 1: “Materials On-Site” Payment Guidelines</i>

End of Specifications

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ITEM NO. 101

Preparing Right- Of-Way

101.1 DESCRIPTION: This item shall govern preparing the right-of-way for construction operations by removing and disposing of all obstructions from the right-of-way and from designated easements where removal of such obstructions is not otherwise provided for in the contract documents.

1. It is the intent of this specification to provide for the removal and disposal of all obstructions and/or materials, not specifically provided for elsewhere by the contract documents.
2. This item shall also include the removal of trees, stumps, bushes, shrubs, brush, roots, vegetation, logs, rubbish, paved parking areas, miscellaneous stone, brick, drainage structures, manholes, inlets, abandoned railroad tracks, scrap iron and all debris, whether above or below ground, except live utility facilities.
3. This item shall not govern the demolition of buildings by the use of explosives. Such demolition work shall be governed by the use of a special specification controlling the work.

101.2 CONSTRUCTION METHODS: Areas designated in the contract documents shall be cleared of all obstructions, vegetation, abandoned structures, etc., as listed within this specification Item No. 101 Preparing Right-Of-Way and as shown on the plans, except trees or shrubs specifically designated by the Engineer for preservation.

1. Such obstructions shall be considered to include, but not be limited to, remains of houses or structures not completely removed by Contractor or others, foundations, floor slabs, concrete, brick, lumber, plaster, cisterns, septic tanks, basements, abandoned utility pipes or conduits, equipment or other foundations, fences, retaining walls, outhouses, shacks, and all other debris, as well as buried concrete slabs, curbs, driveways and sidewalks.
2. All fences along the right-of- way which are damaged or removed temporarily by the Contractor shall be replaced by the Contractor to an equal or better condition, at no expense to SAWS.
3. Contractor shall adhere to the current City of San Antonio Tree Ordinance
4. Trees and shrubs designated by the tree ordinance for preservation shall be carefully trimmed as noted in the contract documents and shall be protected from

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- scarring, barking, or other injuries during construction operations. Exposed ends of pruned limbs shall be treated with an approved pruning material.
5. Unless otherwise indicated in the contract documents, all underground obstructions shall be removed to the following depths:
 - a. In areas to receive embankment, 2 ft below natural finished grade.
 - b. In areas to be excavated, 2 ft below the lowest elevation of the excavation;
 - c. All other areas, 2 ft below finished grade.
 6. Holes remaining after removal of all obstructions, objectionable materials, vegetation, etc., shall be backfilled and tamped as directed by the SAWS Inspector, and the entire area shall be bladed to prevent ponding of water and to provide drainage. In areas that are to be immediately excavated, backfilling and blading may be eliminated, if approved by the SAWS Inspector.
 7. Areas to be used as borrow sites and material sources shall have all obstruction, objectionable materials, vegetation, etc., removed to the complete extent necessary to prevent such objectionable matter from becoming mixed with the material to be used in the construction.
 8. Where a conduit is shown to be replaced, it shall be removed in its entirety, and all connections to the existing conduit or pipe shall be made. Where an existing conduit or pipe is to be cut and plugged, the line shall be cut back not less than 2 ft, and a plug of concrete not less than 2 ft long shall be poured and held in the end of the conduit or pipe. The plug may also be accomplished by using a precast stopper grouted into place.
 9. Material to be removed will be designated as “salvageable” or “non-salvageable” in the contract documents prior to bidding by the Contractor. All “salvageable” material will remain the property of the SAWS and will be stored at the site as directed by the SAWS Inspector. All “non-salvageable” materials and debris removed shall become the property of the Contractor and shall be removed from the site and shall be disposed of properly.
 10. All asphaltic material shall be disposed of or recycled at the facility authorized to accept the asphalt for such purposes and applicable to appropriate guidelines and regulations.

101.3 MEASUREMENT: Measurement of the Item No. 101, Preparing Right of Way, as specified herein, will be by the “Lump Sum,” as the work progresses.

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101.4 PAYMENTS: Payment shall be compensation for all work including the furnishing of all materials, equipment, tools, labor, tree pruning, removal, protection, landscape impacts, and incidentals necessary to complete the work. Payment earned for this line item will be withheld, until said documents are submitted and approved by SAWS: all material submittals, Item No. 902 Safety and Health Program, Item No. 903 Construction QC/QA Program, Item No. 1114 Pre-Construction and Post Construction Videos, and Item No. 1110 Progress Schedule. Partial payments of the “Lump Sum” bid for preparing right-of-way 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 and Preparing Right-Of-Way).

1. When 1% of the adjusted contract amount for construction items is earned, 50% of the “Lump Sum” bid or 5% of the total contract amount, whichever is less, will be paid.
2. When 5% of the adjusted contract amount for construction items is earned, 75% of the “remainder of the Lump Sum” bid or 10% of the total contract amount, whichever is less, will be deducted from the above amount.
3. When 10% of the adjusted contract amount for construction items is earned, 90% of the “remainder of the Lump Sum” bid or 15% of the total contract amount, whichever is less, will be paid. Previous payments under this item will be deducted from the above amount.
4. Upon completion of all work under this contract, payment for the remainder of the “Lump Sum” bid for Preparing Right-Of-Way will be made on the final pay estimate.

- End of Specification -

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ITEM NO. 299

Flowable Fill

299.1 DESCRIPTION: The work covered by this item consists of furnishing, transporting, mixing, testing and installing flowable fill. Flowable fill is a concrete material suitable as a backfill for utility trenches, abandoned pipes, manholes and valves. It is a heavy material and will exert a high fluid pressure against any forms, embankment, or wall used to contain backfill.

299.2 REFERENCE STANDARDS: Reference standards cited in this Specification Item No. 299 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City of San Antonio (COSA) Standard Specifications for Construction
 - a. ASTM C 31 – Making and Curing Concrete Test Specimens in the field.
 - b. ASTM C 39 – Compressive Strength of Cylindrical Concrete Specimens.
 - c. ASTM C 40 – Organic Impurities in Fine Aggregates for Concrete.
 - d. ASTM C 94 - Ready-Mixed Concrete.
 - e. ASTM C 150 - Portland Cement.
 - f. ASTM C 192 – Making and Curing Concrete Test Specimens in the Laboratory.
 - g. ASTM C 260 – Air-Entraining Admixtures for Concrete.
 - h. ASTM C 494 - Chemical Admixtures for Concrete.
 - i. ASTM C 618 – Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Concrete.
3. ASTM C 4318 – Liquid Limit, Plastic Limit and Plasticity Index of Soils. Texas Department of Transportation (TxDOT)
 - a. TxDOT DMS-4600 Hydraulic Cement
 - b. TxDOT DMS-4610 Fly Ash
 - c. TxDOT DMS 4640 Chemical Admixtures for Concrete
 - d. Tex-401-A
 - e. TxDOT Tex-106-A
 - f. TxDOT-Tex-418-A
 - g. TxDOT-Tex-447-A

299.3 SUBMITTALS:

1. All submittals shall be in accordance with Engineer's requirements. All submittals shall be approved by the Engineer and acknowledge by the Inspector prior to delivery of materials and commencing any portion of the proposed scope of work.
 - a. Submit proposed mix design. Mix design shall state the following information:
 - 1) Mix design number or code designation to order the concrete from the supplier.

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- 2) Design strength at 7 days (unless otherwise noted on the Plans).
- 3) Cement type and brand.
- 4) Fly ash type and brand.
- 5) Admixtures type and brand.
- 6) Proportions of each material used.
- 7) Submit a copy of delivery tickets accompanied by batch tickets, providing the information required by ASTM C 94 to SAWS Inspector in the field at time of delivery.

299.4 MATERIALS:

1. Cement. Furnish hydraulic cement that meets the requirements of TxDOT's DMS-4600, "Hydraulic Cement," TxDOT's Hydraulic Cement Quality Monitoring Program (HCQMP), and ASTM C-150 Type I Portland Cement. Sources not on the HCQMP or other sources to be used in combination with an approved source will require approval before use.
2. Fly Ash. Furnish fly ash conforming to TxDOT DMS-4610, "Fly Ash."
3. Chemical Admixtures. Furnish chemical admixtures conforming to TxDOT DMS-4640, Chemical Admixtures for Concrete.
4. Fine Aggregate. Provide fine aggregate that will stay in suspension in the mortar to the extent required for proper flow and that meets the gradation requirements of Table 1. Test fine aggregate gradation in accordance with TxDOT standard laboratory test procedure Tex-401-A. Plasticity Index (PI) must not exceed 6 when tested in accordance with TxDOT standard laboratory test procedure Tex-106-A.
5. Mixing Water. Use mixing water conforming to the requirements of Specification Item No. 300, Concrete (Natural Aggregate).

Table 1	
Aggregate Gradation Chart	
<i>Sieve Size</i>	<i>Percent Passing</i>
$\frac{3}{4}$ inch	100
No.200	0-30

299.5 CONSTRUCTION: Unless otherwise shown on the plans, furnish a mix meeting the requirements of this section as set forth below.

1. Strength. The compressive strength range shall be between the following strength values unless otherwise directed by the Engineer or shown on the plans:
 - a. Low Strength. Between 80 psi and 150 psi at 28 days,
 - b. High Strength. Greater than 500 psi at 28 days. For emergency repairs, strength shall be greater than 50 psi at 2 hours.
2. Consistency. Design the mix to be placed without consolidation and to fill all intended voids.
 - a. Fill an open-ended, 3 inch diameter by 6 inch high cylinder to the top to test the consistency.
 - b. Immediately pull the cylinder straight up. The correct consistency of the mix must produce a minimum 8 inch diameter circular spread with no segregation.

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- c. When necessary, use specialty type admixtures to enhance the flowability, reduce shrinkage, and reduce segregation by maintaining solids in suspension.
 - d. All admixtures must be used and proportioned in accordance with the manufacturer's recommendations.
 - e. Mix the flowable fill using a central-mixed concrete plant, ready-mix concrete truck, pug mill, or other approved method.
- 3. Shrinkage and Bleeding. Limit shrinkage to 0.5% or less based upon the results from ASTM C 827, "Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures."
 - a. Batch, mix and transport flowable fill in accordance with ASTM C 94, except when directed otherwise by the Engineer.
 - b. Mix flowable fill in quantities required for immediate use. Do not use portions which have developed initial set or which are not in place within 90 minutes after the initial water has been added.
 - c. Do not mix flowable fill while the air temperature is at or below 35 degrees F without prior approval from the Engineer.
 - d. Monitor and control the fluid pressure during placement of flowable fill prior to set. Take appropriate measures to avoid excessive pressure that may damage or displace structures or cause flotation. Cease operations if flowable fill is observed leaking from the area.
 - e. Repair or replace damaged or displaced structures at no additional cost to SAWS.
 - f. Clean up excess flowable fill discharged from the work area and remove excess flowable fill from pipes at no additional cost to SAWS.

299.6 TESTING: Testing shall be in accordance with TxDOT standard laboratory test procedure Tex-418-A

- 1. Contractor to furnish all labor, equipment, tools, containers, and molds required for sampling, making, transporting, curing, removal, and disposal of test specimens. Furnish test molds meeting the requirements of TxDOT standard laboratory test procedure Tex-447-A
- 2. Two specimens are required for a strength test, and the compressive strength is defined as the average of the breaking strength of the 2 cylinders.
- 3. Contractor to transport, strip, and cure the test specimens as scheduled at the designated location.
- 4. Cure test specimens in accordance with TxDOT standard laboratory test procedure Tex-447-A.
- 5. The Contractor will sample, take, and test all quality control testing.
- 6. Contractor to dispose of used, broken specimens in an approved location and manner.
- 7. The frequency of job control testing will be at the direction of the Engineer.
- 8. SAWS will be responsible for quality assurance testing.

299.7 MEASUREMENT: This Item will be measured by the cubic yard of material placed of accepted work complete in place.

- 1. Measurement will not include additional volume caused by slips, slides, or cave-ins resulting from the Contractor's operations.

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PAYMENT: The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” is for full compensation for furnishing, hauling, and placing materials and for equipment, tools, labor, and incidentals and will be paid for at the unit price bid for “Flowable Fill (Low Strength),” “Flowable Fill (High Strength),” or “Flowable Fill (High Strength emergency Repair)” for Pipe. Flowable Fill shall be paid for at the contract unit price per cubic yard based on the maximum trench widths as established per SAWS Construction Specification Item No. 804, schedule of pay or as indicated on the contract plans and is for full compensation for furnishing, hauling, and placing materials and for equipment, tools, labor, and incidentals.

The use of flowable fill around manholes as per specification items Nos. 850, 851, 852, 853, and 855 is incidental and there will be no additional separate payment item for the material.

-End of Specification -

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ITEM NO. 300

Concrete (Natural Aggregate)

300.1 DESCRIPTION: This item shall govern the storage, handling and usage of materials; and the proportioning, mixing and transportation of concrete for all concrete construction. This specification does not cover the placement, consolidation, curing, or protection of the concrete.

300.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 300 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City of San Antonio (COSA) Specifications for Construction
3. American Concrete Institute
 - a. ACI 117 - Standard Tolerances for Concrete Construction and Materials.
 - b. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 - c. ACI 302.1R - Guide for Concrete Floor and Slab Construction.
 - d. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 - e. ACI 308 - Standard Practice for Curing Concrete.
 - f. ACI 309R - Guide for Consolidation of Concrete.
 - g. ACI 311 - Guide for Concrete Plant Inspection and Field Testing of Ready-Mix Concrete.
 - h. ACI 315 - Details and Detailing of Concrete Reinforcement
 - i. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary.
 - j. ACI 544 - Guide for Specifying, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete.
4. American Society for Testing and Materials (ASTM) International:

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- a. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- b. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
- c. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- d. ASTM A 767 - Standard Specifications for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
- e. ASTM A 775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- f. ASTM A 820 - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.
- g. ASTM A 884 - Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.
- h. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- i. ASTM C 33 - Standard Specification for Concrete Aggregates.
- j. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- k. ASTM C 42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- l. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.
- m. ASTM C 138 - Standard Test Method for Unit Weight Yield and Air Content (Gravimetric) of Concrete.
- n. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
- o. ASTM C 150 - Standard Specification for Portland Cement.
- p. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

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

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

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2. Submit laboratory reports prepared by independent testing laboratory stating that materials used comply with requirements of this Section.
3. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by Engineer.
4. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.
5. When required on Drawing, submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.
6. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.

300.4 MATERIAL: The concrete shall be composed of Portland cement, mineral filler, if necessary, natural aggregates (fine and coarse), and water, proportioned and mixed as hereinafter provided in these specifications. Concrete shall meet all the requirements as set forth in the latest provision of ASTM C94 or the most applicable approved equal provision.

1. The minimum cement content, maximum allowable water content, and maximum slump of the various classes of concrete shall conform to Table 1.

300.5 MEASUREMENT: The quantities of concrete, of the various classifications which constitute the completed and accepted structure, will be measured by the cubic yard in place. Only accepted work will be included, and the dimensions used will be those shown in the contract documents or ordered in writing by the Engineer. Measurement will not include additional quantities due to over excavation, trench slides, and caving.

300.6 PAYMENT: The concrete quantities, measured as provided above, will be paid for at the contract unit prices bid per cubic yard for the various classifications of concrete shown, which prices shall be full compensation for furnishing, hauling and mixing all concrete materials; placing, curing, and finishing all concrete; all grouting and pointing; furnishing and placing all drains and expansion joints, except as hereinafter provided; furnishing and placing metal flashing strips; and for all forms and faux work, labor, tools, equipment, and incidentals necessary to complete the work.

1. The above provisions for payment for drains and expansion joints shall not be interpreted to provide payment for cast iron or structural steel shapes used in drains; for structural steel, cast iron or cast steel bearing plates; or for

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steel members used in armoring roadway joints.

2. Payment for these materials shall be full compensation for work herein specified, including the furnishing of all materials, equipment, tools, labor, and incidental necessary to complete the work.
3. No payment for additional quantities will be made due to over excavation, trench slides, and caving.
4. Payment for reinforcing an item which specifically includes the cost of reinforcement shall be paid for as provided in the specifications for those items
5. No direct measurement or payment will be made for Concrete Class "G," but shall be considered subsidiary to the particular items required by the contract documents.

Table 1				
Class	Minimum compressive strength @ 28 days, psi (Mpa)	Maximum water/cement ratio	Slump range, inches	Min.-max. sacks cement, cubic yard
A	4,000 (28)	4.5	2-4	5
B	2,500 (17)	8	2-5	4.5
C	2,000 (14)	9	1-4	4
D	1,000 (6)	11	1-4	2
G	(as specified in the contract documents)	5.5	2-3	6.0-8.0

- End of Specification -

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ITEM NO. 307

Concrete Structures

307.1 DESCRIPTION: This item shall govern the construction and repair of headwalls, wingwalls, box transitions, approach slabs, retaining walls, and other designated structures. All concrete structures shall be constructed and repaired in accordance with the specifications herein outlined and in conformity with the required lines, grades, sections and details shown in the contract documents or as directed by the Engineer. New Sanitary Sewer Structures shall be Polymer Concrete See Specification Item No. 850 Polymer Concrete Sanitary Sewer Structures or Specification Item No. 853 Glass Fiber Reinforced Polymer (FRP) Manholes and Structures.

307.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 307 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City of San Antonio (COSA) Specifications for Construction
3. American Society of Mechanical Engineers
 - a. ASME B 16.1 –Cast Iron Pipe Flanges and Flanged Fittings
4. American Society for Testing and Materials (ASTM) International:
 - a. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
 - b. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - c. ASTM C 270 - Standard Specification for Mortar for Unit Masonry
 - d. ASTM C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - e. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections

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- f. ASTM C 890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
- g. ASTM C 913 – Standard Specifications for Precast Concrete Water and Wastewater Structures
- h. ASTM C 923 - Standard Specifications for Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes.
- i. ASTM C 990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
- j. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic - Cement Grout (Nonshrink).
- k. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft³).
- l. ASTM D 2665 - Standard Specification for Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe, and Fittings.
- m. ASTM D 2996 - Standard Specification for Filament-wound Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
- n. ASTM D 2997 - Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber- Reinforced Thermosetting-Resin) Pipe.
- o. ASTM F 2306 – Standard Specification for 12 to 60 in. [300 to 1500 mm] Corrugated profile Wall Polyethylene (PE) Pipe Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.
- p. ASTM F 2510 – Standard Specification for Resilient Connectors Between Concrete Manhole Structures and Corrugated High Density Polyethylene Drainage Pipes
- q. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil 3 Using Standard Effort (12,400 ft-lb/ft)
- r. ASTM D 2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings

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- s. ASTM D 2996 - Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber- Reinforced Thermosetting-Resin) Pipe
 - t. ASTM D 2997 - Standard Specification for Centrifugally Cast “Fiberglass” (Glass-Fiber- Reinforced Thermosetting Resin) Pipe
 - u. ASTM F 2306 – Standard Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications
 - v. ASTM F 2510 – Standard Specification for Resilient Connectors between Concrete Manhole Structures and Corrugated High Density Polyethylene Drainage Pipes.
5. American Water Works Association (AWWA)
- a. AWWA C 213 - Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines
6. American Association of State Highway and Transportation Officials (AASHTO)
- a. M306: Standard Specification for Drainage, Sewer Utility and Related Changes.

307.3 SUBMITTALS: Contractor shall submit manufacturer’s product data, instructions recommendations, shop drawings, and certifications. All submittals shall be in accordance with Engineer’s requirements and submittals shall be approved prior to delivery.

- 1. Submit proposed design mix and test data for each type and strength of concrete.
- 2. Submit manufacturer’s data and details of following items for approval:
 - a. Frames, grates, rings, and covers.
 - b. Materials to be used in fabricating drop connections.
 - c. Materials to be used for pipe connections at structure walls.
 - d. Materials to be used for stubs and stub plugs.
 - e. Installation instructions for forms.
 - f. Shop drawing of manhole sections, base units and construction details, including reinforcement, jointing methods, materials and dimensions.

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3. Summary of criteria used in structure design including, as minimum, material properties, loadings, load combinations, and dimensions assumed. Include certification that structure design is in full accordance with ASTM C478 and /or ASTM C 890 and design criteria.
4. Materials and procedures for corrosion-resistant liner and coatings or concrete additive, if required.
5. Seal submittal drawings by Professional Engineer registered in State of Texas.

307.4 MATERIALS:

1. Concrete: All concrete shall conform to the latest provisions of Item No. 300, "Concrete (Class A)" or the most applicable approved equal provision, or the concrete shall be of a class as noted in the contract documents.
2. Reinforcing Steel: All reinforcing steel shall conform to the provisions of Item No. 301, "Reinforcing Steel."
3. Membrane Curing Compound: Provide membrane curing compounds that conform to the latest provision of TxDOT's DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants" or most applicable approved equal provision.
4. Expansion Joint Materials: Provide materials that conform to the latest provision of TxDOT's DMS-6310, "Joint Sealants and Fillers" or most applicable approved equal provision.
5. Cast Iron Castings: All cast iron castings shall conform to the latest provision of the City of San Antonio Department of Public Works' Standard Specifications for Construction Item No. 409, "Cast Iron Castings", or most applicable approved equal provision.
6. Metal for Structures: Metal for structures shall conform to the latest provision of the City of San Antonio Department of Public Works' Standard Specifications for Construction Item No. 302, "Metal for Structures", or most applicable approved equal provision.

307.5 CONSTRUCTION METHODS:

1. Forms: Forms shall be of wood, metal or other approved materials and shall conform to the following requirements
 - a. Wood Forms:

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- 1) Unexposed concrete surfaces, No. 2 common or better lumber.
 - 2) Exposed concrete surfaces, dressed and matched boards of uniform thickness and width.
- b. Plywood: Commercial Standard Douglas Fir, moisture resistant, concrete form plywood, not less than 5 ply and at least 9/16th of an inch in thickness. The face of the plywood shall be free from knot holes and other blemishes.
- c. Metal Forms: Metal forms of an approved type that will produce surfaces equal to or better than those specified for wood forms.
 - 1) Forms may be constructed of any of the above substances or of other material if suited to the intended purpose and when approved by the Inspector.
 - 2) Forms shall be built mortar tight and of sufficient strength to prevent bulging between supports and shall be set and maintained to the line and grade designated until the concrete is sufficiently hardened to permit removal.
 - 3) All details of form construction shall be subject to the approval of the Inspector and, in special cases, the approval of the Engineer may be required.
 - 4) Permission to place concrete will not be given by the Inspector until all form work has been placed in accordance with the above requirements.
 - 5) If at any stage of the work, the forms show signs of bulging, sagging or moving, that portion of the concrete causing such conditions shall be immediately removed, if required by the Inspector, and the forms reset and securely braced against further movement. All form resets will be at no additional cost to SAWS and will not warrant any claims for delays on the project.
 - 6) All corners and edges, which will be exposed after construction, shall be chamfered with triangular chamfer strips $\frac{3}{4}$ inch measured on the sides.
2. Placing Reinforcement: All steel reinforcement shall be placed in accordance with Item No. 301, "Reinforcing Steel."
3. Placing Concrete: The base slabs of inlets, junction boxes, headwalls, culverts and other structures shall be placed and allowed to set before the remainder of the structure is constructed.

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- a. Suitable provisions shall be made for bonding the sidewalls to the base slab by means of longitudinal keys so constructed as to prevent the percolation of water through the construction joints.
- b. Before concrete is placed in the walls, the keyed-edge joints shall be thoroughly cleaned of all shavings, sticks, trash or other extraneous materials.
- c. The top slabs of culverts and like structures may be poured monolithic with the walls, provided the walls are poured and allowed to set a minimum of 1 hour, no more than 2 hours, shall elapse between the placing of the concrete in the wall and that in the top slab; such interval is to allow for shrinkage of the concrete in the wall.
- d. Under adverse weather conditions, the minimum time will be increased by the Inspector.
- e. All concrete shall be placed with the aid of mechanical vibrating equipment supplemented inside the forms.
- f. Vibrating equipment shall be of the internal type and shall maintain a speed of 6,000 impulses per minute, when submerged in concrete. Vibrators shall be adequate in number of units to properly consolidate all concrete. Provide a backup vibrator for large concrete pours.
- g. Form or surface vibrators shall not be used. The duration of vibration shall be limited to properly consolidate the concrete without causing objectionable segregation of aggregates.
- h. Insertion of vibrators into lower courses that have commenced initial set, or the disturbance or reinforcement in concrete beginning to set, shall be avoided.
- i. Concrete shall not be allowed to drop freely more than 5 feet in unexposed work, nor more than 3 feet in exposed work; where greater drops are required, a tremie or other approved means shall be employed.
- j. Concrete shall not be placed when the ambient temperature is below 40°F, nor where the concrete is likely to be subject to freezing before final set has occurred.
- k. When the air temperature is expected to drop below 40°F during the first 72 hours of the curing period, polyethylene sheeting or burlap-polyethylene blankets shall be placed in direct contact with the top surface of the concrete.
- l. Concrete may be poured in temperatures below 40°F, when poured in

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protected areas, or where adequate protection can be provided against freezing, if approved by the Engineer.

- m. When concrete is poured in air temperatures above 85°F, an approved retarding agent, meeting the latest provision of ASTM C494, Type B or most applicable approved equal provision, will be required in all concrete used in superstructures and top slabs of culverts unless directed otherwise by the Engineer.
4. Form Removal: Forms shall be removed only with the approval of the Inspector and in a manner to insure complete safety of the structure when the structure as a whole is supported on shoring.
- a. Form removal from structures shall not begin until the concrete has attained the following compressive strengths:
 - b. Vertical forms shall not be removed until the concrete has set a minimum of 24 hours, or the concrete has attained a minimum compressive strength of 500 psi.
 - c. When wall and top slabs are poured monolithically, wall forms shall not be removed until the concrete has attained a minimum compressive strength of 2,000 psi, or as directed by the Engineer.
5. Finish: Honeycomb and other minor defects shall be patched with one part of cement to 2 parts fine aggregate. All exposed surfaces shall be given one of the following finishes:
- a. Rough Finish: Concrete for which no other finish is indicated or specified shall have fins and rough edges removed.
 - b. Smooth Finish: Smooth finish shall be given to the interior of inlets, junction boxes, culverts and other structures. Joint marks, fins and rough edges shall be smoothed off and blemishes removed, leaving finished surfaces smooth and unmarred, subject to approval by the Inspector.
 - c. Floor Finish: Floor finish shall be given to the floors of all inlets, culverts and other structures, and shall be struck off true to the required grade as shown in the contract documents and floated to a smooth, even finish by manual or mechanical methods. No coarse aggregate shall be visible after finishing.
 - d. Rubbed Finish: All exposed surfaces of retaining walls, wingwalls, headwalls and other structures, after patching and painting has been completed and the surface has been wetted, shall be given a first rubbing with a No. 16 Carborundum Stone.

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- i. After the first rubbing is completed and the ground material has been evenly spread, the material shall be allowed to take a reset.
 - ii. After sufficient aging, the surface shall be wetted and given a finish rubbing with a No. 30 Carborundum Stone, after which the surface shall be neatly striped with a brush and allowed to take a reset.
 - iii. On the inside surfaces of all culvert walls an area from the top slab, on a line 30 degrees from the vertical, to the bottom slab shall be rubbed as specified above.
 - e. The entire structure shall be left with a clear, neat, uniform finish, free from form markings and shall be uniform in color.
 - f. Sidewalk surfaces shall be given a wood float finish, a light broom finish, or may be stripped with a brush as directed by the Inspector or specified in the contract documents.
 - g. Roadway slabs shall be given a broom finish after completion of the floating or straight-edging operation, but before the disappearance of the moisture sheen.
 - i. The grooves of the finish shall be parallel to the centerline of the roadway.
 - ii. The average texture depth of the grooves shall be a minimum of 0.035 inches.
 - h. The Contractor has the option of substituting the surface finish described in the latest provision of the City of San Antonio Department of Public Works' Standard Specifications for Construction Item No. 311, "Concrete Surface Finish," or most applicable approved equal provision, on the surface areas listed in the specification.
6. Curing: Immediately after placing or finishing, concrete surfaces not covered by forms shall be protected from loss of surface moisture for not less than 4 curing days. When forms are left in place, they shall be kept sufficiently wet to reduce cracks in the forms and prevent the form joints from opening.
- a. If forms are removed before 4 curing days have transpired, the formed surface shall be protected for the remainder of the 4 day curing period. Protection and curing shall be accomplished by one of the following methods and shall be subject to the approval of the Inspector during the entire curing process:
 - b. Water Curing: Water curing shall be effected by covering exposed surfaces

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with cotton or burlap mats, previously wetted before applying, and kept thoroughly wet during the entire curing period.

- c. The application of the mats shall not mar or disturb surfaces which will be exposed on completion.
 - d. Membrane compound curing: Provide membrane curing compounds that conform to the latest provision of TxDOT's DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants" or the most applicable approved equal provision.
- 7. Fine Grading: All fine grading of structure foundations shall provide for seating on firm, clean, natural earth foundation except as otherwise provided.
 - 8. Any under-cut foundations, except where authorized, shall be corrected to the satisfaction of the Inspector, at the sole expense of the Contractor.
 - 9. Excavation and Backfilling shall conform to the latest provision of the City of San Antonio Department of Public Works' Standard Specifications for Construction Item No. 306, "Structural Excavation" or the most applicable approved equal provision. All references therein to density and/or compaction levels are superseded by those of SAWS, described elsewhere in these standard specifications.

307.6 MEASUREMENT: No direct measurement or payment will be made for the work to be done or the equipment to be furnished under this item, but shall be considered subsidiary to the particular items of work for which unit prices are required in the proposal.

307.7 PAYMENT: No direct payment will be made for the work to be done or the equipment to be furnished under this item, but shall be considered subsidiary to the particular items of work for which unit prices are required in the proposal.

-End of Specification-

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ITEM NO. 550

Trench Excavation Safety Protection

550.1 DESCRIPTION: This item shall govern the trench excavation safety protection required for the construction of all trench excavation protection systems to be utilized in the project and including all additional excavation and backfill necessitated by the protection system.

550.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 550 refer to the current reference standard published at the time of the latest revision .

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City Of San Antonio (COSA) Standard Specifications for Construction
3. Texas Commission of Environmental Quality (TCEQ)
 - a. Chapter 217 Design Criteria for Domestic Wastewater Systems
 - b. Chapter 213 Edwards Aquifer
 - c. Chapter 290; Subchapter D – Rules and Regulations for Public Drinking Water
4. Occupational Safety and Health Administration (OSHA).
 - a. Federal Regulations, 29 CFR, Part 1926, Standards – Safety and Health Regulations for Construction – Subpart P Excavation,

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

1. Submit a safety program specifically for the construction of trench excavation. Design the trench safety program to be in accordance with OSHA 29CFR standards governing the presence and activities of individuals working in and around trench excavations.
2. Construction and shop drawings containing deviations from OSHA standards or special designs shall be sealed by a Professional Engineer Licensed in the State of Texas retained and paid by Contractor.
3. Review of the safety program by Engineer will only be in regard to compliance with specification and will not constitute approval by Engineer nor relieve Contractor of obligations under State and Federal trench safety laws.
4. Submit certification that trench safety system will not be subjected to loads exceeding those which the system was designed to withstand according to the available construction and geotechnical information.
5. An excavation plan submittal signed and sealed by a Texas licensed professional engineer shall be submitted for review and acceptance by the SAWS' Representative, if applicable, prior to the delivery of materials and commencing

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any portion of proposed construction activities where the planned excavation is 20 feet or greater.

550.4 CONSTRUCTION: Trench excavation safety protection shall be accomplished as required by the latest provision of Part 1926, Subpart P – Excavations, Trenching, and Shoring of the OSHA Standards and Interpretations, or the most approved equal provision.

1. A trench shall be defined as a narrow excavation made below the surface of the ground or pavement. In general, the depth is greater than the width, but the width of a trench is not greater than 15 feet.
2. If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet or less (measure at the bottom of the excavation), the excavation is also considered to be a trench.
3. In addition, "Trench Excavation Protection" will not be limited to these applications, but may be used whenever deemed expedient and proper to ensuing work.

550.5 MEASUREMENT: Trench Excavation Safety Protection shall be measured by the linear foot along the centerline of any OSHA defined trench that may be entered by personnel and is not greater than 15 feet wide, including manholes and other structures.

550.6 PAYMENT: Payment for Trench Excavation Safety Protection, measured as described above, shall be made at the unit price bid per linear foot of Trench Excavation Safety Protection regardless of the depth of the trench.

1. Payment shall include all components of the Trench Excavation Safety Protection System which can include, but not be limited to, sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering or temporary diversion and proper recapture and transportation of water to provide adequate drainage.
2. Payment shall also include the additional excavation and backfill required, any jacking, jack removal, and removal of the trench supports after completion.
3. Payment of all work prescribed under this item shall be full compensation for all additional excavation and backfill associated with the item; for any retention by Contractor of structural design/geotechnical/safety/equipment consultant; for furnishing, placing and removing all shoring, sheeting, or bracing; for dewatering or temporary diversion and proper recapture and transportation of water; for all jacking and jack removal; and for all other labor, material, tools, equipment and incidentals necessary to complete this portion of the work.

- End of Specification -

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ITEM NO. 804

Excavation, Trenching and Backfill

804.1 DESCRIPTION: This section shall govern the excavation, trenching, and backfilling for water, sanitary sewer, and recycled water construction, unless otherwise noted in the contract documents. The work shall include all necessary drainage, dewatering, pumping, bailing, sheeting, shoring and incidental construction.

804.2 REFERENCE STANDARDS: Reference standards cited in this Specification Item No. 804 refer to the current reference standard published at the time of the latest revision

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City Of San Antonio (COSA) Standard Specifications for Construction
3. Texas Commission of Environmental Quality (TCEQ)
 - a. Chapter 217 Design Criteria for Domestic Wastewater Systems
 - b. Chapter 290; Subchapter D – Rules and Regulations for Public Drinking Water
4. American Society for Testing and Materials (ASTM) International:
 - a. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipe Lines.
 - b. ASTM C76- Standard Specification for Reinforced Concrete Culverts, Storm Drain, and Sewer Pipe.
 - c. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
 - d. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
 - e. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes.
 - f. ASTM D 6938 - Test Method for in place Density and Water

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- Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- g. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- h. ASTM D 558 - Standard Test Methods for Moisture-Density Relations of Soil Cement Mixtures.
- i. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600kN-m/m³)).
- 5. American Association of State Highway and Transportation Officials (AASHTO)
 - a. AASHTO M306: Standard Specification for Drainage, Sewer, Utility, and Related Castings.
- 6. Occupational Safety and Health Administration (OSHA).
 - a. Federal Regulations, 29 CFR, Part 1926, Standards – Safety and Health Regulations for Construction – Subpart P Excavation,
- 7. International Organization of Standardization (ISO)
 - a. ISO9001 Standards
- 8. Texas Department of Transportation (TxDOT)
 - a. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.
 - b. TxDOT Tex-110-E - Particle Size Analysis of Soils.
 - c. TxDOT Tex-112-E – Test Procedure for admixing Lime to Reduce Plasticity Index of Soils
 - d. TxDOT Tex-113-E - Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials
 - e. TxDOT Tex-114 -E- Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade, Embankment Soils, and Backfill Material
 - f. TxDOT Tex-142- E –Laboratory Classification of Soils for Engineering Purposes

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804.3 SUBMITTALS: All submittals shall be in accordance with Engineer's requirements. All submittals shall be approved by the Owners' Representative prior to delivery of materials and commencing any portion of the proposed scope of work.

1. Contractor to submit cut sheets when applicable.
 - a. No trenching will commence until cut sheets have been approved by SAWS' Representative.
 - b. The depths of cuts indicated on the cut sheet, are from the center line hub elevation to the invert of the pipe.
2. Submit detailed trench plans, shoring system designs, installation sequences, and flowable fill mix designs.
3. Submit planned typical method of excavation, backfill placement and compaction including:
 - a. Trench widths
 - b. Procedures for foundation and pipe zone bedding placement, and trench backfill compaction
 - c. Procedures for assuring compaction against undisturbed soil when pre-manufactured trench safety systems are proposed.
 - d. An excavation plan submittal signed and sealed by a Texas licensed professional engineer shall be submitted for review and acceptance by the SAWS' Representative, if applicable, prior to the delivery of materials and commencing any portion of proposed construction activities where the planned excavation is 20 feet or greater.
4. Submit trench excavation safety program in accordance with requirements of Specification Item No. 550 Trench Excavation Safety Protection
5. Submit record of location of utilities as installed, referenced to survey control points. Include:
 - a. Locations of utilities encountered or rerouted.
 - b. Give stations, horizontal dimensions, elevations, inverts, and gradients.
6. Submit detailed drawing with plotted utility or obstruction location to SAWS' Representative.
7. Submit Emergency Action Plan (EAP) to address contingency plans in the event of damage to utilities. Include the following:

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- a. Contact personnel and agencies including primary and secondary telephone, numbers,
 - b. Contractor's hierarchy of responsible personnel,
 - c. Traffic control measures, and
 - d. Identification of resources to be available on or near project site in event of damage to utilities.
8. Submit backfill material sources and product quality information in accordance with requirements of this specification.

804.4 MATERIALS: The Contractor shall procure, store, and place materials from either onsite or offsite sources which comply with the specified requirements.

1. The use of sand backfill is not allowed, unless sand is native soil to trenchline, is clean, and is approved by SAWS' Engineer.
2. Backfilling for pipelines is divided into three (3) separate zones:
 - a. Bedding: the material in the trench bottom in direct contact with the bottom of the pipe;
 - b. Initial backfill: is defined as backfill having a thickness in its compacted state from the surface of the bedding to a point 1 foot above the top of the pipe.
 - c. Secondary backfill: the backfill zone extending from the initial backfill surface to the top of the trench.
 - d. Materials and placement for each of the zones shall be as described herein
3. Trench Bottom Materials:
 - a. Stable Material: Existing stable material present during excavation includes:
 - (1) Trench bottom (free of water, muck, debris);
 - (2) Rock in boulder, ledge or coarse gravel (particle size not larger than 1- ¾ inch) formations;
 - (3) Coarse sand and gravels with maximum particle size of 1- ¾ inch, various graded sands and gravels containing small percentages of fines, generally granular and non-cohesive either wet or dry; and

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- (4) Fine sands and clayey gravels; fine sand, sand-clay mixtures, clay and gravel-clay mixtures.
- b. Unstable Material: Existing unstable materials are silt, muck, trash or debris in the trench bottom bearing level; rock on boulder ledge or coarse gravel (particle size larger than 1- ¾ inch) formations.
- 4. See Table 1 for an outline of the bedding and initial backfill requirements for various pipe materials.

TABLE 1						
BEDDING AND INITIAL BACKFILL REQUIREMENTS						
	UNSTABLE		STABLE*		ROCK	
	Bedding	Initial Backfill	Bedding	Initial Backfill	Bedding	Initial Backfill
WATER	6" or D/8	1.0' above	6" or D/8	1.0' above pipe	6" or D/8	1.0' above pipe
CSC	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5
DI	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5
PVC	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5
HDPE	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5
WSP	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5	Modified Grade 5
SEWER	6" or D/8	1.0' above pipe	6" or D/8	1.0' above pipe	6" or D/8	1.0' above pipe
RIGID	sewer gravel	sewer gravel	sewer gravel	sewer gravel	sewer gravel	sewer gravel
FLEXIBLE	sewer gravel	sewer gravel	sewer gravel	sewer gravel	sewer gravel	sewer gravel

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NOTE: The use of sand backfill is not allowed, except as secondary backfill if sand is native soil to trenchline, is clean, and is approved by SAWS' Engineer.

CSC = Concrete Steel Cylinder

DI = Ductile Iron

HDPE = High Density Polyethylene Pipe.

PVC = Polyvinyl Chloride

WSP = Tape Wrapped Steel Pipe.

D = Outside Diameter of Pipe

5. Sanitary Sewer Backfill:

a. Bedding Material:

- (1) The existing material at the bearing level shall be removed and replaced to a minimum depth of 6 inches or 1/8 of the outside diameter of the pipe, whichever is greater, with bedding material.
- (2) The bedding material shall extend up the sides of the pipe sufficient to embed the lower quadrant of the pipe.
- (3) The bedding material shall be composed of well-graded, crushed stone or gravel conforming to the requirements of Table 2 unless modified by the Engineer in writing.

Table 2	
Sanitary Sewer Backfill Materials	
Sewer Gravel	Percent
Passing 1- ½ inch sieve	100
Passing 1 inch sieve	95 to 100
Passing 1/2 inch sieve	25 to 60
Passing No. 4 sieve	0 to 10
Passing No. 8 sieve	0 to 5

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6. Potable Water and Recycle Mains Backfill

a. Bedding Material:

- (1) The existing material at the bearing level shall be removed and replaced to a minimum depth of 6 inches or 1/8 of the outside diameter of the pipe, whichever is greater, with bedding material.
- (2) The bedding and initial backfill materials for concrete steel cylinder pipe (CSC), ductile iron pipe (DI), Wrapped Steel (WS) Pipe, High Density Polyethylene Pipe (HDPE) and Polyvinyl Chloride Pipe (PVC) in all nominal diameters shall be composed of well graded crushed stone or gravel conforming to the requirements of Table 3 unless modified by the Engineer in writing.

Table 3	
Modified Grade 5 Backfill Materials	
Modified Grade 5	Percent
Passing ½ inch sieve	100
Passing 3/8 inch sieve	95 to 100
Passing No. 4 sieve	20 to 80
Passing No. 10 sieve	0 to 25
Passing No. 20 sieve	0 to 2

b. Where copper or HDPE services (¾" – 2") are installed, initial backfill shall be sand conforming to the following requirements:

- (1) Natural sand or sand produced from crushed gravel or crushed rock maximum ¼ inch free from clay and organic material conforming to the requirements of Table 4 unless modified by the Engineer.
- (2) Larger services utilizing DI pipe or PVC (C-900) pipe shall be backfilled the same as mains and conform to the

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requirements of Table 3 unless modified by the Engineer in writing.

Table 4	
Sand Backfill- For Services	
Sand No.	Percent
Passing No. 4 Sieve	95
Passing No. 200 sieve	8

804.5 CONSTRUCTION: All existing utilities shall be protected from damage during the excavation and backfilling of trenches and, if damaged, shall be replaced by the Contractor at their own expense.

1. General:

- a. Unless otherwise shown in the contract documents, **all excavation shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed, to include but not limited to groundwater, water, rock, stone, sand, concrete, organic material, existing abandoned utility lines whether shown on the plans or not, or any kind of material that is encountered.**
- b. Trenches shall not be backfilled until constructed structures or appurtenances, as installed, conform to all requirements specified.
 - (1) Failure to comply will require Contractor to re-excavate trench at no expense to SAWS.
- c. Where pipe is specially coated or sleeve/tape wrapped for protection against corrosion, care shall be taken not to damage the coating or sleeve/tape wrap.
 - (1) Damage to be assessed by Manufacturer and repaired to manufacture's recommendation at no expense to SAWS.
- d. Where a trench has been improperly backfilled, or settlement occurs, the identified section shall be excavated to the trench depth and a length 50 feet in both directions of the failed area, then refilled and compacted to the grade and compaction level required.

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- e. Safety Devices: The Contractor shall provide and maintain barricades, flags, road flares, and other safety devices as required by local, state, and federal codes and ordinances and conduct work to create a minimum inconvenience to the public.
 - f. Temporary suspension of work does not relieve Contractors' responsibility of the above requirements.
 - g. Safety and Health Regulations: The Contractor shall at all times conform to all of the latest applicable regulations of 29 CFR Part 1926 Subpart "P" entitled Excavation, of OSHA Safety and Health Regulations for Construction," or most applicable approved equal provisions, and all other applicable state and local rules and regulations.
 - h. Archaeological (Unidentified Archaeological Sites): If the Contractor should encounter a section of an archeological feature, such as a acequia (early Spanish irrigation ditch) or any other archaeological deposits during construction operations, the Contractor must stop excavation immediately and contact the SAWS' Engineer and SAWS' Inspector, who will call the City of San Antonio Historic Preservation Officer at (210) 207-0035 for an archaeological investigation as per Section 35-432.3 of the City Code, "Unidentified Sites Archaeological."
 - (1) The Contractor cannot begin excavation again without written permission from SAWS.
 - (2) If more than three days are required for investigation (not including holidays and weekends) and the Contractor cannot work on other project scope items, the Contractor will be permitted to negotiate for additional construction time through a Request for Information (RFI).
 - i. The RFI shall be submitted within ten days after date of the first notice, additional standby time will not be considered.
 - (3) If the time required for investigation does not exceed three days for each event, contract duration will not be extended.
2. Excavation: The Contractor shall perform all excavation of every description and of all substances, including rock, encountered to the lines and grades shown in the contract documents or as determined by the Engineer.

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- a. During excavation, material suitable for backfilling shall be stockpiled in an orderly manner a safe distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins as per 29 CFR Part 1926 Subpart "P" entitled Excavation, of OSHA Safety and Health Regulations for Construction,"
- b. All excavated materials not required or suitable for backfill shall be removed and properly disposed of by the Contractor or as directed by the Inspector at no additional cost to SAWS.
- c. Grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved methods.
- d. Sheet piling and shoring shall be installed in accordance with all applicable safety requirements for the protection of the work, adjoining property, and for the safety of all personnel.
- e. Unless otherwise indicated, excavation shall be by open cut, hand, backhoe, hoe-ramp, rock saw, or other approved method.
- f. Short sections of a trench may be tunneled, if the pipe or structure can be safely and properly installed or constructed, and backfill can be properly compacted in such tunnel sections.
- g. Tunneled section must be authorized by SAWS' Engineer prior to start of Construction.
- h. Where over-excavation occurs and when not as directed by the Engineer or Inspector, the under-cut trench shall be restored to grade at no cost to SAWS by replacement with a material conforming to the requirements of the bedding material or a material approved by the Engineer.

3. Trenching

- a. Trench walls shall be vertical
- b. Open trenches are limited to 200 ft. open at one time.
- c. Contractor shall compact trench and install an all-weather surface on any paved surface, roadway or trench as directed by SAWS' inspector, prior to proceeding to the next section. Sections are limited to 200 ft. of open trench.
- d. Projects under 500 ft. must be completely restored at the end of

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each day.

- e. Where the trench bottom has been over excavated in excess both vertically and horizontally, beyond the limits as defined in contract documents, the pipe shall be concrete-encased or encased as directed by the engineer.
 - (1) Encasement shall extend from the trench wall to trench wall and be a minimum of 6 inches above the top of pipe. No separate pay item (See Specification Item No. 858, Concrete Encasement.)
- f. Where the trench bottom is not excavated in accordance with this specification due to rock or other hard under lying materials, then the pipe shall be concrete encased as defined in Specification Item No. 858, Concrete Encasement.
- g. The practice of undercutting at the bottom or flaring at the top will not be permitted except where it is justified for safety or at the Engineer's and/or Inspector's direction.
- h. In special cases, where trench flaring is required, the trench walls shall remain vertical to a depth of at least 1 foot above the top of the pipe.
- i. The trench bottom shall be square or slightly curved to the shape of the trenching machine cutters.
- j. The trench shall be accurately graded along its entire length to provide uniform bearing and support for each section of pipe installed upon the bedding material.
- k. Bell holes and depressions for joints shall be dug after the trench bottom has been graded and bedding installed.
- l. The pipe shall rest upon the new bedding material for its full length.
- m. The minimum allowable base width of the trench shall be not less than 12 inches greater than the exterior diameter of the pipe, not less than 6 inches on each side.
- n. Trench supports are exclusive of the minimum trench width.
- o. The maximum allowable base width of trench shall be not greater than 24 inches than the exterior diameter of the pipe, not more than 12 inches on each side.
- p. Trench supports are exclusive of the maximum trench width.

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- q. Whenever such maximum allowable width of trench is exceeded, except as provided for in the contract documents, or by written approval of the Engineer, the Contractor, at his sole expense, shall encase the pipe in concrete from trench wall to trench wall.
 - r. Any additional trench restoration required as a result of an excavation wider than this maximum width or subsequent surface or paving work, will be done at the Contractor's sole expense.
 - s. When unsuitable bearing materials such as water, silt, muck, trash, debris or rock in ledge, boulder or coarse gravel (particle size larger than 1- $\frac{3}{4}$ inch) is encountered at the bearing level, the Contractor shall over- excavate and remove such materials to a depth no less than 6 inches below the bottom of the pipe and replace it with a material conforming to the requirements of this Specification or as approved by the Engineer and/or Inspector.
4. Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.
- a. The Contractor shall not allow water to accumulate in excavations or at subgrade level.
 - b. Remove water to prevent softening of foundation bottoms and soil changes detrimental to stability of subgrades and foundations.
 - c. Provide and maintain dewatering system components necessary to convey water from excavations.
 - d. Convey water removed from excavation and rainwater to collecting or runoff areas away from buildings and other structures.
 - e. Establish and maintain temporary drainage ditches and other diversions outside excavation limits.
 - f. Do not use trench excavations as temporary drainage ditches.
 - g. Dewatering devices shall be provided by the Contractor with filters to prevent the removal of fines from the soil.
 - h. Should the pumping system draw fines from the soil, the Inspector shall order immediate shutdown, and remedial measures will be the responsibility of the Contractor.
 - i. Upon completion of the dewatering work, the Contractor shall remove all equipment and leave the construction area in a neat,

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clean, condition that is acceptable to the Inspector.

- j. The Contractor shall maintain a groundwater table at least 12 inches below the finished excavated trench depth.
 - k. Performances of the dewatering system for lowering groundwater shall be measured by observation wells on piezometers installed in conjunction with the dewatering system, and these shall be documented at least daily.
 - l. The Contractor shall maintain a daily log of these readings and submit them to the Inspector before payment.
 - m. No direct payment shall be made for costs associated with dewatering.
 - n. All costs in connection therewith shall be included in the applicable contract price for the item to which the work pertains.
5. Backfilling: Trenches shall not be backfilled until the construction structures or appurtenances, as installed, conform to the requirements specified.
- a. Initial backfill is defined as backfill having a thickness in its compacted state from the surface of the bedding to a point 1 foot above the top of the pipe.
 - b. Initial Bedding material shall be consolidated to assure it is incorporated from the bottom of the trench up to the pipe centerline.
 - (1) A hand-held vibrator, commonly used for concrete work, can be used for this purpose. The vibrator shall be inserted every 3 feet on each side of the pipe.
 - c. For pipelines up to 24 inches in diameter initial backfill material shall be placed in two separate lifts above the bedding material the pipe is set on.
 - (1) The first lift shall be spread uniformly and simultaneously on each side and under the bottom quadrant of the pipe to the mid-point or spring line of the pipe.
 - d. For diameters larger than 24 inches, initial backfill material shall be evenly and simultaneously spread alongside, under the lower quadrant of the pipe and over the pipe in 18 (first lift) or 12 inch lifts to a point sufficient to a minimum of 1 foot above the top of the pipe (See Drawing Series DD-804).

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- e. Placement of the first lift of initial backfill shall be subject to inspection and approval prior to placement of second lift, which shall extend from the spring line of the pipe to a minimum of 1 foot above the top of the pipe.
- f. Secondary backfill is defined as backfill from 1 foot above the top of the pipe to the top of the trench or bottom of pavement section.
- g. Secondary backfill shall generally consist of materials removed from the trench and shall be free of brush, debris and trash.
 - (1) Rock or stones having a dimension larger than 6 inches at the largest dimension shall be sifted out and removed before the material is used in the secondary backfilling zone.
 - (2) Secondary backfill material shall be primarily composed of compactible soil materials. The secondary backfill material shall be placed in maximum 12 inch loose lifts or as directed by the Engineer and/or Inspector.
- h. Secondary backfill shall be constructed in accordance with details shown in the construction documents.
- i. All compaction within the secondary backfill zone shall be such that the relative dry density of each layer shall be not less than 98% compaction from the top of the initial backfill to the bottom of pavement section as outlined in TxDOT Testing Methods Tex-113 or Tex-114.
- j. For native sand backfill and non-cohesive soils, Engineer will specify compaction requirements.
- k. The second lift shall be evenly spread in a similar manner as the first lift.
- l. Where specified, by Engineer, only the secondary backfilling may incorporate native excavated materials approved, by Engineer, for backfilling, consisting of earth, loam, sandy clay, sand and gravel, soft shale or other approved materials, free from large clods of earth or stones.
- m. Where pipe is specially coated or sleeve/tape wrapped for protection against corrosion, care shall be taken not to damage the coating or sleeve/tape wrap.
- n. Damaged wrap will be replaced at Contractor's expense.
- o. Where a trench has been improperly backfilled, or where settlement occurs, the identified section shall be excavated to the trench depth and a length 50 feet in both directions of the failed

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- area, then refilled and compacted to the grade and compaction level required at the Contractor's expense.
- p. The use of sand backfill shall not be allowed, except as secondary backfill if the native soil is sand. Compaction and moisture-density relationship to be determined by TxDOT Testing Methods Tex-113 or Tex-114.
 - q. Soil Characteristic determined by TxDOT-142e.
 - r. The pavement (asphalt) section shall have 95% compaction density with a maximum dry density at + or – 1% optimum moisture content as determined by tests on samples as outlined in the latest provisions of TX-DOT Testing Method Tex 113-E or Tex-114, unless otherwise shown on the contract documents.
 - s. At the time of compaction, the water content shall be at optimum moisture content, + or - 1% points as outlined in the latest provisions of TX-DOT Testing Method Tex 113-E or Tex-114.
6. Trench Surface Restoration: The surface of the backfilled trench shall be restored to match the previous existing conditions.
- a. This shall include final grading, placement of topsoil and seeding, placement of sod (such as at homes or businesses that had maintained grass), or other unprepared and prepared surfaces.
 - b. Contractor shall compact trench and install an all-weather surface on any paved surface, roadway or trench as directed by SAWS inspector, prior to proceeding to next section. Sections limited to 200 ft. of open trench.
 - c. Trenches in alleys actively being used by vehicles (such as trash pickup, vehicle parking, etc.) shall be restored by grading and compacting to 98% (per TxDOT Tex-113 or Tex - 114) or higher with a minimum of 4 inches of flex- base materials for the entire width of the alley.
 - d. Asphaltic materials shall have a compaction density of 95%.
 - e. Alleys not actively used by vehicles shall be graded and compacted to 98% (per TxDOT Tex-113 or Tex - 114) or higher from the top of the initial backfill to the bottom of the pavement section, then spread grass seed for entire width of the alley.
 - f. Trenches in paved streets shall be covered with a temporary all-weather surface to allow for vehicular traffic and protect trench from weather, water infiltration and runoff until the final

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asphalt/concrete paving is complete.

- (1) This surface shall be a minimum of 4 inches hot-mix cold lay compacted and rolled asphaltic black base, either hot-mix or cold-mix applied, or plates with cold mix asphalt installed around the edges.
 - (2) It is the Contractor's responsibility to maintain this surface until the final street restoration is complete.
 - (3) Sections limited to 200 ft. of open trench at a time.
 - (4) Temporary street striping may also be required.
 - (5) This surface must be removed prior to final asphaltting.
- g. All street work shall be done in accordance with the latest City of San Antonio Public Works' (or other city as applicable) construction specifications.
- h. Included in this requirement is replacement of any curbs or sidewalks damaged or removed during the construction.
- i. No separate payment for the surface restoration is permitted. The cost for this work must be included in the appropriate bid item.

804.6 DISPOSAL OF EXCAVATED MATERIALS: Any excess excavated material, not utilized after all fill requirements have been met, shall become the responsibility of the Contractor.

1. The Contractor shall dispose of it by hauling and wasting outside the limits of the rights-of-way or easements of this project and of public thoroughfares and water courses, in conformity with pertinent City, County, State and Federal codes and ordinances and in a manner meeting the approval of the Engineer or Inspector.

804.7 QUALITY CONTROL:

1. All testing to be coordinated 48 hours in advance with SAWS Inspector.
2. Samples to be taken in conjunction with SAWS samples at same time and location.
3. Contractor to be prepared to test if coordinated with Inspector.
4. Quality Assurance Testing: The Owner shall have such tests and inspections as he may desire performed by a nationally-accredited,

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independent testing laboratory for his guidance and control of the work.

- a. The Owner will determine in-place density and moisture content by anyone or combination of the following methods:
 - (1) TxDOT Tex-113-E - Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials
 - (2) TxDOT Tex-114 -E- Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade, Embankment Soils, and Backfill Material
 - (3) ASTM D2922 (density of soil and soil aggregate in-place by nuclear methods – shallow depth),
 - (4) ASTM D1556 (density and unit weight of soil in-place by sand cone method),
 - (5) ASTM D2216 (lab density of water content of soil and rock),
 - (6) ASTM D3017 (water content of soil and rock – shallow depth in-place by nuclear methods) or most applicable approved equal provisions.
- b. Payment for such tests shall be the responsibility of the Owner, including the material proctor tests and density tests.
- c. The Contractor shall request testing work performed by the Owner by notifying the Owner of the areas available by Station Numbers or Dimensions and Lift Numbers.
- d. The Contractor shall provide access to SAWS and to lab to the test area, backfilling test areas and provide associated trench excavation safety protection at the Contractor's expense for all depths and lifts.
- e. The frequency and location of testing shall be determined solely by the SAWS. Or at a minimum tests will be done at location points randomly selected as indicated by the Inspector/Test Administrator, per each 18 (first lift from bottom) and 12 inch loose lift per 100 linear feet, at a probe depth of six (6) inches. One per lift per 100 ft.
- f. The Owner may test any lift of fill at any time, location, or elevation.

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5. Quality Control Testing: The Contractor shall be responsible for compaction in accordance with the appropriate Specification.
 - a. Compaction tests will be done at location points randomly selected or as indicated by the SAWS' Inspector/Test Administrator, per each 18 (first lift from bottom) and 12 inch loose lift per 100 linear feet, at a probe depth of six (6) inches. One per lift per 100 ft.
 - b. The inspector shall determine the depth at which the density test shall be taken.
 - c. All depths shall be considered for testing without a predetermined maximum or minimum
 - d. Test requirements above are indicated as a minimum requirement, but maybe subjected to follow more stringent requirements as established by other appropriate agencies (such as COSA Public Works Right of Way Management Plan, etc.)
 - e. Any failed test shall require the Contractor to remove and replace that layer of backfill in the identified section of the failed test location to the trench depth and a length 50 feet in both directions, then refilled and compacted to the grade and compaction level required.
 - 1) The Contractor will also be required at no cost to SAWS to provide two additional tests at the replaced location where the initial test failed and at one location point, randomly selected or as indicated by the SAWS Inspector/Test Administrator.
 - f. Sanitary Sewer Laterals will be subject to compaction tests at the discretion of the SAWS' Inspector/Test Administrator within 100 linear foot segments.
 - 1) Any failed test shall require the Contractor to remove and replace that layer of backfill in the identified section of the failed test location to the trench depth and a length 50 feet in both directions, then refilled and compacted to the grade and compaction level required.
 - 2) The Contractor will also be required at no cost to SAWS to provide two additional tests at the replaced location where the initial test failed and at one location point, randomly selected or as indicated by the SAWS' Inspector/Test Administrator.

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- g. The Contractor shall be responsible for all costs associated with the proctor and density tests, and for providing to SAWS and Consultant, if applicable, verification that necessary compaction levels were achieved.
- h. These tests shall be performed by a nationally-accredited, independent testing laboratory.
- i. The Contractor shall provide access to SAWS and to lab to the test area, backfilling test areas and provide associated trench excavation safety protection at the Contractor's expense for all depths and lifts.

804.8 MEASUREMENT: Excavation, Trenching and Backfill will not be measured for payment

804.9 PAYMENT: No direct payment shall be made for incidental costs associated with quality control testing, excavation, trenching backfilling for water mains and sanitary sewers, and placement of all-weather material and all costs in connection therewith shall be included in the applicable contract price for the item to which the work pertains.

-End of Specification-

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ITEM NO. 818

Water Pipe Installation PVC (C-900, and C-909) Pipe 4 inch to 24 inch pipe

818.1 DESCRIPTION: This item shall consist of PVC (C-900 and C-909) for 4 inch to 24 inch pipe installation in accordance with these specifications and as directed by the Engineer.

818.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 818 refer to the current reference standard published at the time of the latest revision.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City of San Antonio (COSA) Standard Specifications for Construction
3. Texas Commission of Environmental Quality (TCEQ) Chapter 290 Public Water Supply
4. American Society for Testing and Materials International
 - a. ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
 - b. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - c. ASTM D 2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
 - d. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - e. ASTM 2412 – Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading
 - f. ASTM D 2444 - Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).
 - g. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - h. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
5. American Water Works Association (AWWA)
 - a. AWWA C 900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 4 In through 60 in (100 MM through 1,500 MM).
 - b. AWWA C 909 - Standard for Molecularly-Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 Inches through 12 Inches (100mm through 300 mm), for Water Distribution.
 - c. AWWA M23 – PVC Pipe – Design and Installation
6. Plastic Pipe Institute

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- a. PPI TR3 - Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.
- 7. Uni-Bell PVC Pipe Association
 - a. UNI-B-13 - Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride Pipe.
- 8. International Organization of Standardization (ISO)
 - a. ISO9001

818.3 SUBMITTALS: All submittals shall be in accordance with most recent version of SAWS's General Conditions requirements. Submit the following prior to performing any work.

- 1. Certifications:
 - a. Per General Conditions section 5.12.2 all Contractor submittals for all pipe and other products or materials furnished under this specification shall be marked as reviewed and approved by Contractor for compliance with Contract Documents and the referenced standards.
 - b. The Manufacturer shall provide ISO 9001 Certificate by a third party.
 - c. Submit written verification that the pipe Manufacturer has been manufacturing pipe per required ASTM with similar design pressure and size as this Project.
 - d. Submit written verification from the pipe Manufacturer demonstrating compliance with the production and delivery schedule of the pipe as indicated in the Contractor's schedule.
- 2. Contractor shall submit Manufacturer's product data, installation recommendations, shop drawings, and certifications.
 - a. Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.
 - b. Contractor to review and submit PVC pipe manufacturers recommended installation procedures.
 - c. Calculations and limits of thrust restraint shall be based on AWWA M23, latest edition.
 - d. Submit manufacturer's certifications that PVC pipe and fittings meet requirements of this
 - e. Section and AWWA C 900 and AWWA C 909 for pressure pipe applications,
 - f. or appropriate ASTM standard specified for gravity sewer pipe.
 - g. Submit manufacturer's certification that PVC pressure pipe for water lines and force mains has been hydrostatically tested at factory in accordance with AWWA C 900, AWWA C 909 and this Section.
 - h. Submit manufactures allowable deflection
- 3. Shop Drawings:
 - a. Catalog Data Sheets for all materials confirming pipe, fittings, and other materials conform to requirements of this specification.
 - b. Pipe Supplier Information.

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- i. Submit company name, contact name, and contact number.
- c. Details of all piping systems components confirming that the pipe and fittings conform to the specified requirements.
- d. The Contractor shall submit shop drawings of pipe, fittings, gaskets, hardware, flanges, appurtenances, special details sufficient to demonstrate compliance with these Specifications and applicable pipe installation Specification.
- e. Fabrication drawings showing:
 - 1) Wall thickness.
 - 2) Pipe length.
 - 3) Pipe joint
- 4. Testing Plan: Submit at least prior to start of construction and at minimum, include the following:
 - 1) Testing dates.
 - 2) Piping systems and section(s) to be tested.
 - 3) Method of isolation. Method of isolation to be approved by SAWS Inspector.
 - 4) Method of conveying water from source to system being tested.
 - 5) Hydrostatic leak testing.
 - i. Submit a hydrostatic leak testing plan which includes equipment (pump, water meter, pressure regulating valve, pressure gauges, etc.), water handling procedures (supply and disposal), sequence and schedule by test section, and pressure test data
 - ii. Certifications of Calibration: Approved testing laboratory certificate if pressure gauge for hydrostatic test has been previously used. If pressure gauge is new, no certificate is required.
- 5. Testing Reports:
 - a. Furnish affidavit certified that all pipe meet the provisions of the specification and has been tested and submit reports in accordance with the applicable ASTMs and AWWA Standards. Reports to include the following:
 - i. Hydrostatic proof test reports.
 - ii. Sustained pressure test reports.
 - iii. Burst strength test reports.
 - iv. Stress Regression Testing
 - v. Additional reports may be requested by SAWS' Inspector
- 6. Detail drawings indicating type, number, and other pertinent details of the slings and/or other methods proposed for pipe support and handling during manufacturing, transport, and installation. All pipe handling equipment and methods shall be acceptable to Owner.
- 7. Pipe Manufacturer's Written Quality Assurance/Quality Control Program.
- 8. Field Service Representative Resume

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818.4 MATERIALS: The materials for water main installation shall conform to the specifications contained within the latest revision of SAWS Material Specifications:

1. Material Specification Item No. 113-03: Specifications Ductile-Iron Restrained Joint Fittings for Use on Ductile Iron and Poly-Vinyl Chloride Pipe
2. Material Specification Item No. 95-10, "Pipe Joint Restraint Systems,"
3. Material Specification Item No. 05-12: Specifications for C-900 Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch Through 60-Inch
4. Material Specification Item No. 05-13: Specifications for C909 Oriented Polyvinyl Chloride (PVC) Pressure Pipe, 4-Inch Through 12-Inch
5. Material Specification Item No. 05-31: Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series), ASTM 2241.
6. The pressure rating for pipe materials apply to any work performed in SAWS Pressure Zones. Minimum pressure rating for all pipes shall be 235 psi, or as identified in plans and bid documents.
7. Pipe shall be DR 18 pressure rating 235 psi.
8. PVC water pipe shall be blue in color. **White PVC pipe is not permitted.**
9. Only PVC pipe for 4 inch to 24 inch pipe sizes shall be used.
10. PVC pipe markings shall include:
 - a. Manufacturer's name or trademark;
 - b. Standard to which it conforms;
 - c. Pipe size;
 - d. Material designation code;
 - e. Pressure rating;
 - f. SDR number or schedule number;
 - g. Potable water laboratory seal or mark attesting to suitability for potable water;
 - h. A certifier's mark may be added; and
 - i. Manufactured date (installation shall not exceed one year from this date)

818.5 CONSTRUCTION: PVC (C-900, and C-909) pipe shall be installed as specified within Item No. 812, "Water Main Installation" of these specifications.

1. PVC (C-900, and C-909) mains shall be laid to the depth and grades shown in the contract documents.
2. The pipe shall be laid by inserting the spigot end into the bell flush with the insertion line or as recommended by the manufacturer.
3. **At no time shall the bell end be allowed to go past the "insertion line."**
4. A gap between the end of the spigot, and the adjoining pipe is necessary to allow for expansion and contraction.
5. Deflection of PVC (C-900 and C-909) pipe shall be limited to 1 degree of the manufactures recommended deflection.
 - a. Changes in direction of PVC pipe shall only be use of fittings or by deflecting straight pipe sections at joints.
 - b. Longitudinal bending of pipe is not allowed

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- c. Deflection of pipe at fittings is not allowed
- d. Deflection of straight pipe sections shall not exceed 1 degree at each joint (even if joint restraint devices are installed), which corresponds to the following in pipe alignment:
 - i. Length of pipe, feet offset, inches allowable radius of curvature, feet 204 maximum, feet 1,1146 minimum

6. Joint Restraints:

- A. All mains consisting of PVC (C-900 and C-909) joint restraints as specified in SAWS' Material Specification Item No. 95-10, "Pipe Joint Restraint Systems," shall be installed in accordance with manufacturer's recommendations.
- B. Joint restraints shall be bi-directional and installed to fully restrain the system as shown in Standard Drawing Details DD-839 series, or as indicated in the contract documents.

- 7. PVC (C-900, and C-909) pipe shall be field cut using a power saw with a steel blade or abrasive disc, depending on the size of pipe.
- 8. If a bevel is needed after field cutting, it should be in accordance with the latest applicable recommendations of: Uni-Bell or ASTM/AWWA standards. Such work will be subject to approval by the Inspector.
- 9. Tracer wire shall be utilized for location and taped directly to the pipe.
 - a. Tracer wire shall be properly spliced at each end connection and each service connection.
 - b. Tracer wire shall be adequately wrapped and protected at each splice location in accordance with manufacturer recommendations.
 - c. No bare tracer wire shall be accepted.
 - d. Wire shall also come up to the top of valve extensions and fire hydrant stems, as directed by the Inspector.
 - e. Tracer wire shall be utilized for location purposes and taped directly to the top of pipe.
 - f. Tracer wire shall be of solid core (14 gauge insulated), and shall be taped to the main in minimum of 10 inch increments.
 - g. Detection tape shall not be used in lieu of tracer wire.

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818.6 MEASUREMENT: PVC pipe will be measured by the linear foot for each size and type as follows:

1. Measurements will be from the center line intersection of runs and branches of tees to the end of the valve of a dead end run.
2. Measurements will also be between the center line intersection of runs and branches of tees.
3. Where the branch is plugged for future connection, the measurement will include the entire laying length of the branch or branches of the fitting.
4. The measurement of each line of pipe of each size will be continuous and shall include the full laying lengths of all fittings and valves installed between the ends of such line except that the laying length of reducers will be divided equally between the connected pipe sizes.
5. Lines leading to a tapping connection with an existing main will be measured to the center of the main tapped.

818.7 PAYMENT: Payment for PVC Pipe water main installed will be made at the unit price bid per linear foot of pipe of the various sizes installed by the open cut method.

1. Such payment shall also include tracer wire, detection tape, excavation, selected embedment material, backfill, compaction, compaction testing, polyethylene sleeve, hauling and disposition of surplus excavated material, including all existing pipe, fittings, appurtenances to be abandoned or removed, installation of all-weather surface, and other required testing as per Specification Item No. 804, Excavation Trenching and Backfill.
2. Materials paid on site will be in accordance with Table 1 of Specification Item No. 100 Mobilization.

-End of Specification-

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ITEM NO. 836

Grey Iron and Ductile-Iron Fittings

836.1 DESCRIPTION: This item shall consist of grey-iron and ductile-iron fittings installation and adjustment installed in accordance with these specifications and as directed by the Engineer.

836.2 REFERNCED STANDARDS: Reference standards cited in this Specification Item No. 836 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City of San Antonio (COSA) Standard Specifications for Construction
3. Texas Commission of Environmental Quality (TCEQ) Chapter 290 Public Water Supply
4. American Society for Testing and Materials (ASTM) International:
 - a. ASTM D 1248 – Standard Specification Polyethylene Plastics Molding and Extrusion Materials for Wire and Cable.
 - b. ASTM F 477 – Elastomeric Seals (gaskets) for Joining Plastic Pipe.
 - c. ASTM G 62 – Standard Test Methods for Holiday Detection in Pipeline Coatings.
5. American National Standard Institute (ANSI)
 - a. ANSI A 21.4 (AWWA C 104) – Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings, for Water.
 - b. ANSI A 21.10 (AWWA C 110) – Standard for Ductile-Iron and Gray-Iron Fittings, 3-in. through 48-in.
 - c. ANSI A 21.11 (AWWA C 111) – Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - d. ANSI A 21.15 (AWWA C 115) – Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - e. ANSI A21.16 (AWWA C 116) – Protective Fusion Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey iron Fittings for Water Supply Service.
 - f. ANSI A 21.50 (AWWA C 150) – Standard for Thickness Design of Ductile-Iron Pipe.
 - g. ANSI A 21.51 (AWWA C 151) – Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water and Other Liquids.
 - h. ANSI A 21.53 (AWWA C 153) – Standard for Ductile Iron Compact Fittings, 3 inches through 24 inches and 54 inches through 64 inches for Water Service.
 - i. ANSI/AWS D11.2 –Guide for Welding Iron Castings
6. American Society of Mechanical Engineers (ASME)
 - a. ASME B 16.1 – Cast Iron Pipe Flanges and Flanged Fittings.

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7. American Water Works Association (AWWA)
 - a. AWWA C 105 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - b. AWWA C 300 – Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and other Liquids.
 - c. AWWA C 600 – Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
8. American Water Works Association (AWWA)
 - a. SSPC-SP 6 – Steel Structures Painting Council, Commercial Blast Cleaning.

836.3 SUBMITTALS: Contractor shall submit manufacturer's product data, instructions, recommendations, shop drawings, and necessary certifications.

1. For pipes 16 inches and greater submit shop drawings signed and sealed by Professional Engineer registered in State of Texas showing the following:
 - a. Manufacturer's pipe design calculations.
 - b. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, fitting, flange, and special details, with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, restrained joints, and other critical features.
 - c. Indicate station numbers for pipe and fittings corresponding to Drawings. Do not start production of pipe and fittings prior to review and approval by Engineer.
 - d. Calculations and limits of thrust restraint shall be based on AWWA M41 or DIPRA Thrust Restraint for Ductile Iron Pipe, latest edition.
 - e. Class and length of joint.
 - f. Submit manufacturer's certifications that ductile iron pipe and fittings meet provisions of this Section and have been hydrostatically tested at factory and meet requirements of ANSI A 21.51.
 - g. Submit certifications that pipe joints have been tested and meet requirements of ANSI A 21.11.
 - h. Submit affidavit of compliance in accordance with ANSI A21.16 for fittings with fusion bonded epoxy coatings or linings.

836.4 MATERIALS: The materials for grey-iron and ductile-iron fittings installation shall conform to the latest provisions of American National Standard for Ductile-Iron (ANSI)/American Water Works Association (AWWA) C153/A21.53, Compact Fittings 3-inch through 64-inch and ANSI/AWWA C110/A21.10, Full Body Fittings 3-inch through 48-inch for Water Service or most applicable approved equal provisions, and the specifications contained within the latest revision of SAWS' Material Specification Item No. 10-10, "Grey-Iron and Ductile-Iron Fittings."

836.5 CONSTRUCTION: All fittings shall be either restrained mechanical joint compact or flanged joint, unless otherwise specified in the contract documents. All mechanical joint compact fittings shall be installed using approved restraining glands in accordance with SAWS' Material Specification Item No. 113-02, "Ductile Iron Restrained Joint Fittings for Use on Ductile Iron."

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1. No separate payment will be made for these restraining glands.
2. Approved adapters shall be used where necessary to provide a transition between pipes and/or fittings of differing outside diameters.
3. Thrust blocking shall only be utilized, in addition to restraining glands, if specified in the contract documents, when tying into existing non-restrained pipe, or when approved by the Inspector.
4. Anti-corrosion protection consisting of polyethylene sleeve and asphaltic material for ferrous surfaces shall be applied to exterior surfaces of all fittings installed. Anti-corrosion embedment shall be provided as specified in Specification Item No. 804, "Excavation, Trenching and Backfill."

836.6 MEASUREMENT: Ductile-Iron and Grey-Iron Fittings will be measured by their weight as listed in Table 836-1 of this specification of the various sizes of fittings installed.

836.7 PAYMENT: Payment for Grey-Iron and Ductile-Iron Fittings shall be for Mechanical Joint Compact fittings (AWWA) C153/A21.53 and/or flanged fittings.

1. Payment will be made at the unit price bid for each ton of fittings to the nearest one-hundredth of a ton of fittings installed.
2. Individual fitting weights used for payment calculations will be the weights of fittings listed in Table 836-1 of this specification.
3. Weights of glands, bolts, nuts, gaskets (all types) are considered subsidiary to the fittings and no separate payment will be made for their weight.
4. Payment for fitting weights listed in Table 836-1 shall be full compensation for excavation, installation, anti-corrosion protection, select anti-corrosion embedment material and installation, hauling and disposition of surplus excavated materials, all glands, bolts, nuts, rubbers, and flange gaskets of whatever type required, and concrete thrust/reaction blocking, if required.
5. If fittings other than those listed in Table 836-1 are approved and installed, the Contractor shall provide quantities and manufacturers unit weights exclusive of glands, bolts, and rubbers with pay request.
6. Materials paid on site will be in accordance with Table 1 of Specification Item No. 100 Mobilization.

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TABLE 836-1							
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)							
BENDS							
Size (Inches)	MJ Compact (C153)	MJ (C110)	FLG SB	Size (Inches)	MJ Compact (C153)	MJ (C110)	FLG SB
1/4 Bend (90 Degrees)				1/8 Bend (45 degrees)			
4	25	55	44	4	21	51	36
6	43	86	67	6	35	75	57
8	61	125	115	8	50	110	105
12	119	258	236	12	96	216	196
16	264	454	478	16	200	345	315
20	447	716	878	20	337	555	485
24	602	1105	1085	24	441	777	730
30	979	1740	1755	30	775	1393	1355
36	1501	2507	2135	36	1140	2163	1755
42	2277	3410	3055	42	1652	2955	2600
48	3016	4595	4095	48	2157	4080	3580
BENDS							
Size (Inches)	MJ Compact	MJ (C110)	FLG SB	Size (Inches)	MJ Compact	MJ (C110)	FLG SB
	(C153)				(C153)		
1/16 Bend (22-1/2 Degrees)				1/32 Bend (11-1/4 degrees)			
4	18	50	35	4	17	50	40
6	32	75	64	6	30	73	56
8	46	110	90	8	42	109	90
12	85	220	194	12	74	220	193
16	175	354	315	16	153	354	315
20	314	550	505	20	265	553	505
24	414	809	528	24	339	815	760
30	668	1500	1385	30	603	1410	1395
36	963	2182	1790	36	830	2195	1805
42	1354	3020	2665	42	1210	3035	2680
48	1790	4170	3665	48	1523	4190	3695

San Antonio Water System Standard Specifications for Construction

TABLE 836-1 CONTINUATION				
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)				
TEES				
Size (Inches)		Weight		
Run	Branch	MJ Compact (C153)	MJ (C110)	FLG Short Body
3	3	26	56	53
4	3	31	76	54
	4	33	80	60
6	4	49	114	90
	6	60	124	98
8	4	65	163	155
	6	76	175	148
	8	89	188	179
12	4	99	316	322
	6	115	325	297
	8	127	339	346
	12	162	407	369
16	6	226	563	573
	8	240	565	555
	12	283	615	590
	16	326	676	635
20	6	344	750	773
	8	371	766	720
	12	427	799	816
	16	503	975	950
	20	566	1068	1005

TABLE 836-1 CONTINUATION				
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)				
TEES				
Size (Inches)		Weight		
Run	Branch	MJ Compact (C153)	MJ (C110)	FLG Short Body
24	6	466	1035	1089
	8	487	1047	1060
	12	539	1075	1125
	16	625	1109	1070
	20	729	1504	1510
	24	785	1617	1685
30	8	739	1808	-
	12	800	1842	1801
	16	959	1885	-
	20	1026	1941	-
	24	1228	2496	2475
	30	1373	2531	2615
36	24	1548	2710	2255
	30	1901	3545	3000
	36	2012	3686	3160
42	24	2272	3690	3245
	30	2512	4650	4125
	36	3048	5119	5360
	42	3225	6320	5580
48	24	2934	4995	4385
	30	3147	5140	4455
	36	4046	6280	5555
	42	4249	8130	7195

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TABLE 836-1 CONTINUATION				
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)				
CROSSES				
Size (Inches)		Weight		
Run	Branch	MJ Compact (C153)	MJ (C110)	FLG Short Body
24	6	566	1025	-
	8	578	1085	1045
	12	610	1153	1110
	16	663	1256	1200
	20	975	1733	1675
	24	907	1906	1835
30	8	650	1795	-
	12	870	1925	1865
	16	900	1950	-
	20	1220	2060	-
	24	1497	2776	2675
	30	1808	3188	3075
36	24	1853	2928	2980
	30	2580	3965	-
	36	2698	4370	4370
42	24	2415	3910	-
	30	2920	5040	-
	36	3788	5835	-
	42	3908	6493	7145
48	24	3435	5210	-
	30	4145	5495	-
	36	4873	6790	-
	42	5465	8815	-
	48	5588	9380	-

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TABLE 836-1 CONTINUATION				
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)				
CAPS			PLUGS	
Size (Inches)	MJ Compact (C153)	MJ (C110)	MJ Compact (C153)	MJ (C110)
4	10	17	12	16
6	16	29	19	28
8	24	45	30	46
12	45	82	54	85
16	95	160	97	146
20	141	235	146	218
24	193	346	197	350
30	362	644	381	626
36	627	912	688	884
42	893	1322	1200	1222
48	1076	1737	1550	1597

TABLE 836-1 CONTINUATION				
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)				
SOLID SLEEVES				
Size (Inches)	Weight			
	MJ Short Compact (C153)	MJ Long Compact (C153)	MJ Short (C110)	MJ Long (C110)
4	17	21	35	46
6	28	35	45	65
8	38	48	65	86
12	57	77	113	143
16	127	172	192	257
20	201	258	258	359
24	264	337	340	474
30	500	651	690	1005
36	725	960	947	1374
42	877	1209	1187	1628
48	1406	1516	1472	2033

San Antonio Water System Standard Specifications for Construction

TABLE 836-1 CONTINUATION			
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)			
CONCENTRIC REDUCERS			
Size (Inches)			Weight
Large End	Small End	MJ Compact (C153)	MJ (C110)
6	4	27	59
8	4	38	81
8	6	41	95
12	4	70	136
12	6	69	150
12	8	70	167
16	6	134	234
16	8	136	258
16	12	126	310
20	12	213	427
20	16	221	492
24	12	304	562
24	16	315	633
24	20	315	727
30	16	596	1027
30	20	599	1085
30	24	492	1204
36	20	1042	1459
36	24	785	1580
36	30	655	1868
42	24	1356	2060
42	30	1112	2370
42	36	1116	2695
48	30	1722	3005
48	36	1650	3370
48	42	1429	3750

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TABLE 836-1 CONTINUATION		
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)		
2" Tapped Tees and Crosses		
Size (Inches)	Weight	
	MJ Compact (C153)	MJ (C110)
4	24	47
6	36	71
8	54	97
10	69	130
12	87	169
20	-	259
24	-	320

TABLE 836-1 CONTINUATION		
WEIGHTS OF GREY-IRON AND DUCTILE-IRON FITTINGS (LBS.)		
OFFSETS		
Size (Inches)	Weight	
	MJ Compact (C153)	MJ (C110)
4 x 6	35	75
4 x 12	55	83
6 x 6	35	110
6 x 12	67	138
6 x 24	96	189
8 x 6	82	164
8 x 12	98	209
8 x 24	141	280
12 x 6	121	320
12 x 12	178	420
12 x 24	240	645
20 x 12	-	1025
20 x 24	-	1245

-End of Specifications-

San Antonio Water System Standard Specifications for Construction

ITEM NO. 839

Anchorage/Thrust Blocking and Joint Restraint

839.1 DESCRIPTION: This item shall consist of anchorage/thrust blocking and joint restraint installation in accordance with these specifications and as directed by the Engineer or Manufacturer's recommendations.

839.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 839 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City of San Antonio (COSA) Standard Specifications for Construction

839.3 MATERIALS: The materials for anchorage/thrust blocking installation shall conform to the appropriate specifications contained within the latest revision of SAWS Material Specifications.

1. Pipe restraint devices shall conform to the latest revision of SAWS' Material Specification Item No. 95-10, "Specifications of Pipe Joint Restraint Systems," and Item No. 113-02, "Ductile Iron Restrained Joint Fittings for Use on Ductile Iron."

839.4 CONSTRUCTION: Suitable anchorage/thrust blocking or joint restraint shall be provided at all of the following main locations: dead ends, plugs, caps, tees, crosses, valves, and bends, in accordance with the Standard Drawings DD-839 Drawing Series.

1. All mechanical (joint) restraints shall be bidirectional.
2. Anchor blocks shall be constructed solidly behind the fitting and symmetrical with the axis of resultant thrust, except where this is not possible as in the case of gravity anchorage for vertical bends.
3. If the restraint limits do not fall on a joint, restraint shall be moved to next further joint.
4. Cutting of pipe to install joint restraints is not permitted.
5. Special ties and anchor fittings may be utilized in conjunction with blocking when shown in the contract documents or as directed by Engineer or Inspector.
6. All thrust blocking shall be a minimum of 3,000 psi concrete placed between solid ground and the fitting except as otherwise shown in the contract documents.
7. The area of bearing in contact with solid ground shall be that as shown in the contract documents or as directed by the Engineer.
8. All thrust blocking placed in conjunction with mains and appurtenances shall be in accordance with Standard Drawings DD-839 Series.
9. In all cases, the design of thrust blocking shall be of sufficient size to withstand an assumed soil lateral load bearing capacity of 3,000 psf, unless specified otherwise in the contract documents.

San Antonio Water System Standard Specifications for Construction

10. When specifically requested by the Contractor and approved by the Engineer, the maximum soil lateral load bearing capacity that will be allowed for the design of thrust blocking shall be 5,000 psf.
11. When soil lateral load bearing capacities of 4,000 psf or 5,000 psf are recorded for design of thrust blocks, copies of soil tests made for determining the lateral load bearing capacity of the subject soil shall be submitted to the Engineer for approval.
12. The blocking shall be placed so that pipe and fitting joints will be accessible.
13. Pipe restraint devices shall be installed according to the lengths prescribed herein, recommended by pipe manufacturer, or as noted in the contract documents, whichever is more restrictive.
14. Pipe polywrap shall be placed between the pipe or fitting and the concrete.
15. The reaction block on the unused branch of a fitting shall be poured separately from the block across the back of the fitting. If they are poured simultaneously, a rigid partition shall be placed between the blocks.
16. Valves 12 inches or larger in size shall be supported on a concrete pad extending vertically from 12 inches below the bottom of the valve to the lower quarter point of the hub and laterally from face to face of hubs and transversely from wall to wall of the trench.
17. All joints for carrier pipe installed within casing shall be restrained.

839.5 MEASUREMENT: Anchorage/Thrust Blocking or Joint Restraints are considered subsidiary to the work and no separate payment will be made to the Contractor for this work.

839.6 PAYMENT: Anchorage/Thrust Blocking or Joint Restraints are considered subsidiary to the work and no separate payment will be made to the Contractor for this work.

-End of Specification-

San Antonio Water System Standard Specifications for Construction

ITEM NO. 846

Air Release Assemblies

846.1 DESCRIPTION: This item shall consist of air release assemblies installed in accordance with these specifications and as directed by the Engineer.

846.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 846 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City Of San Antonio (COSA):
 - a. Standard Specifications for Construction
3. American Society for Testing and Materials International (ASTM)
 - a. ASTM A 48 - Standard Specification for Gray Iron Castings.
 - b. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - c. ASTM A 240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
 - d. ASTM A 276 - Standard Specification for Stainless Steel Bars and Shapes.
 - e. ASTM A 313 - Standard Specification for Stainless Steel Spring Wire.
 - f. ASTM B 584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

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

846.4 MATERIALS: The materials for air release assemblies installation and adjustment shall conform to the specifications contained within the latest revision of SAWS' Material Specification 29-01, "Air Release, Vacuum and Combination Air Valves."

846.5 CONSTRUCTION: Air release assemblies shall be installed at the location shown in the contract documents or as directed by the Engineer.

1. Air release assemblies in an open trench water main installation shall be installed in accordance with DD 846 Drawing Series and shall include the valve, valve boxes, pipe, fittings, accessories and appurtenances.
2. It shall include the service line and tap to the main line.
3. Air release assemblies installed in parkways or easements and adjacent to street pavements shall be installed in accordance with DD 846 Drawing Series regardless of size.

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4. Air release, vacuum, and combination air valves shall incorporate an air collection trap in the form of an enlarged pipeline riser installed on the main pipe leading to the air valve connection as depicted in Standard Drawing DD-846 Series.
5. Air release assemblies installed on steel pipe attached to a bridge structure shall include the outlet on the steel pipe, valve, valve box, pipe, fittings, security enclosure, accessories, and appurtenances.

846.6 MEASUREMENT: Air release and combination air release valve assemblies will be measured by the unit of each such assembly of the various sizes of air release assemblies installed.

846.7 PAYMENT: Payment for air release valve and combination air release valve assemblies will be made at the unit price bid for each such assembly of the various sizes installed in accordance with the details shown in the DD 846 Drawing Series.

1. Payment shall also include: excavation, selected embedment material, backfill, compaction, compaction testing, anti-corrosion embedment when specified, freeze protection for mains on bridges, blocking, and various types and sizes of meter boxes, fittings, valve marker, valve, valve boxes, pipe, accessories and appurtenances, service line and tap to the main line, security enclosure adapters, couplings, anchors, hauling and disposition of surplus excavated material, including all existing pipe, fittings, appurtenances to be abandoned or removed, surface and pavement restoration, installation of all-weather surface, and other required testing.
2. Materials paid on site will be in accordance with Table 1 of Specification Item No. 100 Mobilization.

-End of Specification-

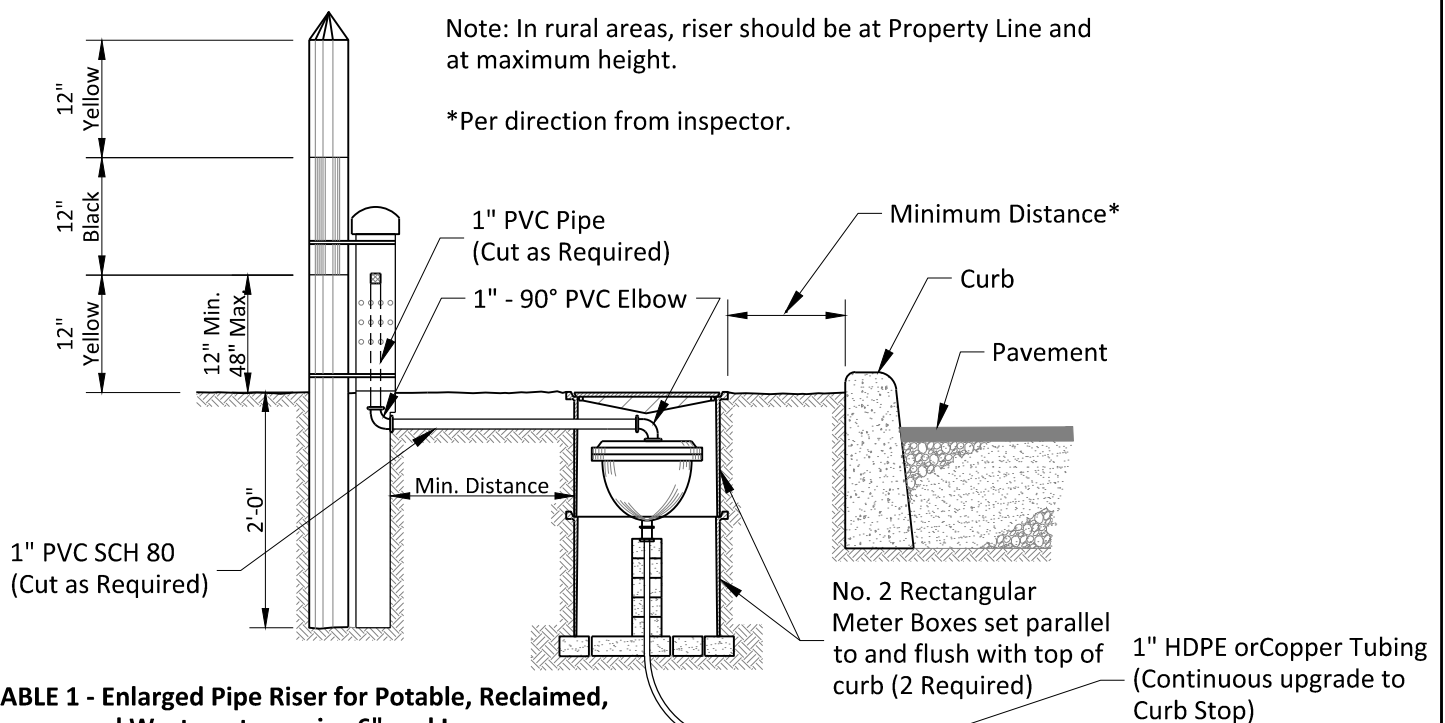
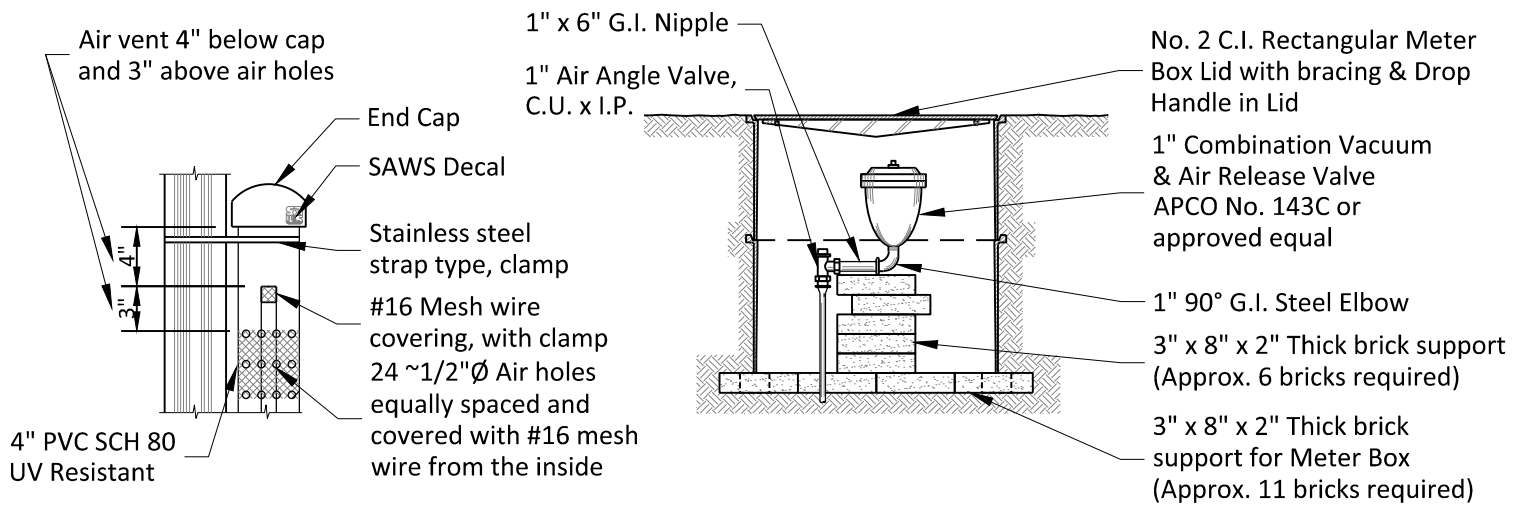
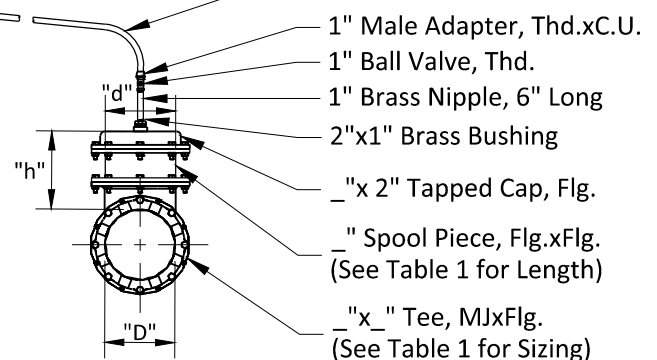


TABLE 1 - Enlarged Pipe Riser for Potable, Reclaimed, and Wastewater mains 6" and Larger

D, Nominal Diameter of Main, In.	Minimum d, in.	Minimum h, in.	Comments
6	6.0	6.0	6 MJ x 6 MJ x 6 FLG DI Tee
8	8.0	8.0	12 MJ x 12 MJ x 12 FLG DI Tee
12	12.0	12.0	16 MJ x 16 MJ x 12 FLG DI Tee
16	12.0	9.6	24 MJ x 24 MJ x 18 FLG DI Tee
24	18.0	14.4	30 MJ x 30 MJ x 18 FLG DI Tee
30	18.0	18.0	36 MJ x 36 MJ x 24 FLG DI Tee
36	24.0	21.6	42 MJ x 42 MJ x 24 FLG DI Tee
42	24.0	25.2	48 MJ x 48 MJ x 24 FLG DI Tee
48	24.0	28.8	Welded-on FLG Outlet
54	30.0	32.4	Welded-on FLG Outlet
60	36.0	36.0	Welded-on FLG Outlet
66	24.0	23.1	Welded-on FLG Outlet
72	24.0	25.2	Welded-on FLG Outlet



Air Collection Traps in Air Valve Piping Notes:

1. Dimensions derived from AWWA Manual 2nd Edition: Chapter 6 M51 Air Valves:

Air-Release, Air/Vacuum & Combination

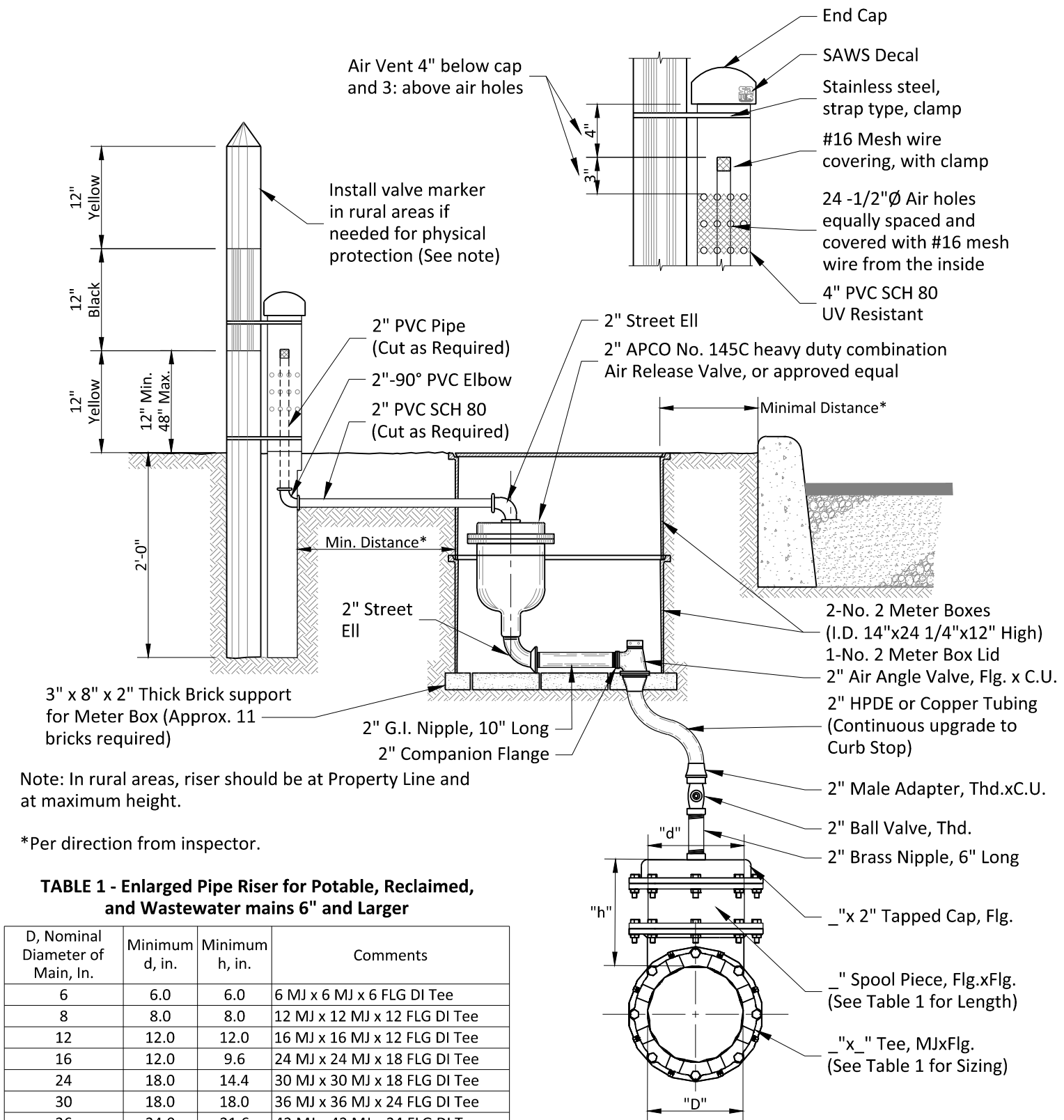


TABLE 1 - Enlarged Pipe Riser for Potable, Reclaimed, and Wastewater mains 6" and Larger

D, Nominal Diameter of Main, In.	Minimum d, in.	Minimum h, in.	Comments
6	6.0	6.0	6 MJ x 6 MJ x 6 FLG DI Tee
8	8.0	8.0	12 MJ x 12 MJ x 12 FLG DI Tee
12	12.0	12.0	16 MJ x 16 MJ x 12 FLG DI Tee
16	12.0	9.6	24 MJ x 24 MJ x 18 FLG DI Tee
24	18.0	14.4	30 MJ x 30 MJ x 18 FLG DI Tee
30	18.0	18.0	36 MJ x 36 MJ x 24 FLG DI Tee
36	24.0	21.6	42 MJ x 42 MJ x 24 FLG DI Tee
42	24.0	25.2	48 MJ x 48 MJ x 24 FLG DI Tee
48	24.0	28.8	Welded-on FLG Outlet
54	30.0	32.4	Welded-on FLG Outlet
60	36.0	36.0	Welded-on FLG Outlet
66	24.0	23.1	Welded-on FLG Outlet
72	24.0	25.2	Welded-on FLG Outlet

Air Collection Traps in Air Valve Piping Notes:

1. Dimensions derived from AWWA Manual 2nd Edition: Chapter 6 M51 Air Valves: Air-Release, Air/Vacuum & Combination

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ITEM NO. 848

Sanitary Sewers

848.1 DESCRIPTION: This item shall govern the furnishing, installation, adjustment, or replacement of sanitary sewer pipe of the size and type specified in the contract documents.

848.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 848 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City of San Antonio (COSA) Specifications for Construction
3. Texas Commission of Environmental Quality (TCEQ)
 - a. Chapter 217 Design Criteria for Domestic Wastewater Systems
 - b. Chapter 213 ("Edwards Aquifer")
4. American Society for Testing and Materials (ASTM)
 - a. ASTM C 150 - Standard Specification for Portland Cement.
 - b. ASTM C 494 - Standard Specification for Chemical Admixture for Concrete.
 - c. ASTM C 618 - Standard Specification for Fly Ash and Raw or Calcinated Natural Pozzolan for use as Mineral Admixture in Portland Cement Concrete.
 - d. ASTM C 937 - Standard Specification for Grout Fluidifier for Pre-placed Aggregate Concrete.
 - e. ASTM C 940 - Standard Test Method for Expansion and Bleeding of Freshly Mixed Grout for Replaced Aggregate Concrete in the Laboratory.
 - f. ASTM C 1017 - Standard Specification for Chemical Admixture for Use in Producing Flowing Concrete.
 - g. ASTM C 1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
 - h. A. ASTM D 618 - Standard Practice for Conditioning Plastics for Testing.
 - i. ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
 - j. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - k. ASTM D 2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
 - l. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

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- m. ASTM D 2310 - Standard Classification for Machine-Made Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
- n. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- o. ASTM 2412 – Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading
- p. ASTM D 2444 - Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).
- q. ASTM D 2657 - Standard Practice for Heat Fusion Joining Polyolefin Pipe and Fittings.
- r. ASTM D 2680 - Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
- s. ASTM D 2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
- t. ASTM D 2992 - Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting) Resin Pipe and Fittings.
- u. ASTM D 3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- v. ASTM D 3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
- w. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- x. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- y. ASTM D 3262 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
- z. ASTM D 3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- aa. ASTM D 3681 - Method for Determining Chemical Resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin Pipe in a Deflected Condition.
- bb. ASTM D 3754 - Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.
- cc. ASTM D 4161 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.
- dd. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- ee. ASTM F 679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- ff. ASTM F 714 - Standard Specification for Polyethylene Plastic (PE) Pipe (SDR-PR) Based on Outside Diameter.

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- gg. ASTM F 794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
- hh. ASTM F 894 - Standard Specification for Polyethylene (PE) Large-Diameter Profile Wall Sewer and Drain Pipe.
- ii. ASTM G 62 - Standard Test Methods for Holiday Detection in Pipeline Coatings.
- 5. American Water Works Association (AWWA)
 - a. AWWA C 110 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 Inches Through 48 Inches for Water.
 - b. AWWA C 111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - c. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches for Water Distribution.
 - d. AWWA C 909 - Standard for Molecularly-Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 Inches through 12 Inches (100mm through 300 mm), for Water Distribution.
 - e. AWWA M23 – PVC Pipe – Design and Installation
 - f. W. PPI TR3 - Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.
 - g. AWWA C 300 - Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and other Liquids.
 - h. AWWA C 950 – Fiberglass Pressure Pipe
 - i. AWWA M 45 – Fiberglass Pipe Design
- 7. National Science Foundation
 - a. NSF Standard 61 - Drinking Water System Components - Health Effects.
- 8. Society of Protective Coatings
 - a. SSPC-SP 6 - Steel Structures Painting Council, Commercial Blast Cleaning.
- 9. Uni-Bell
 - a. UNI-B-13 - Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride Pipe.

848.3 SUBMITTALS: Contractor shall submit manufacturer's product data, instructions, recommendations, shop drawings, and certifications.

- 1. Contractor to submit cut sheets prior to commencement of open cut work.
- 2. Submit proposed methods, equipment, materials and sequence of operations for sewer construction.
- 3. Plan operations so as to minimize disruption of utilities to occupied facilities or adjacent property.
- 4. Submit all test reports and pre and post sewer television inspection video.
- 5. Videos become property of SAWS.

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848.4 MATERIALS: Materials for sanitary sewer pipe and fittings shall be either rigid or flexible. All pipe not listed shall be subject to pre-approval by the Engineer.

1. **Rigid Pipe:**

- a. **Concrete Pipe:** Concrete pipe shall not be used.
- b. **Concrete Steel Cylinder Pipe:** Concrete Steel Cylinder Pipe shall not be used.
- c. **Asbestos-Cement (AC) Pipe:** AC pipe shall not be used. Refer to Specification Item No. 3000, "Handling Asbestos Cement Pipe."

2. **Flexible Pipe:** Pipe consisting of materials other than those listed above.

- a. Any flexible pipe having a deflection of the inside diameter greater than 5% after 30 days of installation will not be accepted.
- b. Testing shall be as per SAWS Test Specification Item No. 849 - Sanitary Sewer Testing
- c. Working room for flexible pipe shall be as per Specification Item No. 804 Excavation Trenching and Backfill.
- d. **Polyvinylchloride (PVC) Sewer Pipe:** Pipe shall be made from class 12454 materials as described in ASTM D1784.
 - i. For pipes 4 inches to 15 inches in diameter, fittings and joints shall conform to ASTM D3034 and D3212, with the exception that solvent cement joints shall not be used.
 - ii. All pipes that are 18 inches to 24 inches in diameter shall meet the requirements of ASTM F679.
 - iii. **All sanitary sewer PVC pipe shall be green. White pipe is prohibited. Contractor will need to submit information to request an exemption to use white pipe such as letters from suppliers that pipe is not available. Once a project is awarded Contractor should bring this exemption to SAWS attention via RFI. If white pipe is approved it must have appropriate markings and be wrapped with green poly wrap. This shall include all lateral piping as well.**
 - iv. At waterline crossings and where water and sewer mains are parallel and separation distance cannot be achieved as per 30 TAC 217.53, use extra stiff pipe SDR 26 PVC (ASTM D2241) with a minimum pressure rating of 160 psi.
- e. **Fiberglass Reinforced Sewer Pipe, Non-Pressure Type:**
 - i. Fiberglass reinforced sewer pipe, non-pressure type, shall be a factory-formed conduit of polyester resin, fiberglass and silica sand built up in laminates and shall conform to the requirements of ASTM D3262, including the appendix and subsequent specifications, and in accordance with SAWS' material specifications.
 - ii. Depths shall comply with requirement of ASTM D3839.
 - iii. Joints for pipe and fittings shall be confined compression rubber gasket bell and spigot type joints conforming to the material and performance requirements of ASTM D4161. Depths shall comply with requirement of ASTM D3681.

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- iv. Flanges, elbows, reducers, tees, wyes, laterals, and other fittings shall be capable of withstanding all operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass-fiber reinforced overlays.
 - v. For pipe diameters 15 inches or larger, lateral openings 6 inch or greater in size shall be made using PVC sewer saddles conforming to ASTM D2661 or insert a tee connection conforming to ASTM D3034, approved by the Engineer, and found in SAWS' Material Specifications.
 - vi. Minimum pipe stiffness shall not be less than SN 72 for direct bury applications
- f. High density, High Molecular Weight Polyethylene Pipe (HDPE):
 - i. HDPE shall meet requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D 1248.
 - ii. Material meeting requirements of cell classification 345434D or E, in accordance with ASTM D 3350, are also suitable for making pipe products under these specifications.
 - iii. Inner wall of pipe shall be of light or gray color for television inspection purposes.
- 3. Pressure Pipe/Force Mains:
 - a. High density, High Molecular Weight Polyethylene Pipe (HDPE):
 - i. HDPE shall meet requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D 1248.
 - ii. Material meeting requirements of cell classification 345434D or E, in accordance with ASTM D 3350, are also suitable for making pipe products under these specifications.
 - iii. Inner wall of pipe shall be of light or gray color for television inspection purposes.
 - b. The pressure rating, size, and pressure class shall be as shown in the contract documents.
 - c. All required joint restraint shall be approved by the Engineer prior to the work being accepted.
 - d. Pressure pipe/Force mains are required to have modified grade 5 material used as bedding.
 - e. Pipes also shall be hydrostatically tested at a minimum of 150 psi after their construction to ensure proper construction.
- 4. Mechanical or compression joints, concrete jointing collars, or non- reinforced rubber adaptors shall be used only as approved by the Engineer.
- 5. All sanitary sewer pipe and fittings utilized within the jurisdiction of SAWS shall be tested by a manufacturer-approved laboratory at the source of supply.
- 6. All shipments of pipe shall be accompanied by a certificate of compliance to these specifications prepared by an independent testing laboratory and signed by a Texas registered professional engineer.

848.5 CONSTRUCTION: All sanitary sewer mains shall be constructed in accordance with the specifications herein outlined and in conformity with the required lines, grades, and details

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shown in the contract documents and as directed by the Engineer. Whenever true line and grade is not attained it will be the Contractor's sole responsibility to remove and reinstall any and all sewer pipe deemed required by the Engineer and shall be done at the Contractor's expense.

1. Successful passage of the Hydrostatic, air test and mandrel test (for flexible pipe, 30 days after installation), as described under TCEQ criteria. In addition sewer pipe must also pass settlement test for the final acceptance of the mains. Settlement Testing shall be performed in accordance with Specification Item No. 849 "Sanitary Sewer Testing".
2. Mains shall be properly backfilled as per Specification Item No. 804, "Excavation Trenching and Backfill" prior to the start of the 30 day testing period.
3. Water Main Crossings: Where gravity or force main sewers are constructed in the vicinity of water mains, the requirements of the 30 TAC§ 217.53 shall be met.
4. For excavation, trenching and backfill requirements see Specification Item No. 804, "Excavation, Trenching and Backfill."
5. Pipe Installation: The Inspector will inspect all pipe before it is placed in the trench and will reject any sections found to be damaged or defective to a degree that would affect the structural integrity of the pipe.
6. Rejected pipe shall be immediately removed from the site of the work and replaced with new acceptable pipe.
7. Sewer main installation should be constructed from downstream to upstream as standard practice.
8. No pipe shall be laid within 10 feet of any point where excavation is in progress. Pipe installation shall proceed upgrade with the bell pointing in the upstream direction of flow.
9. Pipe shall be lowered into the trench without disturbing the prepared bedding or the trench sides.
10. The drilling of lifting holes in the field will not be permitted.
11. Pipe shall be installed by means of a concentric pressure being applied to the pipe with a mechanical pipe puller. Pulling or pushing a joint of pipe in place by using a crane, bulldozer, or backhoe will not be permitted.
12. Pipe shall be "pulled home" in a straight line with all parts of the pipe on line and grade at all times.
13. No side movement or up and down movement of the pipe will be permitted during or after the pulling operation.
14. Should coupled joints of pipe be out of line or off grade, they shall be removed one joint at a time in the presence of the Inspector and brought to the proper line and grade.
15. The lifting or moving of several joints of coupled pipe at one time to close a partially open joint or to fine grade under laid joints of pipe will not be permitted.
16. Contractor shall insure that all existing or proposed manholes or structures shall remain visible and accessible at all times.
17. No manhole or structure covers shall be covered by pavement, equipment, or other obstructions other than a removable, steel plate (min thickness of ½ inch and H-20 traffic bearing rated), temporary lid provided for safety.

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18. Pipe Separation: Sewer pipe separation distances shall be maintained in accordance with TCEQ rules 30 §217.53. See Drawing Series DD-848.
19. Contractor to obtain the services of a licensed surveyor in accordance with the General Conditions for the purpose of validating the elevations of all sewer main work including the installation of manholes. It is the contractor responsibility to use the latest technology including Laser Beams to establish elevations as per design plans.
 - a. Contractor to provide SAWS with the licensed surveyors report validating the all pipe was installed per design plans and upload report in CPMS.
 - b. If the sewer main or manholes are not constructed per plans it is the contractors responsibility to relay or replace any sewer work at his cost with no additional days granted.
20. **No horizontal or vertical curves shall be permitted in conformance with appropriate regulatory agency requirements.**
21. Before leaving the work unattended, the upper ends of all pipelines shall be securely closed with a tight fitting plug or closure.
22. The interior of laid pipe shall be kept free from dirt, silt, gravel, or foreign material at all times.
23. All pipes in place must be approved by the Inspector before backfilling.
24. When replacing an existing system in place, Contractor shall maintain screens to prevent the entrance of construction debris into the sewer system.
25. Pipe bursting on AC sanitary sewer pipe is not allowed.

848.6 MEASUREMENT: All sewer pipes will be measured from center of manhole to center of manhole or end of main.

1. Measurement will be continuous through any fittings in the main, even though the fittings are pay items of the contract.

848.7 PAYMENT: Sewer pipe up to 24-inches will be paid for at the contract bid price per linear foot. Sewer pipe larger than 24-inches will be paid for by percentage listed below.

1. For sewer pipe up to 24-inches said price shall be full compensation for furnishing all materials, including pipe, couplings, trenching, pumping, concrete, plugs, laying and jointing, backfilling, select bedding and initial backfill material, tamping, water, labor, tools, equipment, and all weather surface, testing, acceptable densities and must meet all requirement for testing and other incidentals necessary to complete the work.
2. For sewer pipe over 24-inches the contractor will get paid 80% of the bid item cost for furnishing all materials, including pipe, couplings, trenching, pumping, concrete, plugs, laying and jointing, backfilling, select bedding and initial backfill material, tamping, water, labor, tools, equipment, and all weather surface.
3. For sewer pipe over 24-inches the contractor will get paid the remaining 20% percent of the bid item cost for the approved testing results of acceptable densities

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and must meet all requirement for all other testing and other incidentals necessary to complete the work.

4. When the minimum separation distances for any water and sewer piping facilities cannot be maintained per 30 TAC §217.53, Contractor shall install SDR-26 PVC pipe (160 psi pressure rated). Payment for this higher pressure rated pipe shall be made the contract bid price per linear foot complete in place for the type, and size constructed as described above.
5. Sewer pipe fittings, as part of the main line such as wyes and tees, are inclusive in the cost of Specification Item No.854, "Sanitary Sewer Laterals."
6. Pay cuts will be measured from the top of ground prior to the Contractor's operation and along the centerline of the pipe to the invert of the pipe, to be submitted with cut sheets.

-End of Specification-

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ITEM NO. 849

Sanitary Sewer Testing

849.1 DESCRIPTION: This item shall consist of air, infiltration/exfiltration, pipe deflection, and settlement tests in accordance with this specification and as directed by the Engineer.

849.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 849 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS)
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City of San Antonio (COSA) Standard Specification for Construction
3. Texas Commission of Environmental Quality (TCEQ)
 - a. 217 Design Criteria for Domestic Wastewater Systems
4. American Society for Testing and Materials (ASTM) International:
 - a. ASTM C 828 – Standard Test Method for Low Pressure Air Test of Vitrified Clay Pipe Lines.
 - b. ASTM C 924 – Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
 - c. ASTM D 3034 – Standard Specification for Type PSM Polyethylene (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - d. ASTM F 794 – Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
 - e. ASTM F 1417 – Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air.
 - f. ASTM C 1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.

849.3 SUBMITTALS: Contractor shall submit manufacturer's product data instructions, recommendations, shop drawings, and certifications.

1. Test Plan: Before testing begins and in adequate time to obtain approval through submittal process, prepare, and submit test plan for approval by Engineer.
2. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from Drawings and Specifications.
3. Submit test reports for each test on each segment of sanitary sewer.

849.4 MATERIALS: The materials installed for air and deflection tests shall conform to the appropriate specifications contained within the latest revision of SAWS' Material Specifications.

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849.5 TESTING OF INSTALLED PIPE: The Contractor shall perform a low-pressure air test or an infiltration/exfiltration test, and, for pipe installed by open cut method, a settlement test before the installed work shall be considered accepted. If a gravity collection main is composed of flexible pipe, a deflection test will also be required. Flexible pipe is defined as pipe that will deflect at least 2% without structural distress. Contractor shall insure that all testing is performed in the presence of the Inspector, with copies of all written test results made available to the Inspector. Tests shall conform to the following requirements:

1. **Low-Pressure Air Test:** The procedure for the low-pressure air test shall conform to the procedures described in ASTM C828, ASTM C924, and ASTM F1417 (or other appropriate procedures), except for testing times. The test times shall be as outlined in this section. For sections of pipe less than 36-inch average inside diameter, the following procedure shall apply. The pipe shall be pressurized to 3.5 psi greater than the pressure exerted by groundwater above the pipe. Once the pressure is stabilized, the minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be computed from the following equation:

$$T = \frac{0.085 \times D \times K}{Q}$$

T = Time for pressure to drop 1.0 pound per square inch gauge in seconds;

K = $0.000419 \times D \times L$, but not less than 1.0;

D = Average inside pipe diameter, in inches;

L = Length of line of same pipe size being tested, in feet;

Q = Rate of loss, 0.0015 cubic feet per minute per square foot internal surface shall be used since a K value of less than 1.0 shall not be used.

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The minimum testing times for each pipe diameter is as follows:

Pipe Diameter	Minimum Time	Length for Minimum Time	Time for Longer Length
Inches	Seconds	Feet	Seconds/Ft
6	340	398	0.855
8	454	298	1.520
10	567	239	2.374
12	680	199	3.419
15	850	159	5.342
18	1,020	133	7.693
21	1,190	114	10.471
24	1,360	100	13.676
27	1,530	88	17.309
30	1,700	80	21.369
33	1,870	72	25.856

* Note: Test time starts after the required 60 seconds of stabilization time has transpired.

The test may be stopped if no pressure loss has occurred during the first 25% of the calculated testing time. If any pressure loss or leakage has occurred during the first 25% of the testing period, then the test shall continue for the entire test duration as outlined above or until failure.

Mains with a 27-inch or larger average inside diameter may be air tested at each joint instead of air testing entire pipe.

Mains with a 36-inch average inside diameter and larger must be air tested at each joint. If the joint test is used, a visual inspection of the joint shall be performed immediately after testing. The pipe is to be pressurized to 3.5 psi greater than the pressure exerted by groundwater above the pipe. Once the pressure has stabilized, the minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.

2. **Infiltration/Exfiltration Test:** The total exfiltration, as determined by a hydrostatic head test, must not exceed 10 gallons per inch of diameter per mile of main per 24 hours, at a minimum test head of 2 feet above the crown of the main at an upstream manhole. The Contractor shall use an infiltration test in lieu of an exfiltration test

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when mains are installed below the ground water level. In such cases, the total exfiltration, as determined by a hydrostatic head test, must not exceed 10 gallons per inch diameter per mile of main 24 hours at a minimum test head of 2 feet above the crown of the main at an upstream manhole, or at least 2 feet above the existing groundwater level, whichever is greater. For construction work occurring within a 25-year floodplain, the infiltration or exfiltration must not exceed 10 gallons per inch diameter per mile of main per 24 hours at the same minimum test head as stated in the previous sentence. If the quantity of infiltration or exfiltration exceeds the maximum quantity specified, the Contractor shall propose to the Engineer, and receive approval therefrom, all necessary remedial action, solely at the Contractor's own cost, in order to reduce the infiltration or exfiltration to an amount within the limits specified herein.

3. **Deflection Testing:** As stated in the 30 TAC § 217, deflection test shall be performed on all flexible pipe installed.
 - a. For mains with inside diameters less than 36 inches, a rigid mandrel shall be used to measure deflection.
 - b. For mains with an inside diameter 36 inches and greater, a method approved by the Engineer shall be used to test for vertical deflections.
 - c. For rigid pipe, a manufacturer approved "Go, No Go" deflection rod may be used to test deflection, but must be approved by Engineer or Inspector prior to testing.
 - d. The deflection test must be accurate to within $\pm 0.2\%$ deflection. The test shall be conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of five percent. If a pipe should fail to pass the deflection test, the problem shall be corrected, and a second test shall be conducted after the failed area's final backfill has been in place an additional 30 days. The tests shall be performed without mechanical pulling devices. The Engineer should recognize that this is a maximum deflection criterion for all pipes and a deflection test less than 5 % may be more appropriate for specific types and sizes of pipe. Upon completion of construction, the Engineer or other Texas Registered Professional Engineer appointed by the owner shall certify to the Inspector, that the entire installation has passed the deflection test. This certification may be made in conjunction with the notice of completion required in 30 TAC § 217.14. (1) of this title (relating to General Provisions). This certification shall be provided for the Owner to consider the requirements of the approval have been met.
 - e. Contractor shall provide 24 hr. notice to Engineer and Inspector prior to any testing.
 - f. Engineer of Record must witness all tests over the EARZ.
 - g. Mandrel Sizing. The rigid mandrel shall have an outside diameter (O.D.) not less than 95% of the inside diameter (I.D.) of the pipe.
 - h. The inside diameter of the pipe, for the purpose of determining the outside

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diameter of the mandrel, shall be the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe. All dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

- i. Mandrel Design: The rigid mandrel shall be constructed of a metal or a rigid plastic material that can withstand 200 psi without being deformed.
- ii. The mandrel shall have nine or more "runners" or "legs" as long as the total number of legs is an odd number.
- iii. The barrel section of the mandrel shall have a length of at least 75% of the inside diameter of the pipe.
- iv. A proving ring shall be provided and used for each size mandrel in use.
- v. Method Options: Adjustable or flexible mandrels are prohibited. A television inspection is not a substitute for the deflection test.
- i. Test Reports: Submit reports from tests in accordance with relevant standards.

4. **Settlement Testing:** For all gravity sanitary sewer pipe installed by open-cut method the Contractor shall conduct settlement testing of the newly installed sewer to determine whether excessive sagging of the pipe has occurred. This test does **not** identify the precise threshold at which pipe is properly installed. Rather, it provides a simple, easily interpretable means to identify grossly unacceptable installation of gravity sewer pipe. As such, passing this test shall not excuse poor workmanship identified by other means. Contractor shall follow construction QC/QA program established for the specified project per SAWS Standard Specification 903 and follow best practices to maintain horizontal and vertical alignment control.

- a. This test involves television inspection. Requirement for televising, video format, and submittals shall be governed by SAWS Standard Specification 866. If suitable to the project in question the settlement test televising efforts can be combined with but are in addition to and do not in any way replace or nullify, the efforts or requirements associated with SAWS Standard Specification 866.
- b. Unless otherwise directed by Engineer or Owner, no sewer flow should be introduced into the system when performing settlement test.
- c. This test shall be conducted no earlier than 30 days after installation of the sanitary sewer pipe and final backfill.
- d. For the purpose of this test the term "**segment**" is defined as all pipe between two manholes and/or structures and "**pipe section**" is defined as a single piece of pipe up to and including where it joins adjacent pipe(s).
- e. Segment must be isolated and cleaned to ensure no flow through pipe and

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- that it is free of dirt, rocks, scale, mud, silt, and any other foreign matter prior to performing this test.
- f. Contact the Inspector prior to testing so that they may witness flooding of the system and testing.
 - g. Water shall be introduced into the pipe to provide meaningful observations. To accomplish this, after cleaning, and immediately before performing this test, contractor shall flood system with an amount of water sufficient to flow from the upstream manhole through the segment to be tested and be observed flowing into the downstream manhole. Introduction of water will then be stopped and any standing water allowed to remain in the segment being tested. Testing shall commence when flow is no longer observed in downstream manhole. The established unit cost for settlement testing shall be inclusive of any and all water and work necessary to deliver water to test site and shall thus be provided by contractor at no additional cost to Owner.
 - h. Settlement testing varies by pipe diameter:
 - i. **For pipes from 8 to 42 inches in diameter:** After advancing television unit through pipe to be tested, connect golf ball with rigid wire and string as necessary for golf ball to be fully visible within CCTV footage and maintain contact with bottom of pipe as golf ball is pulled back through each segment. The golf ball shall have a diameter of 1.68 inches or 42.7 mm. Any and all points along the pipe segment at which the golf ball becomes fully submerged in standing water shall be defined as excessive sag.
 - ii. **For pipes 48 inches in diameter and larger:** Manned entry to the pipe will be made. A rigid steel ruler with zero (0) inch mark at the extreme end shall be placed in all areas of standing water in the pipe such that it is in contact with the lowest portion of the pipe's circumference and a reading of the depth of standing water shall be taken. All such readings shall be documented, including, at a minimum, the depth of water and location (STA or upstream or downstream distance from manhole/structure) of each reading taken. Any and all points along the pipe segment at which the measured depth of standing water exceeds 4.0% of the nominal diameter of the pipe in question shall be defined as excessive sag.
 - i. Any and all pipe section(s) of gravity sanitary sewer in which excessive sag is identified shall be rejected. Contractor shall correct each and every such pipe section, including as many upstream or downstream sections or segments as necessary to eliminate excessive sag(s) while maintaining grade required by the contract documents.

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- j. No segment, regardless of length, shall have more than three (3) excessive sags. Identification of more than three (3) excessive sags in a segment of pipe shall be cause for rejection and Contractor shall reinstall the segment in its entirety at no cost to Owner.
- k. All corrected sections and/or segments of pipe shall be retested at no additional cost to Owner until all pipe segments pass this and other tests required by SAWS Standard Specifications and contract documents for the project in question.
- l. Excessive sags shall be documented in video and shall be in accordance with NASSCO-(PACP) requirements per SAWS Specification Item No. 866.
- m. Provide televising and associated reports documenting the occurrence of the test and its results to Owner no later than 3 days following the test.

849.6 MEASUREMENT: Air/Infiltration/Exfiltration, and Deflection Testing will not be measured for payment.

849.7 PAYMENT: No direct payment shall be made for Air/Infiltration/Exfiltration and Deflection Testing and all costs in connection therewith shall be included in the applicable contract price for the item to which the work pertains. Refer to Specification 866 for payment of settlement testing.

-End of Specification-

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ITEM NO. 852

Sanitary Sewer Manholes

852.1 DESCRIPTION: This item shall govern the construction of standard sanitary sewer manholes complete in place and the materials therein, including manhole rings and covers.

852.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 852 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City of San Antonio (COSA) Specifications for Construction
3. Texas Commission of Environmental Quality (TCEQ)
 - a. Chapter 217 Design Criteria for Domestic Wastewater Systems
 - b. Chapter 213 ("Edwards Aquifer")
4. AASHTO – American Association of State Highway and Transportation Officials:
 - a. M306: Standard Specification for Drainage, Sewer, Utility, and Related Castings.
5. ASTM – American Society for Testing and Materials:
 - a. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
 - b. A536: Standard Specification for Ductile Iron Castings.
 - c. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - d. ASTM C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - e. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections
 - f. ASTM C 890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
 - g. ASTM C 913 – Standard Specifications for Precast Concrete Water and Wastewater Structures.
 - h. ASTM C 990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
 - i. ASTM D638: Test Method for Tensile Properties of Plastics.
 - j. ASTM D648: Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edgewise Position.
 - k. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft.)

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- l. ASTM D790: Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- m. ASTM D1238: Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
- n. ASTM D1505: Standard Test Method for Density of Plastics by the Density-Gradient Technique.
- o. ASTM D1693: Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
- p. ASTM D 2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
- q. ASTM D 2996 - Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
- r. ASTM D 2997 - Standard Specification for Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe
- 6. American Society of Mechanical Engineers
 - a. ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings

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

- 1. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.
- 2. Submit all test reports and pre and post sewer television inspection video.
- 3. Videos become property of SAWS.

852.4 MATERIALS: All constructed manholes shall be watertight and equipped with pre-tested and approved ring and covers. Sewer manhole ring and cover castings shall meet the current requirements of the American Association of State Highway and Transportation Officials (AASHTO) Designation M306-10.

- 1. Concrete Manhole Components: For new concrete manholes, all concrete manhole components (cast-in-place or precast manhole base, precast risers, precast cone sections, cast-in-place or precast flat tops, and as applicable) for new manholes shall conform to the applicable requirements of ASTM Designation C478, except as modified below.
 - a. Concrete Grout: All concrete grout used for patching or other similar fill-in work shall be of non-shrink type made with the Komponent[®] admixture specified above, or approved alternate, in accordance with the manufacturer's recommended formulation with Portland cement, fine aggregate, water, and water reducer to produce a compressive strengths of approximately 4,800 psi within 7 days and 7,250 psi within 28 days at a 70 °F baseline temperature.

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2. The manhole ring and cover shall be of ductile iron or gray cast iron construction. The cover shall be solid with no vent or pick holes; hinged with underlying special hinge area leakage protection; the cover secured with four (4) stainless steel bolts; and shall have a recessed “pick bar” for cover opening. Cam lock type covers shall not be allowed.
 - a. Approved manufacturers, as listed in the SAWS Approved Products List (APL), have previously completed required inflow leakage shop testing and have met a maximum allowable leakage rate criterion of 1 gallon per minute (gpm) at 12 inches of water submergence above the manhole cover.
 - b. Nominal cover diameter shall be 32 inches, with 30-inch clear opening, as required by TCEQ
 - c. Vented Manhole Covers will be specified by Engineer.
3. “Throat rings” shall be made of HDPE and have a maximum thickness of 2 inches. No concrete throat rings shall be used.
 - a. The internal diameter shall match that of the ring and cover’s opening. HDPE “throat rings” are to be used in conjunction with a UV stabilized internal polyethylene liner for the purpose of providing an infiltration/inflow (I/I) barrier.
 - b. The I/I Barrier shall be as manufactured by Strike Tool Products of Cannon Falls, MN. See SAWS APL.
 - c. Note of Clarification: A minimum of two and a maximum of six “throat rings” may be used at each adjusted manhole. “Throat rings” are limited to a minimum of two and a maximum of four rings for new manhole construction. Throat rings shall be a maximum thickness of two (2) inches.
4. Bitumastic Joint Sealant, flat tops, and between the ductile or gray cast iron ring (frame) and the uppermost adjustment ring or flat top: See Approved APL.
5. For rehabilitated manholes; first, apply a combination of cementitious coatings followed by an approved epoxy coating. Kerneos SewperCoat 2000 HS and PG, applied at the required one-inch thick application, is the only product approved which does not require a subsequent epoxy coating.
6. Other approved materials are located on SAWS website under SAWS Approved Products List. The list is periodically updated and should be checked by Contractor prior to start of construction.
7. For reconstructed manholes; first, apply a combination of cementitious coatings followed by an approved epoxy coating with the cementitious coating first. Kerneos SewperCoat 2000 HS and PG, applied at the required one-inch thick application, is the only product approved which does not require a subsequent epoxy coating.
8. Other approved materials are located on SAWS website under SAWS Approved Products List. The list is periodically updated and should be checked by Contractor prior to start of construction.
9. New Manholes shall be precast manholes.
 - a. Manufacturer shall be approved by SAWS Products Standard Committee and be on the APL.

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10. Shallow manholes have a depth of 4 feet or less measured from the top of cover to sewer invert.
11. Each manhole joint shall be sealed with Infi-Shield ® Gator Wrap external rubber sleeve as manufactured by Sealing Systems, Inc. The seal shall be made of Stretchable, Self-Shrinking, Intra-Curing Halogenated based rubber with a minimum thickness of 30 mils. The back side of each unit shall be coated with a cross-linked re-enforced butyl adhesive. The butyl adhesive shall be non-hardening sealant, with a minimum thickness of 30 mils. The seal shall stretch around the substrate then overlapped creating a cross-link and fused bond between the rubber and butyl adhesive.

852.5 CONSTRUCTION:

1. Manholes shall be constructed of materials and workmanship as described by these specifications, at such places shown in the contract documents or as designated by the Engineer, and in conformity with the typical details and sketches shown.
2. Unless otherwise shown in the contract documents or approved by the Engineer, standard sanitary sewer manholes shall be constructed with influent and effluent piping less than or equal to 24 inches in diameter with precast reinforced concrete manhole sections.
3. A standard sanitary sewer manhole shall be a single entrance cylindrical structure, having a minimum internal diameter of 4 feet between the cone and base sections.
4. The base of the structure shall include the load bearing portion beneath and exterior of the structure, invert channels and the fill or bench portions adjacent to the lower sewer pipes within the structure.
5. When the manhole depth is 4 feet or less, but not less than three (3) feet, provide a shallow type manhole. Maximum pipe size for shallow type manholes is 12-inch diameter.
6. Special shallow cone sections, or flat cover slabs, shall be used for shallow manholes.
7. The maximum vertical height of the diameter adjustment section or cone shall be 36 inches.
 - a. Adjustment of throat rings may be used for final elevation adjustment of the manhole ring and cover.
 - b. Concrete encasement of the manhole's ring shall be as shown in the DD-852 Standard Drawing Series.
 - c. Ring and cover shall be attached to the diameter adjustment flat top section or cone.
 - d. Manholes which differ from the above description shall be governed by Specification Item No. 850, "Polymer Concrete Sanitary Sewer Structures."
 - e. An External drop manhole shall be provided for a sewer entering a manhole more than 30 inches above the invert, as per TCEQ Rules and Regulations Chapter 217 Design Criteria for Domestic Wastewater Systems.
8. Footings or bases of manholes shall be a minimum of 6 inches in depth below the bottom of the pipe.

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9. All invert channels shall be constructed and shaped accurately so as to be smooth, uniform and cause minimum resistance to flow.
10. The bench shall be finished smooth with a slope of ½ inch per foot from the manhole walls to the edges of the invert.
11. The top half of all sewer pipes within the invert channel or bench zone shall be removed flush to the inside manhole walls.
12. Joints on sewer pipes shall not be cast or constructed within the wall sections of manholes.
13. Concrete cradles shall be required for new pre-cast manholes.
14. Concrete cradles shall extend beyond the outside walls of the manhole a minimum of 36 inches.
15. Voids between exterior pipe walls and manhole walls at all pipe connections in manholes shall be filled with a non-shrink grout, as specified above, or as approved by the Engineer, or as shown in the contract documents and inspected prior to backfilling.
16. Where connections to existing manholes are required, the adjacent pipe bedding shall be prepared to proper grade, the existing manhole neatly cored and the new pipe inserted so that the end is projecting 2 inches from the inside wall.
17. The invert shall then be reshaped to properly channel new flows.
18. Debris of any kind shall be kept out of new or existing manholes or mains.
19. Joints between cones, risers, adjustment rings, flat tops, and between the ductile cast iron ring and the uppermost adjustment ring or flat top, as applicable, shall be thoroughly sealed in accordance with manufacturer's recommendations with adhesive bitumastic products as specified above.

Where precast concrete risers are used, any gaps in the outer joint surfaces shall be additionally coated with non-shrink grout to a minimum thickness of ¼ inch.

20. All manhole rings shall be encased with 4,000 psi reinforced concrete as shown in the contract documents or as approved by the Engineer.
 - a. Concrete manhole ring encasement shall extend 6 inches below the top of the cone and have a minimum width when measured at the manhole ring of 1 foot. The surface of the encasement shall be flush with the top of the manhole ring.
21. All new manholes shall be encased with a minimum of 12 inches thickness of flowable fill to one foot above the top of the cone section to allow for the concrete ring encasement. See DD-852 drawing series.

852.6 TESTING: The Contractor shall notify Inspector and Engineer 48 hours prior to beginning of manhole testing and only after a successful pretest has been performed.

1. The Contractor shall perform the testing for all sanitary sewer manholes in accordance with the following:
2. All manholes must pass a leakage test.
3. The Contractor shall test each manhole (after assembly and backfilling) for leakage, separate and independent of all other sanitary sewer piping, by means of either a

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hydrostatic test, vacuum test, or other methods approved by the Engineer.

4. The Contractor is hereby instructed to conduct either of the two identified tests in the following manner:
 - a. Hydrostatic testing shall be conducted by utilizing approved plugs to seal all influent and effluent pipes in the manhole and filling the manhole to the top of the cone with water.
 - (1) Additional water may be added over a 24-hour period to compensate for absorption and evaporation losses.
 - (2) At the conclusion of the 24-hour saturation period, the manhole shall be filled to the top and observed.
 - (3) Any measurable loss within a 30-minute period shall be considered an unsuccessful test and thus require the Contractor to assess the needed repairs, perform such repairs (subject to the approval of the Engineer), and notify the Inspector when the retest will be performed.
 - (4) All effort, materials, or other costs shall be solely at the Contractor's expense.
 - b. Vacuum Testing: Manholes shall be tested after construction/installation and backfilling with all connections (existing and/or proposed) in place.
 - (1) Drop-connections and gas sealing connections shall be installed prior to testing.
 - (2) The lines entering the manhole shall be temporarily plugged with the plugs braced to prevent them from being drawn into the manhole.
 - (3) The plugs shall be installed in the lines beyond drop connections, gas sealing connections, etc.
 - (4) Prior to performing the test, the Contractor shall plug all lift holes and exterior joints with a non-shrink grout and plug all pipes entering the manhole.
 - (5) Only a cementitious coating may be applied.
 - (6) Contractor shall use a minimum 60 inch-lb. torque wrench to tighten the external clamps that secure the test cover to the top of the manhole.
 - (7) The test head shall be inflated in accordance with the manufacturer's recommendations.
 - (8) A vacuum of 10 inches of mercury shall be drawn, and the vacuum pump will be turned off.
 - (9) With the valve closed, the level vacuum shall be read after the required test time.
 - (10) If the drop in the level is less than 1 inch of mercury (final vacuum greater than 9 inches of mercury), the manhole will have passed the vacuum test.
 - (11) The required test time is 2 minutes.

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- c. Acceptance: Any manhole which fails the initial test must be repaired with a non-shrink grout or other suitable material based on the material of which the manhole is constructed.
 - d. The manhole shall be retested as described above until a successful test is attained.
 - e. After a successful test, the temporary plugs will be removed.
 - f. To ensure that the plugs have been removed, Contractor shall only do so in the presence of the Inspector.
 - (1) Repairs to Existing Manholes: Any existing manhole which fails to pass the hydrostatic/vacuum test shall be closely examined by the Inspector and the Contractor to determine if the manhole can be repaired.
 - g. Thereafter, the Contractor shall either repair or remove and replace the manhole as directed.
 - h. Any manhole excavated for repairs or excavated for tie in, shall be backfilled with a minimum of 12 inches thickness of flowable fill to one foot above the top of the cone section to allow for the concrete ring encasement.
 - i. After abrading and cleaning, additional protective coating material shall be applied to the repair area.
 - j. All touch-up repair procedures shall follow the protective coating manufacturer's recommendations
5. If a sanitary manhole fails to pass one of the above tests, it shall be repaired in accordance with the manufacturer's recommendations and re-tested. Should the test fail a second time, Contractor shall perform another leak test utilizing the other testing option in this specification. Should the test fail the third time, Contractor shall remove and replace the manhole and perform all the necessary test at no additional cost to SAWS. Manholes shall not be accepted until it passes all tests.
6. Engineer of Record must witness all tests over the EARZ.

852.7 MEASUREMENT: All manholes zero feet to 6 feet deep and designated in the contract documents will be measured as the total number of such manholes constructed, including those exceeding 6 feet in depth from the lowest invert elevation to the top of the ring.

- 1. Manholes deeper than 6 feet shall be measured by the number of vertical feet in excess of 6 feet.

852.8 PAYMENT:

- 1. All manholes shall be paid at the contract unit price bid for each such manhole, which price shall be full compensation for all precast sections or throat rings, UV stabilized polyethylene liner, cones, bases, rings and covers, manhole ring, encasement, manhole rubber joint seal, flowable fill, mortar, drop pipes, saws cutting of surfaces, surface restoration, and fittings, labor, tools, equipment, testing, tees, wyes, and incidentals necessary to complete the work.

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2. Extra depth manholes shall be paid for at the contract unit price bid per vertical foot as measured above.
3. Shallow manholes shall be paid at the contract unit price.
4. Concrete cradles for pipes shall be measured and paid for at the contract unit price bid as provided for in Specification Item No. 858, "Concrete Encasement, Cradles, Saddles and Collars."
5. Gravel subgrade filler for manholes shall not be measured separately for payment.

- End of Specification-

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ITEM NO. 856

Pipe Jacking

856.1 DESCRIPTION: This item shall govern the furnishing and installation of casing and/or pipe by the method of pipe jacking. Such method to include auger boring, guided boring, pilot pipe jacking, hand mined pipe jacking, and direct pipe jacking as shown in the contract documents and in conformity with this specification. This specification does *not* cover tunneling of any kind such as would involve liner plate or any other method employing a fixed in place liner. This specification does *not* cover microtunneling. All methods not included in this specification require separate special specifications to be developed that are unique to each individual project.

856.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 856 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS)
 - a. Specification for Water and Sanitary Sewer Construction
 - b. SAWS Material Specifications
2. City of San Antonio (COSA)
 - a. Utility Excavation Criteria Manual.
 - b. Standard Specifications for Construction
3. AASHTO – American Association of State Highway and Transportation Officials
4. American Association of State Highway and Transportation Officials (AASHTO)
5. American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering
6. American Society for Testing and Materials (ASTM)
 - a. ASTM A 36 - Standard Specifications for Carbon Structural Steel
 - b. ASTM A 134 Standard Specification for Pipe, Steel, Electric-Fusion (Arc)-Welded (Sizes NPS 16 and Over)
 - c. ASTM A 283 - Standard Specifications for Low and Intermediate Tensile Strength Carbon Steel Plates.
 - d. ASTM A 307 - Standard Specifications for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
7. Occupational Safety and Health Administration (OSHA)
8. Design Guidance Document for Pipe Jacking Versus Tunneling Methods

856.3 SUBMITTALS: Contractor shall submit manufacturer's product data, instructions, recommendations, shop drawings, and certifications including, but not limited to, shop drawings identifying proposed pipe jacking method, installation of pits or shafts, installation of jacking supports/back stop, arrangement and position of jacks and pipe guides, runners, casing spacers, and grouting plan.

856.4 MATERIALS:

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1. Carrier Pipe: Carrier pipe shall be of the types and sizes shown in the contract documents and shall conform to the requirements of these specifications.
2. If PVC pipe is to be utilized as carrier pipe, installation shall conform to Item Specification No. 818, "PVC (C-900 and C-909) Pipe Installation" and shall be fully restrained in casing.
3. Sanitary sewers, materials shall conform to Specification Item No. 848, "Sanitary Sewers," or as specified in the contract documents by the Engineer, and in accordance with DD-856 of the Standard Drawing Series.
4. Casing Pipe: Casing, if required, shall be as follows for water and sewer mains:
 - a. Steel
5. Grout: Grout for annular spaces shall be sand cement slurry containing a minimum of 7 sacks of Portland Cement per cubic yard of slurry.
 - a. All slurry shall be plant batched and transit mixed.

856.5 CONSTRUCTION:

1. Pipe Jacking: Suitable pits or trenches shall be excavated for the purpose of jacking operations for placing end joints of the pipe.
 - a. When trenches are cut in the side of embankment, such work shall be securely sheeted and braced.
 - b. Jacking operations shall in no way interfere with the operation of railroads, streets, highways or other facilities and shall not weaken or damage such facilities.
 - c. The pipe to be jacked shall be set on guides to support the section of pipe being jacked and to direct it in the proper line and grade in accordance with submittal.
 - d. Embankment material shall be excavated just ahead of the pipe and material removed through the pipe, and the pipe forced through the opening thus provided.
 - e. The excavation for the underside of the pipe, for at least $\frac{1}{3}$ of the circumference of the pipe, shall conform to the contour and grade of the pipe.
 - f. A clearance of not more than 2 inches may be provided for the upper half of the pipe.
 - g. The distance that the excavation shall extend beyond the end of the pipe shall depend on the character of the material, but it shall not exceed 2 feet in any case.
 - h. The pipe shall be jacked from the downstream end.
 - i. Permissible lateral or vertical variation in the final position of the pipe from line and grade will be as shown in the contract documents or as determined by the Engineer.
 - j. Any pipe that cannot be repaired to its original condition or is damaged in jacking operations shall be removed and replaced at the Contractor's expense. Jacking pits shall be backfilled immediately upon completion of jacking operations.
 - k. Boring operations may include a pilot hole which shall be bored the entire length of crossing and shall be used as a guide for the larger hole to be bored. Water or drilling fluid may be used to lubricate cuttings.
2. Joints: Joints for pipe for Pipe Jacking shall be as specified in Specification Item No. 848, "Sanitary Sewers," Specification Item No. 857 "Fiberglass Reinforced Pipe for

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Large Diameter Gravity Sanitary Sewer,” Specification Item No. 816 “Steel Pipe Installation,” or Specification Item No. 820 “Concrete Steel Cylinder Pipe Installation” or as shown in the contract documents, shop drawings, or as per additional pipe manufacturer's recommendations.

3. Grouting of Casing and/or Direct Jack Pipe: The annular space between casing pipe or direct jack pipe and limits of excavation (borehole) shall be pressure grouted unless otherwise specified in the contract documents.
4. Grouting of Annular Space between Casing and Carrier Pipe: For sewer pipe, the annular space between casing and carrier pipe shall be pressure grouted unless otherwise specified in the contract documents.

856.6 MEASUREMENT: Pipe Jacking shall be measured by the linear foot of bore as measured from face to face of jacking pits.

1. Carrier pipe used in bores or jacked into place shall be measured by the linear foot of pipe installed from end to end of pipe to the limits shown on the plans.
2. Casings, where required by the plans, of the size and material required shall be measured by the linear foot actually installed in accordance with the plans.

856.7 PAYMENT: The work performed and materials furnished as specified herein, measured as provided above, shall be paid for at the contract unit bid price per linear foot of pipe jacking which price shall be full compensation for furnishing all materials including carrier pipe and casings (as indicated for each appropriate bid item listed below), casing spacers, grout, labor, tools, equipment and incidentals necessary to complete the work, including excavation, grouting, backfilling, restoration to original ground conditions, end caps, and disposal of surplus materials.

1. Carrier pipe shall be paid for at the contract unit price bid for "Carrier Pipe for Pipe Jacking" per linear foot of pipe installed and measured as described above.
2. Casings shall be paid for at the contract unit price bid for "Casing" per linear foot of casing installed and measured as described above.

-End of Specification-

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ITEM NO. 858

Concrete Encasement, Cradles, Saddles and Collars

858.1 DESCRIPTION: This item shall govern the placement of concrete encasements, cradles, saddles, collars on either existing or proposed water/sewer mains, when specified in the contract documents, or as directed by the Engineer or Inspector.

858.2 REFERENCE STANDARDS: Reference standards cited in this Specification Item No. 858 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City of San Antonio (COSA) Standard Specifications for Construction
3. Texas Commission of Environmental Quality (TCEQ)
 - a. Chapter 217 Design Criteria for Domestic Wastewater Systems
4. American Society for Testing and Materials (ASTM)
 - a. ASTM C 138. Standard Test Method for Unit Weight, Yield and Air Content (Gravimetric) of Concrete.
 - b. ASTM C 144. Standard Specification for Aggregate for Masonry Mortar
 - c. ASTM C 150. Standard Specification for Portland Cement.
 - d. ASTM C 494. Standard Specification for Chemical Admixture for Concrete.
 - e. ASTM C 618. Standard Specification for Coal Fly Ash and Raw or Calcinated Natural Pozzolan for use as Mineral Admixture in Portland Cement Concrete.
 - f. ASTM C 869. Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.
 - g. ASTM C 937. Standard Specification for Grout Fluidifier for Pre-placed Aggregate Concrete.
 - h. ASTM C 942. Standard Test Method for Compressive Strength of Grout for Pre-placed Aggregate Concrete into Laboratory.
 - i. ASTM C 1017. Standard Specification for Chemical Admixture for Use in Producing Flowing Concrete.

858.3 MATERIALS: All concrete shall conform to the provisions of Specification Item No. 300, "Concrete (Class B)," or as noted otherwise in the contract documents.

858.4 CONSTRUCTION:

1. Concrete Encasement: When concrete encasement is shown in the contract documents, or when directed by Engineer or Inspector, the trench shall be excavated and fine graded to a depth conforming to details and sections shown therein, or as per Standard Drawings DD-858 Series.
2. The main shall be supported by precast concrete blocks of the same strength as the concrete for encasement and securely tied down to prevent floatation.

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3. Encasement shall then be placed to a depth and width conforming to the details and sections shown in the contract documents or per the referenced standard drawings.
4. Concrete Cradles: When concrete cradles are shown in the contract documents or when called for by the Engineer or Inspector, the trench shall be prepared and the main supported in the same manner as described in this Specification, and shall be constructed in accordance with details and sections shown in the contract documents. Straps/Tie Downs shall be a minimum of No. 4 diameter rebar.
5. Concrete Saddles: When shown in the contract documents or when directed by the Engineer or Inspector, the main to receive concrete saddles shall be backfilled in accordance with Specification Item No. 804, "Excavation, Trenching and Backfill" to the spring line and concrete placed for a depth and width conforming with details and sections shown in the contract documents.
6. Concrete Collars: When shown in the contract documents or when directed by the Engineer or Inspector, concrete collars shall be constructed in accordance with details and sections shown in the contract documents.

858.5 MEASUREMENT: Concrete Encasement, Cradles, Saddles, and Collars will be measured by the cubic yard of accepted work, complete in place.

1. Reinforcing, if required by the Engineer or Inspector, shall not be measured for payment.

858.6 PAYMENT: Concrete Encasement, Cradles, Saddles and Collars will be paid for at the unit price bid per cubic yard, which price shall be full compensation for furnishing and placing all materials, rebar, manipulation, labor, tools, equipment and incidentals necessary to complete the work.

1. Payment for concrete encasement shall consist of 6 inches of concrete around the pipe where required (as per Standard Drawings DD-858 Series), minus manholes, structures, etc.
2. No additional payment will be made for over excavation whichever is greater.

-End of Specification-

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ITEM NO. 860

Vertical Stacks

860.1 DESCRIPTION: This item shall govern the construction of vertical stacks from the sewer main to the horizontal position of lateral heading towards the right of way.

860.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 860 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City Of San Antonio (COSA) Standard Specifications for Construction
3. Texas Commission of Environmental Quality (TCEQ)
 - a. Chapter 217 Design Criteria for Domestic Wastewater Systems
 - b. Chapter 213 ("Edwards Aquifer")
4. American Society for Testing and Materials (ASTM) International:
 - a. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - b. ASTM D 3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - c. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 - d. ASTM F 477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

860.3 SUBMITTALS: Contractor shall submit manufacturer's product data, instructions, and recommendations.

860.4 MATERIALS:

1. Pipe: Pipe and fittings shall conform to the requirements of Specification Item No. 848, "Sanitary Sewers," and Specification Item No. 854, "Sanitary Sewer Laterals."
2. Concrete Encasement: Concrete encasement shall conform to the requirements of Specification Item No. 858, "Concrete Encasement, Cradles, Saddles and Collars."

860.5 CONSTRUCTION: All work performed under this item shall conform to the latest applicable provisions of Specification Item No. 848, "Sanitary Sewers," and the details shown in the contract documents. Generally, vertical stacks for sewer laterals shall be installed where the depth of the main (measured from the top of the sewer main to the finished grade) is eight feet or greater, or where specified by the Inspector, or Contract Documents.

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860.6 MEASUREMENT: Vertical stacks shall be measured by the vertical foot. Footage shall be computed as follows: Dimension from the top of the lateral (where it appears in the trench wall), to the top of the sewer main.

860.7 PAYMENT: Vertical stacks shall be paid for at the contract unit price bid per vertical foot as measured above, which price shall be full compensation for furnishing all pipe, pipe fitting, joint materials, restoration, concrete encasement, materials, tools, equipment, labor and incidentals necessary to complete the work. No separate pay shall be made for wyes, tees, or bends.

1. Materials paid on site will be in accordance with Table 1 of Specification Item No. 100 "Mobilization."

End of Specification

ITEM NO. 865

**Bypass Pumping
Small Diameter Sanitary Sewer Mains**

865.1 DESCRIPTION: The work covered by this item consists of bypass pumping operations for existing sanitary sewers less than 24-inches in diameter in order to temporarily reroute sanitary sewer flows to prevent a sanitary sewage overflow (SSO) and to provide adequate and reliable sanitary sewer flow at all times during construction, while the tasked scope of work is executed.

1. The work also covered in this item is for the use of inflatable and mechanical pipe plugs.
2. The use of inflatable/mechanical plugs in the water and sewer industry is the standard method to temporarily plug a pipe where permanent flow control devices are not available or are not operating as designed.
3. An inherent danger exists with all inflatable products.
4. If any conditions with this equipment exist that may jeopardize the safety of workers or others, do not use it.
5. This item includes all requirements for implementing a temporary pumping system for the purpose of diverting sanitary sewage flow around any construction-related activity to an approved reintroduction point within the sanitary sewer system.
6. The Contractor shall minimize the health, safety, and regulatory risks by taking all reasonable measures to avoid an SSO.
7. All bypass systems shall comply with all the requirements of this section unless specifically noted otherwise.
8. The Contractor shall be responsible for the design of the bypass pumping plan and system. Contractor's bypass pumping system design shall be developed based upon the requirements of the Contract Documents.
9. Contractor's bypass pumping system design shall be developed based upon full pipe flow using a Manning Roughness coefficient of 0.013.
10. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction
11. Pump and haul bypass systems shall not be allowed within the Edwards Aquifer Recharge Zone (EARZ) or for larger sanitary sewers with significant sewage bypass flows.
12. Contractor shall provide for temporary measures to convey sewage flows and avoid sewage spills should a storm event occur that generates sanitary sewer flows in excess of Contractor's bypass pumping system.

865.2 REFERENCE STANDARDS: Reference standards cited in this Specification Item No. 865 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction (2014)
 - b. SAWS Materials Specifications

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2. City Of San Antonio (COSA) Standard Specifications for Construction
3. Texas Commission of Environmental Quality
 - a. TCEQ under 30 TAC Chapter 312, Subchapter G
 - b. Edwards Aquifer Recharge Zone (30 TCEQ § 213).
4. American Concrete Pipe Association
 - a. Concrete Pipe Design Manual

865.3 SUBMITTALS:

1. All submittals shall be in accordance with Engineer's requirements. All submittals shall be approved by the Engineer prior to delivery of materials and commencing any portion of the proposed scope of work.
2. For all projects requiring bypass pumping, the Contractor shall prepare and submit a Bypass Pumping Plan (BPP).
 - a. The BPP shall be submitted a minimum of (2) two weeks prior to commencing any portion of the proposed scope of work and shall be approved by the Engineer prior to beginning Work.
 - b. The BPP shall be signed and sealed by a professional engineer licensed in the State of Texas (Contractor's Engineer).
3. Contractor shall submit manufacturer's product data, instructions, recommendations, shop drawings, and necessary certifications in order for the proposed BPP to be reviewed and approved.
4. The following shall be submitted as part of the BPP:
 - a. A cover letter containing the following information;
 - i. The project name and job number.
 - ii. The name and address of the Contractor.
 - iii. Contact information of the Contractor's project manager, superintendent, foreman/supervisor, safety professional, etc.
 - iv. Resumes for qualified pump personnel and supervisors
 - v. A description and location of the planned bypass pumping work to be performed; include data for stationary and pump and haul bypass systems as applicable.
 - b. Emergency (24 hrs/day, 7 days/week) contact information for the bypass pumping subcontractor, if applicable. Make sure to include the name, cell phone number, and title of the person(s) onsite responsible for the bypass pumping operation.
 - c. The name, phone number, title, signature, and PE seal of the Contractor's Engineer preparing the BPP.
 - d. Copies of permits or other documents showing the Contractor has obtained all clearances necessary for installation and operation of the BPP.
 - e. If Contractor elects to use a combination of stationary bypass pumping and pump and haul for his bypass system, Contractor's BPP shall identify the quantity of flows that will be pumped and pumped and hauled for each type of bypass system along with the points where flows will be removed and reintroduced into the sanitary sewer system.

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- f. Certificate of Compliance that the BPP complies with all SAWS and regulatory requirements and that all components have been designed by a professional engineer licensed in the State of Texas.
- g. The Contractor's Engineer shall review all components of the submitted BPP for adequacy to the Contractor's selected design flow conditions and insure that all bypass pumping system components are of adequate size, strength, meet the reliability criteria specified herein.
- h. A description of the maximum amount of sanitary sewer flows to be bypassed by the Contractor's bypass pumping system and how the flow conditions will be monitored during system operations (including all flow measurement devices, calculations, equipment, or other sources of how data was obtained).
- i. Descriptions of all proposed bypass pumping components to be used.
- j. If applicable, describe all different bypass pumping phases.
 - i. Include bypass pump(s) size(s) and capacity, as well as the size(s) and capacity of the suction/discharge piping.
 - ii. The description shall also include manhole(s)/structure(s) depth(s) and size(s) that will be used during the bypass pumping operation, sanitary sewer plugging method and type of plugs to be used, flowmeter installation locations, etc.
- k. All plugs are required, submit a Plug Use Plan (PUP) according to the requirements of this specification.
 - i. Contractor shall provide SAWS with adequate prior notification to allow SAWS to witness installation and removal of all plugs.
 - ii. Description of procedure for locating and recovering any lost plug.
- l. Description of minimum equipment on hand should an emergency plan be implemented, i.e. spare pump, emergency generator.
- m. The date and time the bypass pumping is expected to begin and be completed. Indicate if bypass pumping will take place outside normal work hours which are between 8 am to 5 pm Mondays through Fridays (except for SAWS observed holidays).
- n. The pump curves, showing operating range. This shall include the proposed system curve, addressing the pump operation in relation to the suction/discharge piping's alignment with respect to restriction and/or elevations.
- o. Suction and discharge piping material(s) and capacity to be used for the bypass pumping operation, including the material(s) for any bend(s) and/or valve(s) that will be used.
- p. Sound attenuated pumps are required at all sites.
- q. A sketch showing the location of the pump(s) and the route of the suction, discharge, and diversion piping.
- r. If Contractor elects to use locations outside of the easements obtained by SAWS or locations that are not indicated for use on the BPP plan sheet, Contractor shall be solely responsible for obtaining the required easements and written documentation required for use of these locations, a copy shall be provided to SAWS prior to Contractor's use.

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- s. A sketch detailing proposed restoration of the suction and discharge points if the Contractor proposed to make openings in the existing pipes or structures.
 - i. If different than shown in contract documents, the new sketch shall be dimensioned and all-inclusive showing all SAWS manhole numbers that will be used for suction and discharge operations.
 - ii. If any other structure will be used for suction and/or discharge operations, then the nearest manhole(s) shall be labeled.
 - iii. The sketch shall include the name of any streets and/or major intersection in the area. All features possibly affected by the alignment of the BPP's components (driveways, vehicular traffic, residential or commercial dwellings (due to noise)) shall likewise be addressed.
- t. For pump and haul systems the sketch shall show the location of all system components along with the staging areas, haul routes, and an explanation of the expected cycle time of all aspects of the operation.
- u. Clear photographs of the manhole(s) interior that will be used for the bypass pumping operation, including pole camera photographs of pipes where plugs will be installed.
 - i. All photographs will be labeled with the manhole number, date, and intended use of the manhole by the Contractor's BPP.
- v. A Traffic Control Plan that pertains solely to the bypass pumping operations. This may differ than the project's traffic control plan for the overall scope of work.
 - i. The Traffic Control Plan shall include all required permits including street cut permits.
- w. Contractor shall maintain pedestrian and vehicular traffic and comply with ADA regulations for access to all residential and commercial property unless written approval is otherwise obtained from the property owner allowing for reduced access.
- x. An Emergency Plan detailing procedures to be followed in the event any portion of the bypass operation fails and causes either surcharging or an actual SSO. A sanitary sewer surcharge is herein defined as any flows entering the manhole or structure (above the crown of the pipe). Contractor is herein advised that:
 - i. The existing sanitary sewer system may surcharge during certain storm events. The Contractor's BPP must recognize this potential and accommodate it with sufficient bypass capacity, restoration of flow through the sanitary sewer system, or other measures acceptable to SAWS during these flow events. These measures shall be included in the submitted BPP.
 - ii. The Contractor's BPP cannot cause any surcharging that results in damage or SSOs.
 - iii. Any damage or SSOs during bypass pumping operations resulting from Contractor's bypass system shall be deemed a failure of BPP, and the Contractor must re-propose an improvement to their BPP for review and approved. Contractor shall be fully responsible for all

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- damages and costs related to the installation, operation, and maintenance of Contractor's bypass pumping operations including damages, clean up, fines, penalties, and other related costs.
- iv. Contractor to include minimum equipment on hand for implementing and emergency plan. (i.e. spare pump, emergency power source.)
 - y. Where bypass piping is installed within the floodplain of waterways subject to flooding, the Contractor shall submit an anchorage plan and calculations to ensure that piping is properly anchored.
 - z. The pipe shall be capable of remaining in place during a 100-year storm event.
 - aa. Anchorage plan and calculations shall be designed and sealed by a professional engineer licensed in the State of Texas (Contractor's Engineer). This shall be the same PE that sealed the BPP Certificate of Compliance.
 - bb. For pump and haul system, submit copy of Hauler's Transporter Registration as issued by TCEQ under 30 TAC Chapter 312, Subchapter G.
 - cc. For pump and haul system, submit information on licensed disposal site to be used by the Contractor
 - dd. Submit the checklist found at the end of this document confirming that all items required by this section are included in the BPP submittal.
 - ee. For all projects requiring the use of pipe plugs on pipes the Contractor shall furnish a submittal containing manufacturer's product data, instructions, recommendations and a project PUP. The PUP shall be submitted and approved by the SAWS engineer a minimum of (2) two weeks prior to commencing any portion of the proposed scope of work.

The following shall be submitted with the PUP:

- i. A cover letter containing the following information;
 - a) The project name and job number;
 - b) The name and address of the Contractor
 - c) Contact information of the Contractor's project manager, superintendent, foreman/supervisor, safety professional, etc.
 - d) Emergency (24 hrs/day, 7 days/week) contact information for the staff responsible for operating and maintaining the plug. Include the name, phone number, email address and the person(s) onsite who is responsible for the project.
 - e) The name and contact information for the PUP preparer.
- ii. Plug Plan
 - a) The plan shall show where on the project site the Contractor intends to use pipe plugs, including:
 - b) manhole numbers;
 - c) the upstream and downstream pipe diameters and pipe materials;
 - d) pipe slopes;
 - e) pipe depth;
 - f) pipe flow direction;
 - g) known peak or surcharge flow data;
 - h) types of plugs to be used;

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- i) types of restraint used;
 - j) type of radio transmitting device.
 - k) flow monitoring system plan
 - l) airline regulator and gauge location
- iii. Calculations
 - a) Provide calculations of the maximum anticipated head pressure on the plug and the resultant tensile force required to restrain the plug prior to plug inflation and during plug removal.
 - b) Provide calculations of the required inflation pressure of the plug.
 - c) Calculations shall be sealed and signed by a professional engineer licensed in the state of Texas in civil or mechanical engineering, representing plug manufacturer.
- iv. Plug selection
 - a) Detail the plug selection for each installation including given conditions, pipe size and anticipated pressure requirements. Include in plan sleeves that will be used.
- v. Plug inspection:
 - a) Provide a manufacturer's inspection form detailing recommendations for plug inspection of plug condition before and after use; form to be signed by Contractor staff responsible for plug installation prior to and after plug installation.
- vi. Monitoring plan
 - a) Provide a monitoring plan for observing the plug inflation pressure gauge and hoses. Monitoring shall be for 24-hours per day during the plug use duration.
 - b) Provide a written response plan for when the plug loses pressure.
 - c) Provide a plug retrieval plan.
- vii. Plug restraint details
 - a) Provide means and methods for anchoring, support, and bracing appropriate for anticipated operating pressure conditions
 - b) Size restraint (cable or chain) based on calculated loads using a safety factor of 4.
 - c) Eye bolts to be $\frac{3}{4}$ inch min galvanized steel.
 - d) Provide multiple tie-off locations for chain or wire cable restraint, greater than or equal to calculated loads using a safety factor of 4 or greater. Tie off locations cannot be located on private property.
 - e) Rope of any kind is not an acceptable material for plug restraint.
 - f) Manufacturer's Literature
- ff. Provide manufacturer's literature on proper plug use and safety precautions, including available on-line training.

865.4 EQUIPMENT AND MATERIALS: The Contractor shall provide all necessary pumping equipment, piping and all other necessary appurtenances in order to maintain a reliable sanitary sewer flow in the sanitary sewer system (including any temporary manholes) at all

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times during construction for stationary pumping and pump and haul bypass pumping systems. For 8" and 12" sanitary sewer mains which flow level is less than one half of the pipe diameter a float monitoring system or radio transmitter will not be required. All materials, equipment, etc., must be in good condition, and shall not have visible damage such as cracks, holes, foreign material, blisters, etc.

1. Plugs: Plugs must be selected and installed according to the size of the line to be plugged.
 - a. Plugs shall be secured and anchored to prevent plug movement or escape into the adjoining sanitary sewers should the plug fail.
 - b. All plugs shall be equipped with a radio transmitter that will be used to locate any plug that has escaped in the adjacent system.
 - c. The radio transmitter shall be designed for environment that it will be installed.
 - d. The Contractor shall also provide and keep on site the matching radio receiver that will be used to locate any plug that is lost in the adjacent system.
 - e. Plugs will be in good condition and reviewed by the Contractor for defects that might lead to failure prior to being installed.
 - f. The Contractor shall provide and sign a Plug Inspection form verifying plugs have been inspected.
 - g. All plugs shall include a non-corrosive/non-plastic name plate permanently anchored to both ends of the plug.
 - h. Name plate shall include SAWS Job No. permanently stamped, engraved or welded on the name plate with a minimum of 1 inch tall legible lettering.
 - i. Airline regulator and gauge shall be located outside excavation and shall be secured and anchored. Location shall be shown on the PUP.
 - j. An additional plug (for each size of plug used) must be onsite and ready to be installed in the event a plug fails or becomes dislodged. Plug(s) will be reviewed by the Inspector and/or Engineer for defects that might lead to failure prior to being installed.
 - k. Contractor shall immediately locate and remove any plug that has shifted its position, slipped within the pipe, dislodged, moved, or otherwise provided an indication that its suitability for use in plugging may be suspect or compromised.
 - l. Contractor shall immediately notify SAWS of any plug that has provided an indication that its suitability for use in plugging may be suspect or compromised and allow SAWS to observe plug removal and replacement.
 - m. It is also imperative that the Contractor notify the Inspector at the completion of the work. In order to verify that all plugs have been removed from the system, Contractor shall only do so in the presence of the Inspector.
 - n. The Contractor shall provide all necessary equipment, plugs, hoses, gauges and necessary appurtenances to install the plug, maintain the plug during use and remove the plug at completion.
 - o. All plugs must be in good condition, and shall not have visible damage such as cracks, holes, tears, cuts, punctures, abrasions, loose or damaged

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- p. fittings, cracks in castings and excessive wear.
 - q. All plugs 24-inches and larger shall have an air release valve for rupture protection.
 - r. All plugs shall be equipped with a radio transmitter locating device that is activated by the plug losing air pressure. The locating transmitter device shall be effective to a depth of 65 feet, and have a battery life of 1,000 hours when operated in pulse mode after activation.
 - s. All plugs shall have a protective sleeve.
 - t. If the plug is damaged, do not use the plug and remove it from the job site.
 - t. Contractor must be aware of the limitations associated with plugs..
- 2. Stationary Bypass Pumping Systems
 - a. High-Density Polyethylene (HDPE) is the preferred pipe material for all bypass piping.
 - b. HDPE shall be used when bypass discharge pipe will be going through streams, storm water culverts, the Edward's Aquifer Recharge Zone, and/or environmentally sensitive areas.
 - c. At other locations, not within the Edward's Aquifer Recharge Zone, flexible discharge hose that is in good condition and does not leak, may be allowed subject to it acceptably passing testing.
 - d. HDPE pipe must be assembled and joined using fused couplings, fused flanges or fusion welding in order to avoid joint leakage. SAWS shall be notified in sufficient time to allow them to inspect the pipe joints during assembly. SAWS shall be notified a minimum of 48 hours in advance of all fusing/joining operations.
 - e. HDPE fusion welding must be performed by personnel certified as fusion technician(s) by the manufacturer of HDPE pipe and/or fusing equipment. SAWS shall examine welds prior to use in BPP operation.
 - f. BPP shall indicate the proposed DR of the pipe to be used.
 - g. Rigid suction hose that is in good condition and does not leak may be allowed for withdrawal of flows from the suction point into the bypass pumps.
 - h. Pipe material other than HDPE shall be submitted to the Engineer for approval. Neither "Irrigation type" pipe nor glued PVC pipe will be permitted.
 - i. Any hoses or pipes that leak shall be removed and replaced with non-leaking hoses or pipes.
 - j. Pumps must be fully automatic self-priming units that do not require the use of foot valves or vacuum pumps to prime the system.
 - k. No electric pumps will be allowed; all pumps must be diesel powered. Contractor shall provide suitable spill control and containment measures to avoid environmental contamination by pumps, fuels, or lubricants.
 - l. All pumps shall be open impeller solids handling type pumps, capable of passing a minimum of 3-inch diameter solids.

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- m. Contractor shall have one backup pump, equal in capacity to the largest pump in the system, connected into the bypass pumping system, and ready for operation in case any of the primary pumps fail.
 - n. The backup pump shall not be used in Contractor's calculations for determining the pumping capacity requirements for the stated flow conditions above.
 - o. Sound-attenuated pump enclosures shall be required on all projects where the bypass pumps are required.
 - p. Contractor shall provide sufficient sound attention measures to comply with City of San Antonio noise limitation requirements.
3. Pump and Haul Bypass Pumping Systems
- a. Pump and haul bypass pumping systems shall use good-quality vacuum trucks, equipment, and materials from manufacturers commonly engaged in the manufacture, service, and repair of these types of sanitary sewer service trucks and equipment.
 - b. All equipment shall be designed and manufactured for sanitary sewer service, shall function acceptably, be reliable, and free from leaks or other deleterious environmental impacts.
 - c. All equipment proposed for use in pump and haul bypass pumping shall have been maintained per the manufacture's recommendations.
 - d. Equipment service records shall be made available at SAWS request.
 - e. Any hoses or pipes that leak shall be removed and replaced with non-leaking hoses or pipes.

865.5 CONSTRUCTION: During construction, it will be the Contractor's responsibility to maintain a safe and secure environment at all times.

- 1. All provisions and/or requirements of the BPP must be followed throughout the course of any bypass flow operations.
- 2. Contractor must notify the SAWS' Inspections Department 72 hours prior to commencing the bypass pumping operations.
- 3. SAWS requires the Contractor to manage the flow of wastewater in a planned and proactive manner.
- 4. Contractor shall be fully responsible for all damages and costs related to the installation, modification of existing manholes/structures, operation, and maintenance of Contractor's bypass pumping operations including damages, clean up, fines, penalties, and other related costs.
- 5. Bypass pumping systems shall be stationary systems consisting of portable pumps, piping, and appurtenances unless a "pump and haul" bypass system is accepted by SAWS.
- 6. Pump and haul bypass systems can use a relay system of vacuum trucks using a pump and haul approach to bypass sewage flows.
- 7. Where pump and haul bypass systems are allowed the Contractor may elect to submit using a pump and haul bypass system for these locations or to use a stationary bypass system.

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8. The Contractor shall have full time (24-hour), onsite qualified pump personnel including supervision for monitoring the entire bypass installation while it is in operation.
9. The entire length of bypass piping shall be walked and inspected hourly to monitor for leaks.
10. High-level alarm notification to cell phones shall not eliminate this requirement.
11. Where bypass pumping systems exceed 1,500 feet in length or cannot be completely observed from the bypass pump location, at least one attendant shall be assigned to the pump operation, and one additional attendant shall be assigned to walk and monitor the pipeline.
12. Prior to installing any plugs, the Contractor and SAWS shall inspect the existing pipe using a pole camera, for imperfections that might cause damage to the plug, cause the plug to not seal or function properly, or compromise the integrity of the pipe when the plug is inflated.
13. If debris is present in the existing line to be plugged, it shall be removed prior to plug installation.
14. The results of this inspection shall directly impact the planned plugging location(s). Contractor shall allow the Engineer an opportunity to confirm that the location of plug(s) is acceptable.
15. The Contractor shall monitor on daily basis the radio transmitter battery and radio signal strengths. If either are found to be below the manufacturer's requirements the radio transmitter shall be immediately replaced.
16. Lines inserted into any manholes or structures shall be constructed with elbows, or be otherwise angled, to direct discharge along the most efficient path for entry into the downstream line without causing unnecessary turbulence of flow.
17. The termination point of the discharge piping shall extend to the crown of the pipe housed within the manhole or structure receiving the bypassed flows.
18. Contractor shall provide continuous supply on-site fuel storage sufficient for 24-hour operation of the bypass pumping installation.
19. Contractor shall protect all components of the bypass operations from vandalism and vehicular damage by making the site secure.
20. Contractor shall minimize sanitary sewer odors by using lids, shroud covers, or any method accepted by the Inspector or Engineer.
21. Contractor shall be solely responsible for any and all damages to private and/or public property caused by, or during, the installation, operation, and/or removal of the bypass pumping system. Contractor shall be fully responsible for all damages and costs related to the installation, operation, and maintenance of Contractor's bypass pumping operations including damages, clean up, fines, penalties, and other related costs.
22. Once all work is completed and the bypass pumping operation is no longer required, the Contractor must disinfect and drain the entire BPP system in accordance with approved submittal. All excavations for bypassing operations shall be backfilled, compacted and pavement restored as directed by the Engineer.

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23. SAWS will not be responsible for additional traffic control measures that might be required by CoSA, Bexar County, TxDOT, or any other public entity having jurisdiction of the project location.
24. Flow Tracking
 - a. Contractor shall continuously track all flows being bypassed. Flow monitoring data shall be provided to SAWS Inspector on a daily basis.
25. Plug Installation
 - a. Safety
 - i. The Contractor shall be solely responsible for the safe and effective use of plugs, including the proper combination of inflatable/mechanical plugs to block the sewer flow at both the upstream and downstream ends of a sewer bypass.
 - ii. Inflatable plugs should be used only after receiving training as recommended by the manufacturer.
 - iii. An inherent danger exists with all inflatable products. If any conditions with this equipment exist that may jeopardize the safety of workers or others, corrective actions should be taken prior to the equipment use.
 - b. Plugs
 - i. Plugs must be selected and installed in accordance with the manufacturers recommendations.
 - ii. Plugs shall be tested prior to use. See Plug testing of this Specification.
 - iii. Plugs must be selected and installed according to the size of the line to be plugged.
 - iv. Spare plugs – Provide spare plugs on-site ready to be installed in the event a plug fails or becomes dislodged.
 - v. Plugs must be removed from the system upon completion of the work. In order to verify that all plugs have been removed from the system, Contractor shall only do so in the presence of the Inspector.
 - vi. Damages – The Contractor will be responsible for damages due to plugs being left in place or dislodged, including but not limited to:
 1. Damages to SAWS infrastructure or private property.
 2. Costs associated with sanitary sewer overflows including: regulatory fines; sewage and debris cleanup; debris disposal at an appropriate landfill; disinfection of all surfaces which have come in contact with the sewage.
 3. All costs associated with locating and retrieving lost or dislodged plugs.
 4. A lost plug shall require Contractor to pay a minimum of a \$25,000 fine for each plug lost. These costs will not be considered for any additional payment.
 5. If the plug is damaged, it shall be immediately removed from the job-site.

865.6 TESTING AND QUALITY CONTROL: Testing and quality control will be required for stationary bypass pumping and pump and haul bypass systems as indicated below. For 8" and 12" sanitary sewer mains which flow level is less than one half of the pipe diameter a 24 hour by pass test will not be required. A one to two hour test will be required at the discretion of the inspector.

1. Contractor shall obtain and keep copies of all required permits on site prior to beginning Testing and throughout performance of the Work.
2. Contractor must prove to the Owner that the equipment, materials and all operational aspects and/or appurtenances related to the BPP are in good condition prior to commencing the bypass pumping operation.
3. Failure to do so will result in the Contractor not being permitted to continue with any construction work requiring bypass pumping operations.
4. Contractor must notify the SAWS' Inspections Department 48 hours prior to commencing any testing.
5. Any flows surcharging the sanitary sewer system during the test and/or during actual bypass periods will deem the BPP to be unacceptable and must be revised and resubmitted for approval.
6. There will be no separate pay item if this condition occurs during the timeframe in which bypass pumping test and/or operations are underway during the project. **No testing of the bypass pumping operation shall be conducted between Thursday and Sunday, unless approved by SAWS Inspections Management.**
7. If bypass pumping will take place outside normal work hours which are between 8 am to 5 pm Mondays through Fridays (except for SAWS observed holidays), Contractor shall reimburse SAWS for the overtime costs required by his bypass pumping testing outside of SAWS normal work hours.
8. Stationary Bypass Pumping Systems
 - a. Discharge piping, joints and all accessories will be required to be hydrostatic tested.
 - b. SAWS Inspector must be notified 48 hours prior to any test commencing.
 - c. All piping, joints, and accessories shall be able to withstand at least twice the maximum system pressure or a minimum of 50 psi, whichever is greater. For any bypass operations proposed a test run of at least (2) two hours must be satisfactorily performed, prior to commencing any construction work.
 - d. The SAWS Inspector must acknowledge the start of the (2) two hour test.
 - e. Without the Inspectors' recognition that the (2) two our test has been initiated, the test will be deemed invalid.
 - f. Contractor shall provide both a strobe light type high level alarm, as well as alarm notification to their cell phones, as well as other appointed personnel to be identified by SAWS, and insure adequate alarm notification is attained prior to actual startup of the test period.
 - g. During the testing period, the Contractor shall install a Float Monitoring System in the upstream manhole from the suction location and/or pipe to

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confirm that the bypass pumping flow data shown in their BPP remains applicable.

- h. The float monitoring system shall remain in the manhole and/or pipe for the duration of the bypass operation.
 - i. The data collected during the test and duration of the bypass operation shall be provided to the SAWS Inspector for evaluation and recording on a daily basis and at the Inspector's request.
 - j. It will be required of the Contractor to have personnel remain onsite at the flow monitoring system in order to continuously record (every 30 minutes) the flows during both the test and actual bypass pumping periods.
 - k. Contractor shall submit a copy of Testing Float Monitoring System Data log to SAWS upon successful completion of test within 3 business days to SAWS, failure to do so may result in the test being deemed invalid.
 - l. Data log shall be in column format with each line entry indicating the time, elapsed time of test, level of flow indicated in manholes, total flow being pumped by the BPP system, and any comments pertaining to the test.
 - m. Any failure of equipment, or activities associated with the bypass pumping operations contributing to either a surcharge or SSO, shall be deemed a failed test.
 - n. The test shall then be stopped and any necessary cleanup or reporting efforts performed.
 - o. The BPP will need to be revised, resubmitted and approved prior to the test initiating again. The SAWS inspector will need to be notified 48 hours prior to any and all re-tests of the bypass pumping operations.
 - p. Any effort by SAWS or other third parties to mitigate damages resulting from any surcharging or SSOs shall be the direct and sole responsibility of the Contractor. This includes any related fines, penalties, or damages to public or private property
 - q. Plug Testing
 - i. Plugs shall be tested prior to use. The inflatable plug shall be placed inside of a structurally sound pipe or conduit and inflated to its operating pressure and monitored for 24 hours to observe it holds the required pressure. This testing shall be performed in accordance with the manufacturer's recommendations. Inflating a plug when it is not constrained or overinflating the plug creates a risk of being injured by pieces of the plug exploding if it fails.
9. Pump and Haul Bypass Pumping Systems
- a. Contractor shall perform a full scale demonstration test of his proposed pump and haul bypass system to prove that his system can be successfully used for bypass pumping at the proposed locations.
 - b. Contractor's test shall use all of the equipment and staff that will operate the bypass pumping system during performance of the Work.
 - c. Traffic control systems required during the Work shall be utilized during the test.

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- d. Withdrawals and discharges of flow shall be from or into the manhole locations identified in the Contractor's BPP except for pump and haul system.
- e. This requirement is intended to demonstrate to SAWS that the Contractor's proposed BPP is capable of providing satisfactory bypass pumping prior to Contractor beginning the Work, including the size and number of trucks and cycles times.
- f. Pump and haul system flow shall be disposed of in a TCEQ licensed facility and all manifests shall be kept and submitted to SAWS.
- g. Disposal pump and haul flow in a nearby manhole is not acceptable.
- h. NOT ALLOWED OVER THE EARZ

865.7 MEASUREMENT:

- 1. Measurement for the work specified herein will be by lump sum and shall include pumps, pipe, plugs, transmitters and any other items required for successful bypass pumping.

865.8 PAYMENT:

- 1. Payment of the "Lump Sum" bid for Bypass Pumping shall be in accordance with the following:
 - a. Any effort required for multiple set-ups and operations shall be included in the lump sum price.
 - b. When initial set-up and operation of the bypass pumping system begins (including a successful test), 20% of the "Lump Sum" cost will be paid as applicable to the bypass system used; stationary bypass pumping or pump and haul bypass systems.
 - c. 60% of the "Lump Sum" cost will be paid over equal monthly payments (estimated from the BPP or other documentation approved by the Inspector) during the course of the bypass pumping operation as applicable to the bypass system used; stationary bypass pumping or pump and haul bypass systems.
 - d. 20% of the remaining "Lump Sum" cost will be paid upon an acceptable removal and/or disassembly of all components of the BPP, including site cleanup as applicable to the bypass system used; stationary bypass pumping or pump and haul bypass systems.
 - e. For multi-bypass pumping setups, payment will be proportional to the overall amount of the established bid line item.
 - f. Any damages, repairs, etc., to private or public property will not be considered for any additional payment.

-End of Specification-

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ITEM 866

Sanitary Sewer Main Television Inspection

866.1 DESCRIPTION: The Contractor shall furnish all labor, materials, equipment, and incidentals to provide the televising and a NASSCO-(PACP) compliant standard video, recorded in MPEG-4 (MP4) format. In accordance with NASSCO PACP requirements, all inspections shall be conducted by a NASSCO certified CCTV operator and shall include respective certification number on each video and a NASSCO PACP database shall be submitted and uploaded onto SAWS Contract and Project Management System (CPMS) or SAWS most current program management system. All digital video files shall be color, closed-circuit TV in MPEG-4 (MP4) format. The video shall include an inclinometer, visible on the video being viewed, noting the slope of the main being televised. The Contractor shall provide inclination reports detailing the inclinometer data found in the main being televised. The Contractor shall provide all inspection data of mains and manholes written to a single storage device. The video Contractor maybe required to televise both pre and post project.

866.2 REFERENCED STANDARDS: Reference standards cited in the Specification Item No. 866 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. COSA – City of San Antonio:
 - a. Utility Excavation Criteria Manual.
 - b. City of San Antonio (COSA) Specifications for Construction
3. Texas Commission of Environmental Quality (TCEQ)
 - a. Chapter 217 Design Criteria for Domestic Wastewater Systems
 - b. Chapter 213 (“Edwards Aquifer Recharge Zone”)
4. National Association of Sewer Service Companies
 - a. Pipe Condition Assessment Using CCTV Performance Specification Guideline

866.3 SUBMITTALS: All submittals shall be in accordance with most recent version of SAWS’s General Conditions requirements. Submit the following prior to performing any work.

1. Certifications: Per General Conditions section 5.12.2 all Contractor submittals for all pipe and other products or materials furnished under this specification shall be marked as reviewed and approved by Contractor for compliance with Contract Documents and the referenced standards
2. Contractor is to coordinate the video procedures with the Inspector prior to commencement of any work, including mobilization and preparation of right-of-way effort.
3. The Contractor is to provide the televising and a NASSCO-(PACP) compliant standard video, recorded in MPEG-4 (MP4) format.
4. All inspections shall be conducted by a NASSCO certified CCTV operator and

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shall include respective certification number on each video in accordance with NASSCO PACP requirements.

5. Video shall be submitted and uploaded onto SAWS CPMS or SAWS most current program management system. Video must include all the televised segments for the entire project, or for each worksite.
6. Log of the televised system for review shall be uploaded for review and approval by the Engineer.
7. Contractor to provide a post construction video upon request.
8. Contractor is to coordinate the video procedures with the Inspector at completion of project, prior to close out.
9. The Contractor shall provide a line diagram area sketch and written log for each completed segment of videoed sewer main describing the section being televised, flow and camera direction, position of service connections, description and location of failures, pipe condition, weather conditions, and other significant observations.
10. Video shall include an inclinometer, visible on the video being viewed, noting the slope of the main being televised.
11. The Contractor shall provide a graphed report of the inclinometer data gathered for each completed segment of videoed sewer main.

866.4 EXECUTION: Before construction of the sanitary sewer main, the main shall be televised to locate laterals, observe existing conditions and immediately upon cleaning or clearing existing main. After completion of the work specified in the contract documents, and prior to placement of the final course of asphalt or other final surface, the newly constructed or rehabilitated sanitary sewer main shall be televised immediately upon cleaning.

1. Equipment:
 - a. The television unit shall have the capability of displaying in color, on the video, pipe inspection observations such as pipe defects, sags, and points of root intrusion, offset joints, service connection locations, and any other relevant physical attributes.
 - i. Each video shall be permanently labeled with the following:
 - ii. Project name / SAWS Job # / Work Order #;
 - iii. Date of television inspection;
 - iv. Station to station location and size of sanitary sewer;
 - v. Street/easement location;
 - vi. Name of Contractor;
 - vii. Date video submitted;
 - viii. Video number;
 - ix. SAWS Inspector Name.
 - b. The television inspection equipment shall have an accurate footage counter which displays on the monitor the exact distance of the camera from the center of the starting manhole.
 - c. A camera with rotating and panning lens capabilities is required.
 - d. The camera height shall be centered in the conduit being televised.
 - e. The speed of the camera through the conduit shall not exceed 40 feet per

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- minute.
- f. The produced video shall also have an inclinometer that displays the slope of the sewer main being televised.
- g. The Contractor shall be required to have all materials, equipment, and labor force necessary to complete all videotaping on the job site prior to isolating the sewer manhole segment and beginning videotaping operations.
- 2. Televising shall be observed by the Inspector or Engineer and Contractor, as the camera is run through the system.
- 3. Any abnormalities such as, but not limited to, misaligned joints, cracked/defected pipe, rolled gaskets, shall be repaired by the Contractor solely at his expense.
- 4. Sections requiring repair shall be re-televised from manhole to manhole to verify condition of repair.
- 5. If the Contractor provides a video of such poor quality that it cannot be properly evaluated, the Contractor shall re-televising as necessary and provide a video of good quality at no additional cost to SAWS.
- 6. If the Contractor cannot provide a video of such good quality that can be reviewed by SAWS, SAWS may elect to televise the line at the Contractor's expense.
- 7. Television inspection shall be done one section between two manholes at a time.
- 8. Flow in the section being televised shall be bypassed if the line is in service and the flow exceeds 25% of the internal pipe diameter.
- 9. When the depth of flow at the upstream manhole of the manhole section being worked is above the maximum allowable for television inspection, the flow can be reduced to allowable levels by performing bypass pumping, as approved by the Inspector.
- 10. The Contractor shall not be allowed to float the camera.
- 11. There may be occasions during the televised inspection of a manhole section when the camera will be unable to pass an obstruction.
 - a. At that time, and prior to proceeding, the Contractor shall contact the Inspector.
 - b. If the length of sewer main cannot be televised because of obstructions, the Contractor shall clean the system as is necessary.
 - c. If, in the opinion of the Inspector, the obstruction is attributed to a collapsed main or pipe deflection, televising shall be suspended, payment shall be made based on the actual televised length, and the remaining televising of the sewer line shall be continued upon successful correction of the blockage by the Contractor at his expense.
 - d. No additional payment shall be made for additional setups required due to obstructions encountered during televising.
- 12. No lateral connections shall be made to the sanitary sewer main at the "12 o'clock" position.
- 13. All lateral connections shall clearly indicate which side of the sanitary sewer main it was installed from.
- 14. The Contractor is solely responsible for any damage of sewer mains as a direct result of televising operations.
- 15. Any repair shall also be the responsibility of the Contractor.
- 16. The method(s) used for securing passage of the camera are at the discretion of the Contractor, and as approved by the Inspector.
- 17. No sanitary sewer main televising effort shall commence until all pertinent permits

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- or required approvals have been obtained by SAWS.
18. No separate and/or additional payment will be made for any excavation, man entry, or any other method which may be required to retrieve video equipment that may have been hung up, destroyed, and/or lost during the operation.
19. Bypass Pumping:
- a. The Contractor shall perform bypass pumping operations in accordance with Specification Item No. 864, "Large Diameter Bypass Pumping," or Specification Item No. 865 "Small Diameter Bypass Pumping".
 - b. The Contractor shall furnish all labor, supervision, tools, equipment, appliances, and materials to perform all operations in connection with bypass pumping of sewage flow for the purpose of preventing interference with the televising of the sanitary sewer manholes and mainlines as well as providing reliable sewer service to the occupants of the buildings being served.
 - c. The Contractor will be required to provide adequate pumping equipment and force mains in order to maintain reliable sanitary sewer service in all mains involved in the scope of the work.
 - d. Under no circumstances shall the flow be interrupted or stopped, such that damage is done to either private or public property, or sewage flows/overflows into a storm sewer or natural waterway.
 - e. The Contractor shall provide bypass pumping of sewage around each segment(s) of main that is to be televised and shall be responsible for all required bulkheads, pumps, equipment, piping, and other related appurtenances to accomplish the sequence of pumping.
 - f. The Contractor shall be required to have all materials, equipment, and labor necessary to complete the repair or replacement on the jobsite prior to isolating the sewer manhole or line segment and beginning bypass pumping operations.
 - g. The Contractor shall locate bypass pumping suction and discharge lines so as to not cause undue interference with the use of streets, private driveways, and alleys to include the possible temporary trenching of force mains at critical intersections.
 - h. Traffic management shall be done under the approval of respective SAWS, City, County, or State Traffic, Barricade, and Signalization Departments.
 - i. The Contractor shall not initiate any effort to accommodate bypass pumping piping operations until specific written approval is given.
 - j. The Contractor shall coordinate with all property owners to ensure that no damage will be caused to their property during any and all sewer rehabilitation work.
 - k. The Contractor shall complete the televising as quickly as possible and shall satisfactorily meet all requirements prior to discontinuing bypass pumping operations and returning flow to the sewer manhole or main segment.
 - l. The Contractor shall ensure that no damage will be caused to private property as a result of bypass pumping operations. Ingress and egress to adjacent properties shall be maintained at all times.
 - m. Ramps, steel plates, or other methods shall be employed by the Contractor to facilitate traffic over surface piping.

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- n. Pre-televising of sanitary sewer lines will be required prior to rehabilitating lines.

866.5 SETTLEMENT TESTING: Settlement testing shall be performed in accordance with Specification Item No. 849 "Sanitary Sewer Testing."

866.6 PAYMENT: Payment will be made for the work to be done for pre and post television inspection on the basis of the unit bid price per linear foot of pipe diameters 8" through 15", 18" through 24", and 27" and larger shall be considered full compensation for all labor, materials, settlement test, equipment, tools, logging, cleaning, by pass pumping and incidentals necessary to complete the work, as illustrated below:

- a. 8" through 15"
 - b. 18" through 24"
 - c. 27" and larger
- 1. No additional compensation shall be provided for all needed repairs, re-cleaning, or re-televising effort.
 - 2. There will be no separate pay item for this work for bypass pumping associated with this work.
 - 3. There will be no separate pay item for ramps, steel plates, or other methods be employed by the Contractor to facilitate traffic over surface piping.

-End of Specification-

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ITEM NO. 868

Sanitary Sewer System Cleaning

868.1 DESCRIPTION: This item shall govern cleaning the sanitary sewer system. The Contractor shall furnish all labor, equipment, and materials necessary for cleaning the sanitary sewer system, including the removal of all debris/solids, sand, grease, grit, rock, etc. from the sewer mains, manholes, or structures to facilitate television inspection.

868.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item NO. 868 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. COSA – City of San Antonio:
 - a. Utility Excavation Criteria Manual.
 - b. City of San Antonio (COSA) Specifications for Construction
3. Texas Commission of Environmental Quality (TCEQ)
 - a. Chapter 217 Design Criteria for Domestic Wastewater Systems
 - b. Chapter 213 (“Edwards Aquifer Recharge Zone”)
4. National Association of Sewer Service Companies
 - a. Sewer Pipe Cleaning Specification Guideline

868.3 SUBMITTALS: Submit equipment manufacturer’s operational manuals and guidelines to the Inspector for review.

1. Submit a list of lawful disposal sites proposed for dumping debris from cleaning operations.
2. Submit and maintain Liquid Waste Manifests conforming to City of San Antonio requirements.
3. Send the SAWS copies of the completed manifests to the Inspector within 24 hours after disposal of waste materials.

868.4 CONSTRUCTION: The Contractor shall be required to have all materials, equipment, and labor necessary to complete the cleaning of the sanitary sewer system on the jobsite prior to isolating it for the cleaning process.

1. The Contractor shall only use the type of cleaning identified below to perform the necessary removal of all material which will not create hazards to health, property, affect downstream treatment plant processes, or damage to the sanitary sewer system.
2. The sanitary sewer mains, manholes, and structures shall be cleaned using mechanical, hydraulically-propelled, and/or high velocity sewer cleaning equipment.
3. The cleaning process shall remove all debris, grease, sand, silts, solids, rags, rock, etc. from each sewer segment, including the manhole(s) or structures.
4. Selection of cleaning equipment and the method for cleaning shall be based on the condition of the sanitary sewer lines at the time work commences and will be subject to SAWS' pre-approval.

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5. All cleaning equipment and devices shall be operated by experienced personnel. Satisfactory precautions shall be taken to protect the sanitary sewer lines, manholes, or structures from damage that might be inflicted by the improper use of the cleaning process or equipment.
6. Any damages done to a sewer line manhole, or structure by the Contractor shall be repaired by the Contractor at no additional cost and to the satisfaction of SAWS.
7. Cleaning shall also include the manhole or structure wall washing by a high pressure water jet.
8. Hydraulic-propelled devices which require a head of water to operate must utilize a collapsible dam.
9. The dam must be easily collapsible to prevent damage to the sewer line, property, etc.
10. When using hydraulically-propelled devices, precautions shall be taken to insure that the water pressure created does not cause damage or flood public or private property.
11. The Contractor shall not increase the hydraulic gradient of the sanitary sewers beyond the elevation that could cause overflow of sewage into area waterways or laterals.
12. The flow of wastewater present in the sanitary sewer line shall be utilized to provide necessary fluid for hydraulic cleaning devices whenever possible.
13. Cleaning equipment that uses a high velocity water jet for removing all debris shall be capable of producing a minimum volume of 50 gpm, with a pressure of 1,500 psi, for the sanitary sewer main and 3,500 psi for the (manhole) structure at the pump.
14. Any variations to this pumping rate must be pre-approved by the Inspector.
15. To prevent damage to older sewer lines and property, a pressure less than 1,500 psi can be used.
16. A working pressure gauge shall be used on the discharge of all high pressure water pumps.
17. The Contractor shall use, in addition to conventional nozzles, a nozzle which directs the cleaning force to the bottom of the pipe for sewers 18" and larger in diameter. The Contractor shall operate the equipment so that the pressurized nozzle continues to move at all times.
18. The pressurized nozzle shall be turned off or reduced anytime the hose is on hold or delayed in order to prevent damage to the line.
19. Mechanical cleaning, in addition to normal cleaning when required, shall be with approved equipment and accessories driven by power winching devices.
20. The Contractor shall submit the equipment manufacturer's operational manual and guidelines to the Inspector, which shall be followed strictly unless modified by the Inspector.
21. All equipment and devices shall be operated by experienced operators so that they do not damage the pipe in the process of cleaning. Buckets, scrapers, scooters, porcupines, kites, heavy duty brushes, and other debris-removing equipment/accessories shall be used as appropriate and necessary in the field, in conjunction with the approved power machines.
22. The use of cleaning devices such as rods, metal pigs, porcupines, root saws, snakes,

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- scooters, sewer balls, kites, and other approved equipment, in conjunction with hand winching device, and/or gas, electric rod propelled devices, shall be considered normal cleaning equipment.
23. In addition to the requirements specified herein, the Contractor shall maintain a clean work area and surrounding premises within the work limits so as to comply with Federal, State, and local environmental and anti-pollution laws, ordinances, codes, and regulations when cleaning and disposing of waste materials, debris, and rubbish.
 24. The Contractor shall also keep the work and surrounding premises within work limits free of accumulations of dirt, dust, waste materials, debris, and rubbish.
 25. Suitable containers for storage of waste materials, debris, and rubbish shall be provided until time of disposal. It is the sole responsibility of the Contractor to secure a licensed legal dump site for the disposal of this material.
 26. Under no circumstances shall sewage or solids removed from the main or manhole be dumped on the ground, streets, ditches, catch basins, storm drains, or sanitary sewers. Cost for this item shall be included in the price bid for sanitary sewer system cleaning.
 27. The Contractor may be required to demonstrate the performance capabilities of the cleaning equipment proposed for use on the project. If the results obtained by the proposed sanitary sewer system cleaning equipment are not satisfactory to the Inspector, the Contractor shall use different equipment and/or attachments, as required, to meet the requirements of the contract documents. More than one type of equipment/attachments may be required at any given location within the project scope.
 28. When hydraulic or high velocity cleaning equipment is used, a suitable sand trap, weir, dam, or suction shall be constructed in the downstream manhole in such a manner that all the solids and debris are trapped for removal.
 29. Whenever hydraulically-propelled cleaning tools which depend upon water pressure to provide their cleaning force, or any tool which retard the flow of water in the sanitary sewer mains are used, precautions shall be taken to insure that the water pressure created does not cause any damage or flooding to public or private property being served by the manhole section involved.
 30. Any damage of property, as a result of flooding, shall be the sole liability and responsibility of the Contractor.
 31. The flow of wastewater present in the sanitary sewer system shall be utilized to provide necessary fluid for hydraulic cleaning devices whenever possible.
 32. When additional quantities of water from fire hydrants are necessary to avoid delay in normal working procedures, the water shall be conserved and not used unnecessarily.
 33. No fire hydrant shall be obstructed or used when there is a fire in the area.
 34. The Contractor shall be responsible for obtaining the water meter and all related charges for the set-up, including the water usage bills from respective water purveyor agency. All expenses shall be considered incidental to the cleaning of the existing sanitary sewer system.

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868.5 MEASUREMENT AND PAYMENT: The Contractor shall be fully responsible and shall be paid for sewer system cleaning as part of Item No. 866, "Sewer Main Television Inspection" for furnishing all labor, hauling, materials, equipment, tools, debris disposal, inspection, and incidentals necessary to complete the work. No separate pay item will be made for sewer system cleaning.

-End of Specification-

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ITEM NO. 904 Construction Phase Procedures

904.1 DESCRIPTION: This item shall govern the implementation of the Construction Phase Procedures for construction projects. The Construction Phase Procedures is a guidance document written to help direct and control activities during the construction phase of projects. This Construction Phase Procedures manual is not intended to be a step-by-step procedure. Instead, it is a document which outlines general activities, procedures, and requirements by SAWS to be implemented by SAWS and the Contractor throughout the Construction Phase of a project

904.2 INTRODUCTION: Contractors and subcontractors working on SAWS Construction Projects are required to know all contract document requirements for their project. This manual was designed to cover most issues involved large construction projects. The size, scope, and/or technical complexity of the individual project will determine the extent the procedures in the manual are utilized. Many routine SAWS projects will not necessarily require use of every form listed in this manual. For projects being managed by Consultants, whether hired by SAWS or private entities, it is allowable to use their pre-established forms and documents, so long as they demonstrate adherence to the general format of this manual and meet the general intent of the requirement.

1. Quality Control/Quality Assurance: SAWS has established a Construction Quality Control and Quality Assurance (QC/QA) Program. The Construction QC/QA Program has been written and distributed to facilitate the direction and control of entities and persons performing and managing construction for the SAWS Construction Projects. The Contractor is herein directed to Item No. 903, "Construction QC/QA Program," for a summary of both the Contractor's and SAWS' respective expectations and responsibilities.
2. Partnering: SAWS is committed to promoting partnering with all parties associated with a Construction Project. Shortly after the award of the contract, SAWS will invite the Contractor and Consultants to participate in a Partnering Workshop Session, when considered in the best interest of the Construction Project.
3. Pre-Construction Meeting: A Pre-Construction Meeting will be sponsored by SAWS shortly after award of the project. The meeting is designed to review the various administrative procedures and actions required by all involved parties. Depending upon the project scope and technical requirements, the meeting may be conducted jointly with the Partnering workshop, or held separately. In order to ensure all pertinent issues are covered during the meeting, SAWS has developed a Pre-Construction checklist (Form 18).
4. Safety: SAWS is committed to ensuring that safety is a priority on SAWS Construction Projects. A Construction Safety and Health Program has been prepared and distributed to help prevent accidents, injuries, and damage to

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equipment and property. The Construction Safety and Health Program is not intended to be an all-inclusive listing of safety procedures, rather it is a guidance document. The Contractor is herein directed to Item No. 902, "Health and Safety Program," for a summary of both the Contractor's and SAWS' respective expectations and responsibilities

904.3 RESPONSIBILITIES AND COMMUNICATION: The Construction Observer/Inspector (COI) is the individual who has been designated as the field representative of SAWS. The COI's primary responsibility is to observe construction activities, in accordance with SAWS directives, to assure completion of the project according to the contract documents. The COI and/or their Supervisor are also responsible for regular review of safety documentation and reports and forwarding such documents to SAWS. If the COI observes or perceives an unsafe work practice, he or she shall bring it to the attention of the Contractor's representative, and the SAWS Safety Officer.

The COI is responsible for coordinating between the various parties involved in the project, including the various departments within SAWS, and is the Contractor's primary point of contact on the project. Consequently, all communications will be directed through the COI by all the project participants.

The matrix shown herein lists the general responsibilities of various construction phase activities. The procedures in this document are based on the matrix. The contract and construction documents for each individual project shall be reviewed and the procedures and responsibilities adjusted according to the specific contents therein.

Note: when the term "COI" is used in this document, it refers to the overall SAWS Construction Inspection office. The term collectively means a combination of the individual Construction Inspector assigned to this project, another Construction Inspector temporarily assigned to oversee the project during the absence of the designated Inspector, his/her Area Supervisor, personnel in the Construction Inspection Administrative office, the Construction Inspection Project Engineer, the Manager of Construction Inspection, etc. Internal SAWS policies and procedures dictate the appropriate individual referenced as the "COI."

1. Written Correspondence: General correspondence to the Contractor will be signed by the COI and/or the appropriate Construction Inspection personnel pertaining to legal and contracting issues.

The routing of data and information to outside organizations, without the need of a cover letter, will have a Transmittal Form (Form 1). Written communications internal to SAWS will be prepared on the Memorandum Form (Form 2). Telephone conversations with the Contractor, Engineer, other SAWS Representative, Suppliers, Subcontractors, Vendors, etc. will be noted on the Telephone

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Conversation Record (Form 3).

Written inquiries or questions on the Contract Documents from the Contractor should be written on a Request For Information Form (Form 4). If the Contractor asks a verbal question, the COI will either provide a verbal response or request the contractor submit a Request for Information Form (Form 4). The COI will determine where the question should be forwarded. All questions to the Engineer will be faxed, emailed, or delivered the same day. The COI will monitor or prepare responses to minimize delays to the Contractor by maintaining a log of all Requests For Information (Log 1). The COI will forward the response to the Contractor when complete. The Contractor is required to review the response and return a copy of the form and indicate whether extra compensation is due. If the Contractor indicates extra compensation is due, the Construction Inspection office will review the response again and determine if the response should be amended.

A complete set of files will be maintained at the job site and/or SAWS Construction Inspection office by the COI in accordance with the File Code System in the Appendix of this document. A copy of all sensitive documents will be forwarded to the SAWS Construction Inspection Manager.

2. Electronic Communication: Electronic communication in the form of electronic mail (e-mail) is acceptable and should be used for most unofficial correspondence. Unofficial correspondence may be defined as transmittals, which do not require a signature. If correspondence is made via e-mail, hard copies do not need to follow. Hard copies of e-mail messages may be retained by the sender and may be printed by the recipient so that a record of the unofficial correspondence can be maintained. The recipient shall also return confirmation of e-mail receipt to the sender.
3. Shop Drawings/Submittals: The Contractor is responsible for ensuring that all information is submitted in a timely manner to prevent construction delays. The Contractor will transmit 3 copies of the shop drawings to the COI using the prescribed cover sheet Transmittal of Contractor's Submittal Form (Form 5). The COI will log the shop drawings (Log 2). 1 copy will be sent to the Engineer, one copy to the appropriate SAWS office for comment, and one copy will be retained by the COI with suspense date for follow-up. The copies will be delivered to the Design Engineer and SAWS Engineer within 24 hours after the Contractor has made the submittal to the COI

The target date for the return of the documents from the Engineer shall be 10 calendar days from when the documents are submitted, even though contracts allows 20 calendar days. Before any shop drawings requiring "re-submittal" are returned to the Contractor, the Engineer and/or the COI will call the Contractor and give him/her an opportunity to correct the problems.

The Engineer will denote their respective comment(s) to the submitted documents

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and return their copy to the COI. The COI will consolidate the comments from SAWS staff with the comments from the Engineer, retain one copy and return 1 formal response copy to the Contractor.

904.4 MEETINGS: The COI will assure that minutes for all project meetings are prepared. The Conference Memorandum Form (Form 6) will be used to document the meeting. A copy of the Conference Memorandum will be distributed to each attendant within seven working days of that meeting. Monthly meetings will follow the standard agenda below:

1. Corrections to Previous Minutes;
2. Unresolved Items;
3. Administrative Items;
4. Change Orders;
5. Shop Drawings;
6. Problems, Conflicts, & Observations;
7. Coordination With Owner and/or Other Contractors;
 - a. Bypasses and/or Shutdown
 - b. Other
8. Progress Since Last Meeting;
9. Planned Progress for Next Meeting;
10. Progress Schedule;
11. Other Business;
12. The latest copies of the Submittal Log and Request For Information Log will also be issued at each weekly meeting.

904.5 PROJECT REPORTS:

1. Daily Reports: The COI will prepare a Daily Construction Report Form (Form 7) by no later than 10:00 am the next working day. The reports will be maintained in the job files. The reports begin on the first contract day so that the report number will correspond to contract day. This means that a report is to be prepared for every day including Saturdays, Sundays and holidays even if the Contractor doesn't work. The SAWS Daily Log (Form FN016-4) is an allowable substitution. Consultant developed daily logs can be used if the same basic information is recordable.

The information recorded includes project title, contractor's name, SAWS job number, day (Monday, Tuesday, Wednesday, etc.), date, Contractor work hours, report number, and weather conditions. Information recorded in the boxes includes the number and class (operators, carpenters, laborers, superintendent, foreman, clerical, electrician, etc.) of personnel for the Contractor and his Subcontractors working on the job site. This information can normally be determined from field observation and the Contractor's Daily Construction Report (Form 8). The number, description, and hours operated for all of the Contractor's and Subcontractor's

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equipment on the project site will also be recorded. The hours of operation do not have to be exact but, by observing the work, a reasonable estimate can be made. When Contractor's equipment arrives or departs from the project site, record the size, model number, or capacity in the "Work Performed" section. The information that is to be recorded under "The Work Performed" section is as follows:

- a. Description and/or condition of materials and equipment delivered;
- b. Description of items rejected and reasons therefrom;
- c. Results of inspection tests which are not recorded on standard forms;
- d. Account of work accomplished during the day including location and quantity;
- e. Description of any deviations from plans and specifications, reasons for the deviations, and what was substituted;
- f. Record of specific instructions given to the Contractor;
- g. Details of discussions, or controversies with anyone connected with the work such as the Contractor or their representatives, suppliers, property owners, city, county, state, or federal government personnel;
- h. List of visitors to the project and their business connection;
- i. Details of any personal or property damage that may have occurred as a result of the Contractor's negligence;
- j. Observations of the condition of foundations and other items of work which will be covered;
- k. References to important phone calls. (Details of all phones calls should be recorded on telephone conversation forms.).

The above information could become invaluable if the project becomes involved in any type of claims. The number of employees and delays to equipment operation often are critical items involved with claims.

- 2. Contractor's Daily Reports: The Contractor is required to submit a Daily Construction Report (Form 8) to the COI. The Contractor may use his own form as long as it provides the same information as the form (Form 8) enclosed in the Appendix. The Contractor may submit these Daily Construction Reports on a weekly basis.
- 3. Contractor's Payroll Reports: The Contractor must submit weekly compliance statements and payroll records directly to the Contract Administration Division of SAWS so that they may be reviewed for compliance with Wage and Labor Standard Provisions.
- 4. Monthly Reports: Depending upon the scope, size, and/or complexity of the project, COI will prepare a Monthly Summary of Construction (Form 9) which will include a summary of progress payments, work progress, project work, delivery problems or delays, and potential modifications. The COI shall also review the

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record documents maintained by the Contractor and shall report completeness in the remarks section of the monthly report. The COI shall submit 2 copies of the report with the Contractor's pay request to SAWS.

5. Water Use Logs: The contractor shall prepare a monthly summary of water usage using the Unmetered Water Use Log (Log 8) and the Contractor Tank Truck Water Use Log (Log 9). These reports should accompany the monthly invoices and are required before SAWS will process any payments.

904.6 SAFETY: The SAWS Project Construction Program and Health and Safety Program is not intended to be an all-inclusive listing of safety procedures. It is a guidance document which outlines general safety activities, procedures, and reporting requirements to be implemented by the Contractor. Contractors working on SAWS Construction Projects shall have their own Project Specific Safety Plan which complies with the general requirements of the Safety and Health Program and all applicable regulations. Individuals working on SAWS Construction Projects are responsible for knowing all safety rules, being alert and practicing good, sound judgment in the performance of their jobs, even if specific safety rules are omitted from either this SAWS Construction Program and Safety and Health Program or the Contractor's project-specific safety and health plan. Subcontractors and their employees are responsible for following all requirements of the Contractor's project-specific safety and health plan.

Safety guidelines shall be understood and followed by all individuals while on the job site. Violation of safety and health guidelines, either in job performance or in the letter of the project-specific safety plan, may result in work stoppage until safety requirements are properly fulfilled.

904.7 QUALITY CONTROL/QUALITY ASSURANCE: An important tool in the success of construction projects is the implementation of a Construction QC/QA Program. Partnering will result in a quality completed project and provides for the development of trust and effective communication between the Contractor, Engineer, and SAWS.

1. Quality Control: Quality Control (QC) is the Contractor's means of assuring conformity with the contract documents by defining procedures to manage and control his/her own activities, all Subcontractor's activities, and all suppliers' activities during construction. These procedures will be outlined in the Contractor's project-specific QC Plan, the foundation for quality work. The Contractor's QC plan shall be received and formally accepted before any construction begins. In some cases, this requirement can be met by an interim plan. As part of its QC activities, the Contractor shall document activities performed by the Contractor, Subcontractors, testing laboratories and vendors in accordance with the contract documents. It is imperative that the Contractor's QC representative review all submittals to make sure all requirements are met.
2. Testing: Proper testing procedures, as described in the construction contract

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documents, are forms of quality control to be performed by the Contractor ensuring delivery of an end product which meets the requirements in the contract documents. Testing requirements and procedures shall include but not be limited to the following:

- a. Outline proposed testing procedures prior to construction;
- b. Provide a listing of all required tests as specified in the contract, in addition to providing a listing of all non-specified testing procedures pending approvals;
- c. Specify whether the tests are to be performed by an independent, SAWS approved, certified testing laboratory or by the Contractor with approved certified equipment and procedures or by others (subcontractors or suppliers);
- d. Follow ASTM D3740-96 - Minimum Requirement for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction;
- e. Pipe Testing events will be recorded on a Pipe Leak Test Record (Form 10) and entered on the Pipe Testing Log (Log 3). Other pertinent testing forms may apply. The COI will advise accordingly.

All QC-related activities and costs are the sole responsibility of the Contractor.

3. Quality Assurance: Quality Assurance (QA) is the means by which SAWS assures that the project work complies with the quality established by the construction contract documents. QA will be achieved through a QA Plan which serves as a management tool to establish processes and procedures involving the SAWS and Consultant organization, staffing, training, pre-award activities and construction observation. The QA Plan will identify Quality Assurance personnel, special project requirements and construction administration and observation tasks so as to assure that a consistent process is followed by QA personnel. SAWS COI will perform QA through a combination of routine and random site inspections.

The QA representatives will review and accept the QC Plan and arrange and coordinate construction conferences, partnering workshops and other overall project meetings. The QA representatives will also document and review quality control activities. While QC testing will be completed by the Contractor, QA testing will be conducted by SAWS through the COI. Finally, once all QC activities have been met and verified through the QA process, SAWS will start the acceptance process of the completed work.

All QA-related activities and costs are the sole responsibility of SAWS.

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904.8 PHOTOGRAPHS: The COI will take photographs to document the progress of the project.

904.9 CONSTRUCTION PROJECT SIGNS: The Contractor will provide and erect two construction project signs in a visible area of the specific project. The location of the project signs will be approved by the COI. The construction project signs shall meet specifications and guidelines as outlined in Item No. 869, "Project Signs." The Contractor is herein referred to the San Antonio Water System Standard Drawing No. DD-869-01.

904.10 CHANGES:

1. Change Orders: Changes may be initiated by the Contractor, Engineer, or the COI. When SAWS or the Engineer initiates a change, a Request for Proposal Form (Form 11) will be prepared which describes the nature and justification for the change. The RFP will be forwarded by the COI to the Contractor for pricing. Each RFP shall be sequentially numbered and its status shall be documented on the Change Order Proposal Log (Log 4). When the Contractor initiates the change, the Contractor shall request the next sequential number for the quotation and then submit the quotation to the COI.

Upon receipt of the quotation from the Contractor, the COI will record the appropriate information on the Change Order Proposal Log. The COI shall participate, with other SAWS representatives as appropriate, in negotiation of equitable Change Orders with the Contractor. After negotiations have been complete and the results accepted by SAWS management, a Change Order Form (Form 12) will be prepared for processing. The Change Order Log (Log 5) is used to record information pertaining to the status of each Change Order.

The COI will send 6 copies to the Contractor for processing. The Contractor shall return 5 executed copies to SAWS Construction Inspection for processing.

Change Orders for an aggregate amount greater than a positive or negative change of \$25,000.00 or that need additional contingency funds authorization, require approval by the SAWS Board of Trustees (Board). The Board normally meets twice a month on the first and third Tuesday of each month. During the summer, the Board typically meets once a month. Due to the required review procedures for changes that must meet the Board for approval, the entire process from final agreement on the scope and price to Board approval can take 6 to 8 weeks. Changes less than \$25,000.00 may be processed by SAWS staff without Board approval, if sufficient contingency funds are available. For change orders exceeding \$25,000.00 and requiring immediate action, SAWS staff may submit a ratification request through the engineering group so all affected additional work may proceed in order to prevent unnecessary delays.

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2. Pricing Changes: For some changes, it may be advantageous for work to be performed on a time and materials basis. For this method, the Contractor will track all employee hours, equipment hours, and quantity of materials used. This information must be recorded each day on the Daily Time & Material Record Form (Form 14) or a similar form provided by the Contractor. The COI is required to monitor the work and check the forms submitted each day by the Contractor for accuracy. The General Conditions of the Contract Documents outline what type of overhead and profit that the Contractor may add for this type of charge. This method of pricing changes is not desirable because it places an extra administrative burden on the Contractor and COI and doesn't provide the Contractor with an incentive to work efficiently. Therefore, this pricing method must first be approved by the COI.

904.11 PAYMENTS:

1. Progress Payments: During the latter part of each month as the work progresses the COI and Contractor shall determine the cost of the labor and materials and/or the quantities incorporated into the work during that month. They will also determine the actual invoiced cost of Contractor-acquired materials stored on the Project site and/or within off-site storage facilities either owned or leased by the Contractor and approved by SAWS. The COI will review the draft quantities and percentages (commonly called the "scratch sheet") and determine if they are appropriate. The COI will also check the stored material list for new items and verify that materials are actually on site and that the invoice is attached to the estimate. The previous list of stored material items will be checked for consumption, and removal of items from the list. The COI and Contractor will meet to discuss the estimate and resolve any disputed items. When correct, the Contractor shall obtain signature from the Engineer and forward 8 sets of the Form 15 (Progress Payment) through SAWS for processing. SAWS will confirm that quantities, extensions, and totals are correct, and proceed with processing.

Upon receipt of the Payment Estimate Form (form 15), SAWS will process as follows: Construction Inspection will review, sign, and forward to Contract Administration and update the Contract Summary Sheet (form 16); Contract Administration will review, sign, and forward the payment estimate to the Accounting Department. Payment estimates received in the Accounting Department after Tuesday afternoon, will not be prepared until the following Friday; checks are printed on Friday, provided that there are no holidays in that time. In the contract document's General Conditions, it is stated that SAWS will make payment within 30 days of receipt of a complete and accurate invoice at Contract Administration's Office.

2. Semi-Final Payments: Upon completion of all work, an inspection will be

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performed by SAWS and an Inspection Letter of Conditional Approval will be issued. This letter will include a punch list of all items, if any, which must be completed before final acceptance of the work. The Contractor and COI will then prepare a semi-final payment request, which includes a recapitulation of project costs. The semi-final pay request will list the original contract amount, the total value of the work to date which was figured in the recapitulation of project cost, less the retainage and previous payments, and finally the total amount due for the semi-final payment. Payment procedures will follow the same protocol as the progress payment procedures outlined above.

3. **Final Payment:** Upon final completion of all work (including punch list items), a final Certificate of Acceptance will be issued by SAWS. The Contractor and COI will then prepare the Final Payment Request. Along with the Final Payment Request, the Contractor shall submit a notarized affidavit in duplicate stating under oath that all subcontractors, vendors, and other persons or firms who have furnished or performed labor or furnished materials for the work have been fully paid or satisfactorily secured. Such affidavit shall bear or be accompanied by a statement, signed by the surety company who provided the Payment Bond for the work, to the effect that said surety company consents to final payment to the Contractor being made by SAWS. SAWS will then release the retainage and make final payment to the Contractor. Payment procedures will follow the same protocol as progress payment and semi-final payment procedures described above.

904.12 SPARE PARTS: The Contractor will review the specifications and develop a list of all required spare parts and forward to the COI for verification. The list will be included on the Spare Parts Transfer Log (Log 6) prepared by the Contractor. Each package will have a tag or label with all the required information completed and placed on it. The Spare Parts Transmittal Form (Form 17) will be completed when the spare parts are ready to be turned over to the SAWS operations staff. Separate forms will be used for spare parts from each specification section. A package and Spare Parts Transmittal Form for all parts from a specification section must be completed before the parts will be accepted from the Contractor (no partial submissions for a specification section will be accepted). The COI will verify that each submission is complete and correct before it is turned over to SAWS operations staff.

904.13 PROJECT COMPLETION: When the Contractor is nearing completion of a phase of the project, the Contractor will develop a preliminary punchlist of the items that are deficient on the project. Items may be added to the list as additional review of the project continues. When all or most of the items on the preliminary punchlist are corrected, the Contractor will request the Substantial Completion Inspection. The Substantial Completion Inspection will be conducted with representatives from the Contractor, SAWS, Engineer, Texas Water Development Board (if applicable) and any other appropriate personnel. During this inspection, the final punchlist will be developed. No additional items will be added to the list after this inspection, unless agreed to by all parties. Any

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items discovered after the final list will be considered warranty items. The COI will list any known administrative items remaining such as warranties, bonds, Record Documents, etc. The final punchlist will be attached to the Certificate of Substantial Completion issued by SAWS.

When the Contractor has completed the items on the final punchlist, a final inspection will be scheduled for representatives of the Contractor, COI, Engineer, and any other appropriate organizations. The Final Inspection is intended to verify that the Contractor has corrected all of the items on the final punchlist. SAWS COI will use the Water Acceptance Checklist (Form 20) and Sewer Acceptance Checklist (Form 21) to ensure the work on these utilities meets the contract document requirements. The Contractor will submit his final pay estimate, request release of retainage, and lien release. The Engineer will review the information and make a recommendation to SAWS. The request for release of retainage will be forwarded within the timeframe established by the general conditions and through the same channels as the pay estimates. SAWS Contract Administration will issue final acceptance and payment. See the Project Closeout Process (Form 19) for the typical steps and actions necessary to close out the administrative requirements on the project.

904.14 START UP: Prior to initiation of start up of any new or rehabilitated facilities, the Contractor will review the contract documents and prepare a checklist of requirements for the facility's start-up operation. This checklist of requirements will be verified by the COI. This will include a Training Log (Log 7) of the training required by manufacturers. The COI will coordinate with SAWS operations staff and the Contractor for the date and time of the training. As the training is completed, it will be added to the log.

When the Manufacturer's Representative reviews the installation of his equipment, the representative must certify the installation in writing before SAWS personnel will accept responsibility for the operation of the equipment.

The Contractor is required to develop a Start Up Plan prior to placing the facility(ies) into operation. The plan must be submitted in advance of start up to allow review by the COI, Engineer, and SAWS operations staff. After all parties have reviewed the initial plan, a meeting will be held to discuss the plan and all parties' review comments, as appropriate. The Contractor will revise the plan, per the comments agreed upon at the meeting, and will then resubmit. After review of the revised plan another meeting may be appropriate. This process will continue until an acceptable plan is developed and accepted.

Before start up is to begin, another meeting will be held to discuss the final plan and assure that everyone understands the schedule and responsibilities for startup.

904.15 MEASUREMENT: Measurement of the Item, "Construction Phase Procedures," as specified herein, will not be measured for payment.

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904.16 PAYMENT: No direct payment shall be made for incidental cost associated with preparation and implementation of the Construction Phase Procedures.

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904.17 APPENDIX

FILE SYSTEM	
1.0 CORRESPONDENCE (Letters, Memos, TCRs) 1.1 Contractor 1.2 Engineer 1.3 SAWS 1.4 Request for Information 2.0 MEETINGS 3.0 DESIGN REFERENCE DATA 4.0 PROGRESS PAYMENTS 4.1 Contractor 4.2 Engineer 4.3 Other Consultants 5.0 LEGAL (Contracts, Bonds, Insurance, Notice to Proceed, Sub Approval, EEO, etc.) 5.1 Contractor 5.2 Engineer 5.3 Other Consultants 6.0 PROGRESS REPORTS (CPM Schedule, Monthly Reports) 6.1 Contractor 6.2 Engineer 6.3 SAWS 7.0 CHANGES 7.1 Change Proposal Log 7.1.1 Change Proposal No. 1 7.2 Change Order Log 7.2.1 Change Order No. 1	8.0 TESTING REPORTS 8.1 Concrete 8.2 Soil 8.3 Piping 8.4 Miscellaneous 9.0 DAILY REPORTS 9.1 Daily Reports 9.2 Safety Reports 9.3 Photos 9.4 Materials Storage Recommendations 10.0 STARTUP 10.1 Schedules/Plans 10.2 Training 10.3 Manufacturer's certifications 10.4 Spare Parts 10.5 O & M Manual Transfers 11.0 PROJECT COMPLETION 11.1 Punch List 11.2 Guarantees/Warranties 11.3 Final Inspection/Approval (Lien Release, Substantial Completion, Final Acceptance) 11.4 Record Documents 12.0 ONE YEAR CORRECTION PERIOD 12.1 Work Orders 12.2 Completed Work Orders

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7.3 Directives 7.3.1 Directive No. 1 7.4 Claims Log 7.4.1 Claim No. 1	13.0 SHOP DRAWING SUMITTALS (Shop Drawings, O & M Manuals, Training Lesson Plans) 13.1 Submittal No. 1 14.0 LOGS
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INDEX TO FORMS	
Form No. 1	Transmittal
Form No. 2	Memorandum
Form No. 3	Telephone Conversation Record
Form No. 4	Request For Information
Form No. 5	Transmittal of Contractor's Submittal
Form No. 6	Conference Memorandum
Form No. 7	Daily Construction Report
Form No. 8	Contractor's Daily Construction Report
Form No. 9	Monthly Summary of Construction
Form No. 10	Pipe Leak Test Record
Form No. 11	Request For Proposal
Form No. 12	Change Order
Form No. 13	Work Change Directive
Form No. 14	Daily Time & Material Record
Form No. 15	Payment Estimate
Form No. 16	Contract Summary Sheet
Form No. 17	Spare Parts Transmittal
Form No. 18	Pre-Construction Checklist

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Form No. 19	Project Closeout Process
Form No. 20	Water Acceptance Checklist
Form No. 21	Sewer Acceptance Checklist

INDEX TO LOGS	
Log No. 1	Request For Information
Log No. 2	Shop Drawing Submittal
Log No. 3	Pipe Testing
Log No. 4	Change Order Proposal
Log No. 5	Change Order
Log No. 6	Spare Parts Transfer
Log No. 7	Training
Log No. 8	Contractor Unmetered Water Use Log
Log No. 9	Contractor Tank Truck Water Use Log

-End of Specification-

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ITEM NO. 1110 Progress Schedule

1110.1 DESCRIPTION: This item shall govern the Contractor's responsibility to provide monthly construction schedules as specified herein for the work under this Contract. These schedules shall be developed as time-scaled network diagrams. Schedules include bar graphs, phasing plans, network diagrams, and narrative reports.

1110.2 REFERENCE STANDARDS: Reference standards cited in this Specification Item No. 1110 refer to the current reference standard published at the time of the latest revision date.

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. City Of San Antonio (COSA) Standard Specifications for Construction

1110.3 SUBMITTALS:

1. Contractor's Submittals:
 - a. Within 10 days after receipt of Authorization to Proceed, Contractor shall submit in CPMS for review and approval, a detailed construction schedule, reflecting sequence of operations, milestones and commencing and completion dates of each item of work.
 - b. Other work may be added to the progress schedule as requested or approved by the Engineer.
 - c. At a minimum, the chart shall be maintained current by coloring or cross-hatching a length of bar to indicate the weekly progress towards completion.
 - d. Three copies of the progress schedule shall be submitted each month with the monthly "scratch copy," until completion of the project. If updated progress schedules are not provided, monthly payments will be withheld.
 - e. Updated copies of the progress schedule shall be available at the established progress meetings for review.
Contractor shall submit a projection of estimated monthly payments through the life of the Contract. Initial projections shall be correlated with and provided at the same time as the Schedule of Values (if required). Projections shall be updated when requested by the Inspector.
2. Engineer's Review:
 - a. If revision of either form or content is necessary, Contractor shall revise and resubmit the progress schedule within five calendar days.
 - b. The progress schedule shall be used by the Contractor for planning, organizing, directing, and executing all completion of work and for reporting progress of all remaining work.

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3. Revisions and Updates:

- a. After the Engineer's review of the progress schedule, if the Contractor desires to make changes in his method of executing the work, he shall notify the SAWS in writing, stating the reasons for the changes. If SAWS considers these changes to be of a major nature, the Contractor may be required to revise and resubmit all the affected portions of the progress schedule.
- b. Updated progress schedules shall show all changes in activities and milestones including future changes that can be reasonably anticipated by the Contractor.
- c. At the established progress meetings, the most recently updated progress schedule will be reviewed by the Contractor and Engineer. The schedule and work will be reviewed:
 - 1) To identify those activities started and completed during the previous period;
 - 2) For a review of remaining durations for selected activities not yet started;
 - 3) For the addition of change orders and proposed sequencing changes to the network diagram;
 - 4) For the interfacing of the work under this Contract with the work of other Contractors' or the connection to in-place work.
- d. Following review of the progress schedule at the established meetings, the Contractor shall revise and resubmit the schedule, if any of the following conditions have developed:
 - 1) When a delay in completion of any work item or sequence of work items results in an indicated extension of the project completion;
 - 2) When delays in submittals or deliveries or work stoppages are encountered which make re-planning or rescheduling of the work necessary;
 - 3) When the schedule does not reasonably represent the actual prosecution and progress of the project.
- e. The revised schedule shall be submitted to in CPMS within five calendar days and shall be accompanied by a written narrative report. The narrative report shall include a description of problem areas, current and anticipated delay factors and their estimated impact on performance of other activities and completion dates, and an explanation of corrective action taken or proposed.
- f. All updated or revised schedules submitted after the original schedule shall be in the same detail as the original submittal.

4. **Monthly Report:** Contractor shall submit a copy of the current adjusted construction Progress Schedule showing the progress to the Work to date and a narrative report with every monthly "scratch copy." Failure to submit the progress schedule shall be considered cause for withholding

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any progress payments otherwise due under the Contract. See Section 7.2 of the GENERAL CONDITIONS for more information. The report shall list any construction activities that are behind schedule and discuss measures being taken to bring these activities back on schedule.

1110.4 EXECUTION:

1. Network Diagram:

- a. The network diagram shall show the order and interdependence of activities and sequence in which work is to be accomplished as planned by the Contractor. The diagram shall show how the start of a given activity is dependent upon completion of preceding activities and how its completion restricts the start of following activities.
- b. The diagram shall be constructed in such a manner that sub-networks (relating to particular phases or portions of work) can be readily extracted or revised as required by the Owner. Sub-networks shall include, but are not limited to, the following portions of work:
 - 1) Shop drawings, received from Contractor, submitted to the Inspector, reviewed, and returned to the Contractor;
 - 2) Material and equipment order, manufacturer, delivery, installation, and check-out;
 - 3) Connection to the work of other Contractors' and to in- place work;
 - 4) Work requiring coordination with the work of other contractors;
 - 5) Performance tests and supervisory service activities;
 - 6) Piping activities;
 - 7) Construction of various facilities;
 - 8) Concrete placement sequence;
 - 9) Backfilling, grading, seeding, paving, etc;
 - 10) Plumbing activities;
 - (1) Subcontractor's items of work;
 - (2) Final cleaning.
- c. The network diagram shall show the following information related to activities:
 - (1) Activity number or label;
 - (2) Brief description of activity;
 - (3) Estimated duration, in working days, of each activity.
- d. In addition to showing all construction and coordination activities, the diagram shall show following events and milestones:
 - (1) Notice to Proceed;
 - (2) Connections to the work of other contractors and to in- place work;
 - (3) Ready for operation and Contract completion dates;
 - (4) Shutdowns;
 - (5) Intermediate milestones.
- e. Detail of information shall be such that duration times of activities will

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generally range from 1 to 30 days with not over 2% of activities exceeding these limits. Activities which comprise separate portions of work shall be identified separately by coding.

- f. Network diagram shall be drawn on 22 inch by 34 inch size sheets with flow of activities generally from left to right. Printing shall be suitable for half size (11" x 17").
- g. The network diagram shall be time-scaled.

2. Mathematical Analysis:

- a. Contractor shall provide Owner with the following:
 - 1) The calendar used for the computation of dates specified showing the calendar dates of each working day. The calendar shall incorporate the Contractor's assumptions of working days with due consideration being given to legal statutory holidays, Saturdays and Sundays, and weather shutdowns;
 - 2) A listing of each submittal and update of Contractor's detailed construction schedule;
 - 3) List of representative symbols and codes used in preparation of the network diagram.
- b. Analysis shall include:
 - 1) Calendar date and lists of activities in order of earliest start date;
 - 2) Separate lists of activities within a given sub-network grouped together and listed in order of their earliest start dates.

3. Narrative Report:

- a. The narrative report shall include:
- b. Contractor's transmittal letter;
- c. Schedule narrative concerning completion and progress of all work according to the activity in the Contractor's construction schedule;
- d. Description of any problem areas;
- e. Current and anticipated delays, cause, corrective action to be taken, and impact of the delay on other activities, on milestones, and on completion dates;
- f. Status of pending items such as permits, Contract modifications, and time extensions;
- g. Progress relative to schedule and other project or scheduling concerns;
- h. A discussion of coordination efforts and problems.

4. Log of Shop Drawing Submittals:

- a. The log of shop drawing submittals shall consist of a complete listing of all shop drawings required by the Specifications with anticipated submission dates. Scheduled submission dates shall be consistent with the construction schedule.

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- b. The Contractor shall update the log monthly indicating submittal status. Status shall include all dates submitted and whether the submittal was acceptable or if re-submittal is necessary. Anticipated re-submittal dates shall be indicated.

1110.5 DELAYS AND RECOVERY:

1. If it is determined by the Owner that the Contractor is not maintaining anticipated progress, then the Owner may withhold approval of the monthly progress payment as outlined in Section 7.2 of the GENERAL CONDITIONS.
2. Wherever it becomes apparent from the current monthly progress evaluation and updated schedule data that any milestone interface completion dates and/or Contract completion dates will not be met, the Contractor shall take some or all of the following actions:
 - a. Increase construction manpower in such quantities and crafts as shall eliminate the backlog of work;
 - b. Increase the number of working hours per shift, shifts per day, work days per work week, or the amount of construction equipment, or any combination of the foregoing sufficient to eliminate the backlog of work;
 - c. Reschedule work items to achieve concurrency of accomplishment.
3. Under no circumstances will the addition of equipment or construction forces, increasing the working hours, or any other method, manner, or procedure to return to the current Contractor's construction schedule be considered jurisdiction for Contract modification, increased cost, or treated as an acceleration.

1110.6 MEASUREMENT: There will be no measurement for payment of the Progress Schedule, as specified herein.

1110.7 PAYMENT: No direct payment shall be made of any incidental costs associated with preparing and submitting the Progress Schedule, as specified herein.

- End of Specification-

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ITEM NO. 1112

Project Record Documents

1112.1 DESCRIPTION: Contractor shall maintain and provide the Inspector with project record documents as specified below. Daily logging and transmittal of record drawing information by accurately identifying all completed work is considered incidental and not eligible for additional payment.

1. Maintenance of Documents:

- a. Maintain in Contractor's field office, in a clean, dry, legible condition, a complete set of the following: Contract Documents, including all addenda, approved Shop Drawings, Samples, Photographs, Change Orders, other Modifications of Contract, Test Records, Survey Data, and all other documents pertinent to Contractor's Work.
- b. Provide files and racks for proper storage and easy access.
- c. Make documents available at all times for inspection by Inspector and/or Engineer.
- d. Record documents shall not be used for any other purpose and shall not be removed from the office without Inspector's approval.

2. Recording:

- a. Label each document "PROJECT RECORD," in 2 inch high printed letters.
- b. Keep record documents current and updated daily.
- c. Do not permanently conceal any work until required information has been recorded.
- d. Contract Documents: Legibly mark to record actual construction including:
- e. The depths of various elements of manhole foundation in relation to datum. This shall include the inclusion of surveyed inlet/outlet elevations for each structure installed;
- f. Specifications and Addenda - Legibly mark up each Section to record:
 - 1) Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed;
 - 2) Changes made by Change Orders or Field Change Directives;
 - 3) Other dimensions and details not in original contract documents.
- g. Shop Drawings - Maintain as record documents and legibly annotate drawings to record changes made after review.
- h. Record Documents are subject to submittal, review, and acceptance by the Inspector on a monthly basis and failure to accurately keep these documents current will result in the Inspector withholding the Contractor's monthly payment.

3. Record Drawings:

- a. Record drawings shall reflect completion of the installation of all equipment, piping, and other work by the Contractor. The drawings shall

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show the Work in plan and sections as required for clarity with reference dimensions and elevations for complete record drawings. The monthly record drawings shall be furnished to the Inspector at the time that the "scratch copy" stage of the pay estimate effort is conducted. If the Contractor does not furnish an accurate and approved progress record drawing, the monthly pay estimate will not be processed and payment will be withheld.

4. The Contract Drawings may be used as a starting point in developing these drawings. Subcontractor and manufacturer drawings may be included in this drawing package. The drawing package must be fully integrated and include the necessary cross references between drawings. The drawing package shall include interconnection and termination details to equipment furnished under this Contract Submittal:
 - a. At each monthly "scratch copy" meeting of the pay estimate, the Contractor shall deliver a complete set of reviewable and approvable monthly redline drawings and an updated schedule to the Engineer and Inspector via CPMS. Once items to be paid are agreed upon between the Contractor, Inspector, and Engineer all parties will sign the scratch copy as record of approval before the scratch copy is uploaded to CPMS. If the Contractor does not provide these documents the meeting will be reschedule when the Contractor is ready to comply.
 - b. Accompany the submittal with a transmittal letter in a duplicate containing the following:
 - 1.) Date
 - 2.) Project title and job number
 - 3) Contractor's name and address
 - 4) Title and number of each record document
 - 5) Certificate that each document submitted is complete and accurate
 - 6) Signature of Contractor Engineer, and Inspector

1112.2 MEASUREMENT: There will be no measurement for payment of the Project Record Drawings, as specified herein.

1112.3 PAYMENT: No direct payment shall be made of any incidental costs associated with preparing and submitting the Project Record Drawings, as specified herein.

- End of Specification-

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ITEM NO. 1114

Pre- Construction Video

1114.1 DESCRIPTION: The Contractor shall furnish all labor, materials, equipment, and incidentals to provide the televising in SAWS and recorded in MPEG-1 format. All inspections shall be in accordance with SAWS requirements, shall be submitted and uploaded onto SAWS Contracting and Project Management System (CPMS) or SAWS most current program management system. All digital video files shall be color, closed-circuit TV in MPEG-1 format. The Contractor shall provide all inspection data and upload to CPMS.

1114.2 REFERENCED STANDARDS: Reference standards cited in this Specification Item No. 1114 refer to the current reference standard published at the time of the latest revision date:

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction
 - b. SAWS Materials Specifications
2. COSA – City of San Antonio:
 - a. Utility Excavation Criteria Manual.
 - b. City of San Antonio (COSA) Specifications for Construction
3. Texas Commission of Environmental Quality (TCEQ)
 - a. Chapter 217 Design Criteria for Domestic Wastewater Systems
 - b. Chapter 213 (“Edwards Aquifer Recharge Zone”)

1114.3 SUBMITTALS: All submittals shall be in accordance with most recent version of SAWS’s General Conditions requirements. Submit the following prior to performing any work.

- a. Certifications: Per General Conditions section 5.12.2 all Contractor submittals for all pipe and other products or materials furnished under this specification shall be marked as reviewed and approved by Contractor for compliance with Contract Documents and the referenced standards
- b. Contractor is to coordinate the pre-video procedures with the Inspector prior to commencement of any work, including mobilization and preparation of right-of-way effort.
- c. The Contractor shall provide a diagram and identify the limits of the project area and video the condition of all existing surface features within the project limits including adjoining ROW features such as curbing, sidewalk, fencing, mailboxes, driveways, and trees and shrubs/grass.
- d. Contractor shall provide a copy of the pre-construction video prior to commencement of the project by identifying the condition of all existing surface features within the project limits, including adjoining right-of-way features such as curbing, sidewalk, fencing, mailboxes, driveways, and trees/shrubs/grass

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- e. Video shall be submitted and uploaded onto SAWS CPMS or SAWS most current program management system
- f. Video shall be uploaded for review and approval by the Inspector.

1114.4 EQUIPMENT:

- 1. Equipment:
 - a. The television unit shall have capability of displaying in color, on the video, surface feature locations, and any other relevant physical attributes.
 - i. Each video shall be permanently labeled with the following:
 - ii. Project name / SAWS Job # / Work Order #;
 - iii. Date of television inspection;
 - iv. Street/easement location;
 - v. Name of Contractor;
 - vi. Date video submitted;
 - vii. Video number;
 - viii. SAWS Inspector Name.

The Contractor shall be required to have all materials, equipment, and labor force necessary to complete all videotaping on the job site prior to beginning videotaping operations.
- 2. If the Contractor provides a video of such poor quality that it cannot be properly evaluated, the Contractor shall re-televises as necessary and provide a video of good quality at no additional cost to SAWS.
- 3. If the Contractor cannot provide a video of such good quality that can be reviewed by SAWS, SAWS may elect to televise the site at the Contractor's expense.
- 4. Television inspection shall be done one area at a time.

1114.5 MATERIALS: All videos shall be a SAWS compliant video, recorded in MPEG-1 format and uploaded onto SAWS Contracting and Project Management System (CPMS) or SAWS most current program management system. The video shall include good sound quality; identification of area being videoed, to include cross streets references, addresses, time and date. Each video shall be marked with the name and contract number, name of Contractor, and a description and location of view being recorded.

- 1114.6 EXECUTION:** Prior to beginning the project, the Contractor shall submit one copy of the completed video for the entire project prior to submission of request for mobilization for review and approval. Failure to submit video will result in denial of any request for payment under the Mobilization line item or Preparation of Right-of-Way.
- a. If requested by SAWS Inspector, post construction video shall be submitted prior to project closeout concurrent with project redlines.
 - b. Failure to submit video will result in denial of request for payment.

1114.7 MEASUREMENT: There will be no measurement for payment of the Pre-

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Construction Video, as specified herein.

1114.8 PAYMENT: No direct payment shall be made of any incidental costs associated with preparing and submitting the Pre-Construction Video, as specified herein.

-End of Specification -

San Antonio Water System Standard Specifications for Construction

ITEM NO. 3001

Pole Bracing

3001.1 DESCRIPTION: The Contractor shall coordinate with utility company and provide all labor, supervision, tools, equipment, and materials necessary to brace and/or relocate power poles, guy wires, gas lines as required to complete work. No contract days will be added due to delays. This allowance shall reimburse Contractor for direct fees incurred for bracing/relocation of power poles, guy wires and/or gas lines. Any unused portion of the allowance will be credited to the Owner by a deduct change order. Cost incurred by Contractor for bracing of these utility poles that exceeds the allowance is subsidiary to the respective utility company's work. It is advisable for the Contractor to review the construction documents and visit the construction site to determine potential impacts.

3001.2 CONSTRUCTION:

1. Dependent on Contractor's means and methods for sewer line installation, pole bracing may be required. Contractor shall develop means and methods according to the on-site geotechnical conditions that will avoid conflicts with overhead electric lines, poles and guy wires and coordinate with CPS Energy for pole bracing as necessary as mentioned in 3001.1 Description.
2. Contractor can use CPS Energy easements as shown on plans regarding the sanitary sewer main replacement if the following criteria is met:
 - a. Construction personnel and equipment maintain a ten (10) foot clearance to all CPS Structures.
 - b. Access across the transmission and distribution easements will be allowed, as long as access for CPS Energy maintenance personnel and equipment is maintained at all times.
 - c. Construction vehicles, equipment and piping may be staged within the easements as long as access for CPS Energy maintenance personnel and equipment is maintained at all times.
 - d. No trench spoils/piles may be stored or piled within easements.

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- e. No types of vehicles or equipment may be used that will allow personnel or equipment to be closer to the distribution line than the minimum clearances provided by OSHA or the National Electric Safety Code.
 - f. The easements must be returned to their original condition as existed prior to any staging or other use.
- 3. Contractor shall coordinate with CPS if any of the above mentioned criteria can not be met.
 - 4. Contractor shall contact CPS one (1) week in advance prior to using or crossing a CPS easement.

3001.3 PAYMENTS: Payment will be made to the Contractor based on the allowance included as part of the bid. Contractor shall provide receipts to SAWS for reimbursement.

-End of Specifications-

Item 164

Seeding for Erosion Control



1. DESCRIPTION

Prepare the surface and provide and distribute temporary or permanent seeding for erosion control as shown on the plans or as directed.

2. MATERIALS

- 2.1. **Seed.** Provide seed from the previous season's crop meeting the requirements of the Texas Seed Law, including the testing and labeling for pure live seed (PLS = Purity × Germination). Furnish seed of the designated species in labeled unopened bags or containers to the Engineer before planting. Use within 12 mo. from the date of the analysis. When Buffalograss is specified, use seed that is treated with potassium nitrate (KNO_3) to overcome dormancy.

Use Tables 1–5 to determine the appropriate seeding mix and rates as shown on the plans. Include flower seeding mix in accordance with Table 5 with seeding mix shown in Table 1 and Table 2.

If a grass plant species is not available by the producers, the other grass plant species in the seeding mix will be increased proportionally by the percentage of the missing plant grass species. If a flower plant species is not available by the producers, the other flower species in the seeding mix will be increased proportionally by the percentage of the missing flower species. Substitute species and rates require approval of the Engineer before being incorporated into the seeding mix. The rates listed in the tables are for drill seeding. All other methods of placing seed will require a 25% increase in rate.

Table 1
Permanent Rural Seeding Mix

District	Clay Soils Species, Percent, and Rate (lb. PLS per acre)		Sandy Soils Species, Percent, and Rate (lb. PLS per acre)	
1 (Paris)	Hooded Windmillgrass (Burnet)	15% 0.3	Hooded Windmillgrass (Burnet)	15% 0.3
	White Tridens (Guadalupe)	20% 0.4	Sand Dropseed (Taylor)	15% 0.3
	Little Bluestem (Coastal Plains)	20% 2.0	Little Bluestem (Coastal Plains)	20% 2.0
	Florida Paspalum (Harrison)	15% 2.25	Florida Paspalum (Harrison)	15% 2.25
	Sideoats Grama (Haskell)	05% 0.5	Splitbeard Bluestem (Neches)	10% 1.0
	Splitbeard Bluestem (Neches)	05% 0.5	Sand Lovegrass (Mason)	10% 0.4
	Sand Dropseed (Taylor)	05% 0.1	Green Sprangletop (Van Horn)	15% 0.6
	Canada Wildrye (Lavaca)	10% 2.0		
	Green Sprangletop (Van Horn)	05% 0.2		
2 (Fort Worth)	Hooded Windmillgrass (Burnet)	15% 0.3	Sand Dropseed (Taylor)	15% 0.3
	White Tridens (Guadalupe)	15% 0.3	Sideoats Grama (Haskell)	15% 1.5
	Sideoats Grama (Haskell)	10% 1.0	Little Bluestem (OK Select)	15% 1.05
	Little Bluestem (OK Select)	10% 0.7	Hairy Grama (Chaparral)	15% 0.6
	Buffalograss (Texoka)	10% 1.5	Green Sprangletop (Van Horn)	10% 0.2
	Silver Bluestem (Santiago)	10% 0.4	Hooded Windmillgrass (Burnet)	10% 0.2
	Green Sprangletop (Van Horn)	10% 0.4	Shortspike Windmillgrass (Welder)	10% 0.2
	Sand Dropseed (Taylor)	10% 0.2	Silver Bluestem (Santiago)	10% 0.4
	Canada Wildrye (Lavaca)	10% 2.0		

Table 1 (continued)
Permanent Rural Seeding Mix

District	Clay Soils		Sandy Soils	
	Species, Percent, and Rate (lb. PLS per acre)		Species, Percent, and Rate (lb. PLS per acre)	
3 (Wichita Falls)	Sideoats Grama (Haskell)	15% 1.5	Hooded Windmillgrass (Burnet)	10% 0.2
	Green Sprangletop (Van Horn)	10% 0.4	Sand Dropseed (Taylor)	15% 0.3
	Hooded Windmillgrass (Burnet)	10% 0.2	Green Sprangletop (Van Horn)	15% 0.6
	White Tridens (Guadalupe)	10% 0.2	Sideoats Grama (Haskell)	10% 1.0
	Little Bluestem (OK Select)	15% 1.05	Little Bluestem (OK Select)	10% 0.7
	Silver Bluestem (Santiago)	10% 0.4	Silver Bluestem (Santiago)	10% 0.4
	Buffalograss (Texoka)	10% 1.5	Hairy Grama (Chaparral)	10% 0.4
	Blue Grama (Hachita)	05% 0.2	Arizona Cottontop (La Salle)	10% 0.4
	Sand Dropseed (Taylor)	05% 0.1	Blue Grama (Hachita)	10% 0.4
	Canada Wildrye (Lavaca)	10% 2.0		
4 (Amarillo)	Sideoats Grama (Haskell)	15% 1.5	Green Sprangletop (Van Horn)	15% 0.6
	Silver Bluestem (Santiago)	15% 0.6	Sideoats Grama (Haskell)	10% 1.0
	Buffalograss (Texoka)	15% 2.25	Sand Dropseed (Taylor)	10% 0.2
	Green Sprangletop (Van Horn)	10% 0.4	Silver Bluestem (Santiago)	10% 0.4
	Blue Grama (Hachita)	15% 0.6	Little Bluestem (OK Select)	15% 1.05
	Hooded Windmillgrass (Burnet)	05% 0.1	Arizona Cottontop (La Salle)	10% 0.4
	White Tridens (Guadalupe)	10% 0.2	Blue Grama (Hachita)	10% 0.4
	Western Wheatgrass (Barton)	10% 3.0	Sand Lovegrass (Mason)	10% 0.3
	Canada Wildrye (Lavaca)	05% 1.0	Hooded Windmillgrass (Burnet)	10% 0.2
5 (Lubbock)	Sideoats Grama (Haskell)	15% 1.5	Green Sprangletop (Van Horn)	15% 0.6
	Blue Grama (Hachita)	15% 0.6	Blue Grama (Hachita)	15% 0.6
	Silver Bluestem (Santiago)	15% 0.6	Sideoats Grama (Haskell)	10% 1.0
	Buffalograss (Texoka)	10% 1.5	Little Bluestem (OK Select)	10% 0.7
	White Tridens (Guadalupe)	10% 0.2	Hooded Windmillgrass (Burnet)	10% 0.2
	Green Sprangletop (Van Horn)	10% 0.4	Sand Dropseed (Taylor)	10% 0.2
	Hooded Windmillgrass (Burnet)	05% 0.1	Silver Bluestem (Santiago)	10% 0.4
	Galleta Grass (Viva)	05% 0.3	Arizona Cottontop (La Salle)	10% 0.4
	Western Wheatgrass (Barton)	10% 3.0	Sand Lovegrass (Mason)	10% 0.3
	Canada Wildrye (Lavaca)	05% 1.0		
6 (Odessa)	Whiplash Pappusgrass (Permian)	15% 0.9	Sand Dropseed (Taylor)	15% 0.3
	Green Sprangletop (Van Horn)	10% 0.4	Green Sprangletop (Van Horn)	10% 0.4
	Silver Bluestem (Santiago)	15% 0.6	Sideoats Grama (Brewster)	15% 1.5
	Sideoats Grama (Brewster)	10% 1.0	Whiplash Pappusgrass (Permian)	10% 0.6
	Sand Dropseed (Taylor)	10% 0.2	Hooded Windmillgrass (Burnet)	10% 0.2
	Alkali Sacaton (Saltalk)	10% 0.2	Blue Grama (Hachita)	10% 0.4
	Arizona Cottontop (La Salle)	10% 0.4	Hairy Grama (Chaparral)	10% 0.4
	Blue Grama (Hachita)	10% 0.4	Sand Lovegrass (Mason)	10% 0.3
	Galleta Grass (Viva)	10% 0.6	Little Bluestem (Pastura)	05% 0.5
			Galleta Grass (Viva)	05% 0.3
7 (San Angelo)	Sideoats Grama (Brewster)	15% 1.5	Sand Dropseed (Taylor)	15% 0.3
	Hooded Windmillgrass (Burnet)	10% 0.2	Green Sprangletop (Van Horn)	15% 0.6
	Silver Bluestem (Santiago)	10% 0.4	Hooded Windmillgrass (Burnet)	15% 0.3
	Sand Dropseed (Taylor)	10% 0.2	Shortspike Windmillgrass (Welder)	10% 0.2
	White Tridens (Guadalupe)	10% 0.2	Hairy Grama (Chaparral)	10% 0.4
	Whiplash Pappusgrass (Permian)	15% 0.9	Sand Lovegrass (Mason)	10% 0.3
	Texas Grama (Atascosa)	05% 0.5	Sideoats Grama (Brewster)	10% 1.0
	Green Sprangletop (Van Horn)	10% 0.4	Little Bluestem (OK Select)	10% 0.7
	Little Bluestem (OK Select)	05% 0.35	Whiplash Pappusgrass (Permian)	05% 0.3
	Blue Grama (Hachita)	05% 0.2		
	Galleta Grass (Viva)	05% 0.3		

Table 1 (continued)
Permanent Rural Seeding Mix

District	Clay Soils		Sandy Soils	
	Species, Percent, and Rate (lb. PLS per acre)		Species, Percent, and Rate (lb. PLS per acre)	
8 (Abilene)	Sideoats Grama (Haskell)	10% 1.0	Sand Dropseed (Taylor)	15% 0.3
	Hooded Windmillgrass (Burnet)	10% 0.2	Green Sprangletop (Van Horn)	10% 0.4
	Buffalograss (Texoka)	10% 1.5	Hooded Windmillgrass (Burnet)	15% 0.3
	Blue Grama (Hachita)	10% 0.4	Silver Bluestem (Santiago)	10% 0.4
	Silver Bluestem (Santiago)	10% 0.4	Little Bluestem (OK Select)	10% 0.7
	White Tridens (Guadalupe)	15% 0.2	Shortspike Windmillgrass (Welder)	10% 0.2
	Little Bluestem (OK Select)	10% 0.7	Hairy Grama (Chaparral)	10% 0.4
	Green Sprangletop (Van Horn)	10% 0.4	Sand Lovegrass (Mason)	10% 0.3
	Whiplash Pappusgrass (Permian)	10% 0.6	Arizona Cottontop (La Salle)	10% 0.4
	Galleta Grass (Viva)	10% 0.6		
9 (Waco)	Sideoats Grama (Haskell)	15% 1.5	Hooded Windmillgrass (Burnet)	15% 0.3
	White Tridens (Guadalupe)	15% 0.3	Shortspike Windmillgrass (Welder)	10% 0.2
	Hooded Windmillgrass (Burnet)	10% 0.2	Hairy Grama (Chaparral)	10% 0.4
	Little Bluestem (OK Select)	10% 0.7	Sand Dropseed (Taylor)	15% 0.3
	Buffalograss (Texoka)	10% 1.6	Sideoats Grama (Haskell)	10% 1.0
	Halls Panicum (Oso)	05% 0.1	Little Bluestem (OK Select)	10% 0.7
	Silver Bluestem (Santiago)	10% 0.4	Green Sprangletop (Van Horn)	10% 0.4
	Sand Dropseed (Taylor)	05% 0.1	Texas Grama (Atascosa)	05% 0.15
	Green Sprangletop (Van Horn)	10% 0.4	Silver Bluestem (Santiago)	10% 0.4
	Canada Wildrye (Lavaca)	05% 1.0	Canada Wildrye (Lavaca)	05% 1.0
	Texas Grama (Atascosa)	05% 0.5		
10 (Tyler)	Hooded Windmillgrass (Burnet)	15% 0.3	Hooded Windmillgrass (Burnet)	15% 0.3
	White Tridens (Guadalupe)	15% 0.3	Sand Dropseed (Taylor)	10% 0.2
	Sand Dropseed (Taylor)	05% 0.1	Little Bluestem (Coastal Plains)	20% 2.0
	Little Bluestem (Coastal Plains)	20% 2.0	Florida Paspalum (Harrison)	15% 2.25
	Florida Paspalum (Harrison)	15% 2.25	Splitbeard Bluestem (Neches)	10% 1.0
	Splitbeard Bluestem (Neches)	10% 1.0	Green Sprangletop (Van Horn)	05% 0.2
	Green Sprangletop (Van Horn)	05% 0.2	Sand Lovegrass (Mason)	10% 0.4
	Sideoats Grama (Haskell)	05% 0.5	Red Lovegrass (Duval)	10% 0.2
	Canada Wildrye (Lavaca)	10% 2.0	Hairy Grama (Chaparral)	05% 0.2
11 (Lufkin)	Hooded Windmillgrass (Burnet)	15% 0.3	Hooded Windmillgrass (Burnet)	15% 0.3
	White Tridens (Guadalupe)	15% 0.3	Sand Dropseed (Taylor)	10% 0.2
	Little Bluestem (Coastal Plains)	20% 2.0	Little Bluestem (Coastal Plains)	20% 2.0
	Florida Paspalum (Harrison)	15% 2.25	Florida Paspalum (Harrison)	15% 2.25
	Green Sprangletop (Van Horn)	05% 0.2	Splitbeard Bluestem (Neches)	10% 1.0
	Sideoats Grama (Haskell)	05% 0.5	Green Sprangletop (Van Horn)	05% 0.2
	Splitbeard Bluestem (Neches)	10% 1.0	Red Lovegrass (Duval)	10% 0.2
	Sand Dropseed (Taylor)	05% 0.1	Sand Lovegrass (Mason)	10% 0.4
	Canada Wildrye (Lavaca)	10% 2.0	Hairy Grama (Chaparral)	05% 0.2
12 (Houston)	White Tridens (Guadalupe)	10% 0.2	Hooded Windmillgrass (Mariah)	15% 0.3
	Hooded Windmillgrass (Mariah)	10% 0.2	Sand Dropseed (Nueces)	15% 0.3
	Shortspike Windmillgrass (Welder)	15% 0.3	Shortspike Windmillgrass (Welder)	10% 0.2
	Little Bluestem (Coastal Plains)	15% 1.5	Little Bluestem (Coastal Plains)	15% 1.5
	Florida Paspalum (Harrison)	15% 2.25	Red Lovegrass (Duval)	10% 0.2
	Red Lovegrass (Duval)	05% 0.1	Florida Paspalum (Harrison)	15% 2.25
	Halls Panicum (Oso)	10% 0.2	Splitbeard Bluestem (Neches)	10% 1.0
	Splitbeard Bluestem (Neches)	05% 0.5	Hairy Grama (Chaparral)	05% 0.2
	Sand Dropseed (Nueces)	05% 0.1	Green Sprangletop (Van Horn)	05% 0.2
	Canada Wildrye (Lavaca)	10% 2.0		
13 (Yoakum)	White Tridens (Guadalupe)	15% 0.3	Hairy Grama (Chaparral)	15% 0.6
	Shortspike Windmillgrass (Welder)	15% 0.3	Hooded Windmillgrass (Mariah)	15% 0.3
	Halls Panicum (Oso)	10% 0.2	Shortspike Windmillgrass (Welder)	10% 0.2
	Plains Bristlegrass (Catarina Blend)	10% 0.6	Sand Dropseed (Nueces)	10% 0.2
	Little Bluestem (Coastal Plains)	15% 1.5	Little Bluestem (Carrizo)	10% 1.5
	Sideoats Grama (South Texas)	05% 0.75	Red Lovegrass (Duval)	10% 0.2
	Texas Grama (Atascosa)	10% 1.0	Slender Grama (Dilley)	10% 1.0
	Hooded Windmillgrass (Mariah)	05% 0.1	Plains Bristlegrass (Catarina)	10% 0.4
	Sand Dropseed (Nueces)	05% 0.1	Green Sprangletop (Van Horn)	10% 0.4
	Canada Wildrye (Lavaca)	10% 2.0		

Table 1 (continued)
Permanent Rural Seeding Mix

District	Clay Soils		Sandy Soils	
	Species, Percent, and Rate (lb. PLS per acre)		Species, Percent, and Rate (lb. PLS per acre)	
14 (Austin)	Hooded Windmillgrass (Burnet)	20% 0.4	Hairy Grama (Chaparral)	15% 0.6
	White Tridens (Guadalupe)	10% 0.2	Shortspike Windmillgrass (Welder)	10% 0.2
	Sideoats Grama (South Texas)	10% 1.5	Hooded Windmillgrass (Burnet)	10% 0.2
	Shortspike Windmillgrass (Welder)	10% 0.2	Red Lovegrass (Duval)	10% 0.2
	Plains Bristlegrass (Catarina Blend)	10% 0.6	Sand Dropseed (Nueces)	10% 0.2
	Silver Bluestem (Santiago)	10% 0.4	Little Bluestem (Carrizo)	10% 1.5
	Little Bluestem (OK Select)	10% 0.7	Sideoats Grama (South Texas)	10% 1.5
	Halls Panicum (Oso)	05% 0.1	Silver Bluestem (Santiago)	10% 0.4
	Texas Grama (Atascosa)	05% 0.5	Plains Bristlegrass (Catarina)	10% 0.4
	Canada Wildrye (Lavaca)	10% 2.0	Arizona Cottontop (La Salle)	05% 0.2
15 (San Antonio)	Sideoats Grama (South Texas)	15% 2.25	Slender Grama (Dilley)	15% 1.5
	White Tridens (Guadalupe)	15% 0.3	Hairy Grama (Chaparral)	15% 0.6
	Shortspike Windmillgrass (Welder)	10% 0.2	Shortspike Windmillgrass (Welder)	10% 0.2
	Halls Panicum (Oso)	10% 0.2	Hooded Windmillgrass (Mariah)	10% 0.2
	Plains Bristlegrass (Catarina Blend)	10% 0.6	Red Lovegrass (Duval)	10% 0.2
	False Rhodes Grass (Kinney)	05% 0.1	Sand Dropseed (Nueces)	10% 0.2
	Hooded Windmillgrass (Mariah)	05% 0.1	Pink Pappusgrass (Maverick)	05% 0.3
	Pink Pappusgrass (Maverick)	10% 0.6	Little Bluestem (Carrizo)	10% 1.5
	Texas Grama (Atascosa)	05% 0.5	Arizona Cottontop (La Salle)	05% 0.2
	Multiflower False Rhodes Grass (Hidalgo)	10% 0.2	Multiflower False Rhodes Grass (Hidalgo)	05% 0.1
16 (Corpus Christi)	Arizona Cottontop (La Salle)	05% 0.2	Plains Bristlegrass (Catarina)	05% 0.2
	Shortspike Windmillgrass (Welder)	15% 0.3	Slender Grama (Dilley)	15% 1.5
	Pink Pappusgrass (Maverick)	10% 0.6	Hairy Grama (Chaparral)	15% 0.6
	Halls Panicum (Oso)	10% 0.2	Hooded Windmillgrass (Mariah)	10% 0.2
	Plains Bristlegrass (Catarina Blend)	10% 0.6	Red Lovegrass (Duval)	10% 0.2
	White Tridens (Guadalupe)	10% 0.2	Sand Dropseed (Nueces)	10% 0.2
	Multiflower False Rhodes Grass (Hidalgo)	10% 0.2	Shortspike Windmillgrass (Welder)	10% 0.2
	Hooded Windmillgrass (Mariah)	10% 0.2	Pink Pappusgrass (Maverick)	10% 0.6
	Arizona Cottontop (La Salle)	05% 0.2	Multiflower False Rhodes Grass (Hidalgo)	10% 0.2
	Sand Dropseed (Nueces)	05% 0.1	Arizona Cottontop (La Salle)	05% 0.2
17 (Bryan)	Sideoats Grama (South Texas)	10% 1.5	Little Bluestem (Carrizo)	05% 0.75
	Texas Grama (Atascosa)	05% 0.5		
	White Tridens (Guadalupe)	15% 0.3	Sand Dropseed (Taylor)	10% 0.2
	Hooded Windmillgrass (Burnet)	15% 0.3	Shortspike Windmillgrass (Welder)	10% 0.2
	Little Bluestem (Coastal Plains)	15% 1.5	Little Bluestem (Coastal Plains)	15% 1.5
	Florida Paspalum (Harrison)	15% 2.25	Green Sprangletop (Van Horn)	05% 0.2
	Shortspike Windmillgrass (Welder)	10% 0.2	Florida Paspalum (Harrison)	15% 2.25
	Splitbeard Bluestem (Neches)	05% 0.5	Splitbeard Bluestem (Neches)	10% 1.0
	Green Sprangletop (Van Horn)	05% 0.2	Hooded Windmillgrass (Burnet)	15% 0.3
	Halls Panicum (Oso)	05% 0.1	Red Lovegrass (Duval)	10% 0.2
18 (Dallas)	Sand Dropseed (Taylor)	05% 0.1	Hairy Grama (Chaparral)	10% 0.4
	Canada Wildrye (Lavaca)	10% 2.0		
	Sideoats Grama (Haskell)	15% 1.5	Shortspike Windmillgrass (Welder)	10% 0.2
	Hooded Windmillgrass (Burnet)	15% 0.3	Hairy Grama (Chaparral)	15% 0.6
	White Tridens (Guadalupe)	15% 0.3	Sand Dropseed (Taylor)	10% 0.2
	Little Bluestem (OK Select)	15% 1.05	Little Bluestem (OK Select)	15% 1.05
	Buffalograss (Texoka)	10% 1.5	Sideoats Grama (Haskell)	10% 1.0
	Silver Bluestem (Santiago)	05% 0.2	Green Sprangletop (Van Horn)	10% 0.4
	Green Sprangletop (Van Horn)	05% 0.2	Hooded Windmillgrass (Burnet)	10% 0.2
	Shortspike Windmillgrass (Welder)	05% 0.1	Sand Lovegrass (Mason)	10% 0.4
	Canada Wildrye (Lavaca)	10% 2.0	Silver Bluestem (Santiago)	10% 0.4
	Sand Dropseed (Taylor)	05% 0.1		

Table 1 (continued)
Permanent Rural Seeding Mix

District	Clay Soils		Sandy Soils	
	Species, Percent, and Rate (lb. PLS per acre)		Species, Percent, and Rate (lb. PLS per acre)	
19 (Atlanta)	White Tridens (Guadalupe)	15% 0.3	Hooded Windmillgrass (Burnet)	15% 0.3
	Hooded Windmillgrass (Burnet)	15% 0.3	Sand Dropseed (Taylor)	10% 0.2
	Little Bluestem (Coastal Plains)	20% 2.0	Little Bluestem (Coastal Plains)	20% 2.0
	Florida Paspalum (Harrison)	15% 2.25	Florida Paspalum (Harrison)	15% 2.25
	Sideoats Grama (Haskell)	10% 1.0	Splitbeard Bluestem (Neches)	10% 1.0
	Splitbeard Bluestem (Neches)	05% 0.5	Sand Lovegrass (Mason)	10% 0.4
	Green Sprangletop (Van Horn)	05% 0.2	Red Lovegrass (Duval)	10% 0.2
	Sand Dropseed (Taylor)	05% 0.1	Hairy Grama (Chaparral)	10% 0.4
	Canada Wildrye (Lavaca)	10% 2.0		
20 (Beaumont)	White Tridens (Guadalupe)	10% 0.2	Hooded Windmillgrass (Mariah)	15% 0.3
	Hooded Windmillgrass (Mariah)	10% 0.2	Sand Dropseed (Nueces)	15% 0.3
	Shortspike Windmillgrass (Welder)	15% 0.3	Shortspike Windmillgrass (Welder)	10% 0.2
	Little Bluestem (Coastal Plains)	15% 1.5	Little Bluestem (Coastal Plains)	15% 1.5
	Florida Paspalum (Harrison)	15% 2.25	Red Lovegrass (Duval)	10% 0.2
	Red Lovegrass (Duval)	05% 0.1	Florida Paspalum (Harrison)	15% 2.25
	Halls Panicum (Oso)	10% 0.2	Splitbeard Bluestem (Neches)	10% 1.0
	Splitbeard Bluestem (Neches)	05% 0.5	Hairy Grama (Chaparral)	05% 0.2
	Sand Dropseed (Nueces)	05% 0.1	Green Sprangletop (Van Horn)	05% 0.2
	Canada Wildrye (Lavaca)	10% 2.0		
21 (Pharr)	Shortspike Windmillgrass (Welder)	10% 0.2	Slender Grama (Dilley)	10% 1.0
	Halls Panicum (Oso)	10% 0.2	Hairy Grama (Chaparral)	10% 0.4
	White Tridens (Guadalupe)	10% 0.2	Shortspike Windmillgrass (Welder)	10% 0.2
	Plains Bristlegrass (Catarina Blend)	10% 0.6	Red Lovegrass (Duval)	10% 0.2
	Pink Pappusgrass (Maverick)	10% 0.6	Sand Dropseed (Nueces)	10% 0.2
	Texas Grama (Atascosa)	10% 1.0	Hooded Windmillgrass (Mariah)	10% 0.2
	Multiflower False Rhodes Grass (Hidalgo)	05% 0.1	Pink Pappusgrass (Maverick)	10% 0.6
	Hooded Windmillgrass (Mariah)	10% 0.2	Whiplash Pappusgrass (Webb)	10% 0.6
	Arizona Cottontop (La Salle)	10% 0.4	Multiflower False Rhodes Grass (Hidalgo)	10% 0.2
	Sand Dropseed (Nueces)	05% 0.1	Arizona Cottontop (La Salle)	10% 0.4
	Whiplash Pappusgrass (Webb)	10% 0.6		
22 (Laredo)	Sideoats Grama (South Texas)	15% 2.25	Slender Grama (Dilley)	15% 1.5
	Pink Pappusgrass (Maverick)	10% 0.6	Hairy Grama (Chaparral)	15% 0.6
	Halls Panicum (Oso)	10% 0.2	Hooded Windmillgrass (Mariah)	10% 0.2
	Plains Bristlegrass (Catarina Blend)	10% 0.6	Red Lovegrass (Duval)	10% 0.2
	White Tridens (Guadalupe)	10% 0.2	Sand Dropseed (Nueces)	10% 0.2
	Whiplash Pappusgrass (Webb)	10% 0.6	Pink Pappusgrass (Maverick)	10% 0.6
	Shortspike Windmillgrass (Welder)	05% 0.1	Arizona Cottontop (La Salle)	10% 0.4
	Texas Grama (Atascosa)	10% 1.0	Little Bluestem (Carrizo)	05% 0.75
	False Rhodes Grass (Kinney)	10% 0.2	Sideoats Grama (South Texas)	10% 1.5
23 (Brownwood)	Hooded Windmillgrass (Mariah)	10% 0.2	Shortspike Windmillgrass (Welder)	05% 0.1
	Sideoats Grama (Haskell)	15% 1.5	Green Sprangletop (Van Horn)	15% 0.6
	Hooded Windmillgrass (Burnet)	15% 0.3	Sand Dropseed (Taylor)	15% 0.3
	White Tridens (Guadalupe)	15% 0.3	Sideoats Grama (Haskell)	10% 1.0
	Texas Grama (Atascosa)	10% 1.0	Little Bluestem (OK Select)	15% 1.05
	Little Bluestem (OK Select)	10% 0.7	Silver Bluestem (Santiago)	10% 0.4
	Buffalograss (Texoka)	10% 1.5	Hooded Windmillgrass (Burnet)	10% 0.2
	Silver Bluestem (Santiago)	10% 0.4	Shortspike Windmillgrass (Welder)	10% 0.2
	Shortspike Windmillgrass (Welder)	05% 0.1	Hairy Grama (Chaparral)	10% 0.4
	Sand Dropseed (Taylor)	05% 0.1	Sand Lovegrass (Mason)	05% 0.2
	Green Sprangletop (Van Horn)	05% 0.2		

Table 1 (continued)
Permanent Rural Seeding Mix

District	Clay Soils Species, Percent, and Rate (lb. PLS per acre)	Sandy Soils Species, Percent, and Rate (lb. PLS per acre)
24 (El Paso)	Green Sprangletop (Van Horn) 10% 0.4	Sand Dropseed (Taylor) 20% 0.4
	Sideoats Grama (Brewster) 10% 1.0	Sideoats Grama (Brewster) 15% 1.5
	Whiplash Pappusgrass (Permian) 10% 0.6	Green Sprangletop (Van Horn) 15% 0.6
	Silver Bluestem (Santiago) 10% 0.4	Hooded Windmillgrass (Burnet) 10% 0.2
	Blue Grama (Hachita) 10% 0.4	Blue Grama (Hachita) 10% 0.4
	Galleta Grass (Viva) 10% 0.6	Hairy Grama (Chaparral) 05% 0.2
	Alkali Sacaton (Saltalk) 10% 0.2	Spike Dropseed (Potter) 10% 0.1
	Arizona Cottontop (La Salle) 10% 0.4	Little Bluestem (Pastura) 05% 0.5
	Plains Bristlegrass (Catarina Blend) 10% 0.4	Galleta grass (Viva) 10% 0.6
	False Rhodes Grass (Kinney) 10% 0.2	
25 (Childress)	Sideoats Grama (Haskell) 15% 1.5	Sideoats Grama (Haskell) 15% 1.5
	Hooded Windmillgrass (Burnet) 15% 0.3	Green Sprangletop (Van Horn) 10% 0.4
	Blue Grama (Hachita) 10% 0.4	Sand Dropseed (Taylor) 10% 0.2
	Buffalograss (Texoka) 10% 1.5	Hooded Windmillgrass (Burnet) 10% 0.2
	Galleta Grass (Viva) 10% 0.6	Arizona Cottontop (La Salle) 10% 0.4
	Silver Bluestem (Santiago) 15% 0.6	Blue Grama (Hachita) 10% 0.4
	White Tridens (Guadalupe) 10% 0.2	Little Bluestem (OK select) 10% 1.0
	Green Sprangletop (Van Horn) 05% 0.2	Galleta Grass (Viva) 10% 0.6
	Western Wheatgrass (Barton) 05% 1.5	Sand Lovegrass (Mason) 05% 0.15
	Canada Wildrye (Lavaca) 05% 1.0	Canada Wildrye (Lavaca) 10% 2.0

Table 2
Permanent Urban Seeding Mix

District	Clay Soils Species and Rates (lb. PLS per acre)	Sandy Soils Species and Rates (lb. PLS per acre)
1 (Paris)	Green Sprangletop 0.3	Green Sprangletop 0.3
	Bermudagrass 2.4	Bermudagrass 5.4
	Sideoats Grama (Haskell) 4.5	
2 (Fort Worth)	Green Sprangletop 0.3	Green Sprangletop 0.3
	Sideoats Grama (El Reno) 3.6	Sideoats Grama (El Reno) 3.6
	Bermudagrass 2.4	Bermudagrass 2.1
	Buffalograss (Texoka) 1.6	Sand Dropseed (Borden Co.) 0.3
3 (Wichita Falls)	Green Sprangletop 0.3	Green Sprangletop 0.3
	Sideoats Grama (El Reno) 4.5	Sideoats Grama (El Reno) 3.6
	Bermudagrass 1.8	Bermudagrass 1.8
	Buffalograss (Texoka) 1.6	Sand Dropseed (Borden Co.) 0.4
4 (Amarillo)	Green Sprangletop 0.3	Green Sprangletop 0.3
	Sideoats Grama (El Reno) 3.6	Sideoats Grama (El Reno) 2.7
	Blue Grama (Hachita) 1.2	Blue Grama (Hachita) 0.9
	Buffalograss (Texoka) 1.6	Sand Dropseed (Borden Co.) 0.4
		Buffalograss (Texoka) 1.6
5 (Lubbock)	Green Sprangletop 0.3	Green Sprangletop 0.3
	Sideoats Grama (El Reno) 3.6	Sideoats Grama (El Reno) 2.7
	Blue Grama (Hachita) 1.2	Blue Grama (Hachita) 0.9
	Buffalograss (Texoka) 1.6	Sand Dropseed (Borden Co.) 0.4
		Buffalograss (Texoka) 1.6
6 (Odessa)	Green Sprangletop 0.3	Green Sprangletop 0.3
	Sideoats Grama (Haskell) 3.6	Sideoats Grama (Haskell) 2.7
	Blue Grama (Hachita) 1.2	Sand Dropseed (Borden Co.) 0.4
	Buffalograss (Texoka) 1.6	Blue Grama (Hachita) 0.9
		Buffalograss (Texoka) 1.6
7 (San Angelo)	Green Sprangletop 0.3	Green Sprangletop 0.3
	Sideoats Grama (Haskell) 7.2	Sideoats Grama (Haskell) 3.2
	Buffalograss (Texoka) 1.6	Sand Dropseed (Borden Co.) 0.3
		Blue Grama (Hachita) 0.9
		Buffalograss (Texoka) 1.6

Table 2 (continued)
Permanent Urban Seeding Mix

District	Clay Soils Species and Rates (lb. PLS per acre)	Sandy Soils Species and Rates (lb. PLS per acre)
8 (Abilene)	Green Sprangletop 0.3 Sideoats Grama (Haskell) 3.6 Blue Grama (Hachita) 1.2 Buffalograss (Texoka) 1.6	Green Sprangletop 0.3 Sand Dropseed (Borden Co.) 0.3 Sideoats Grama (Haskell) 3.6 Blue Grama (Hachita) 0.8 Buffalograss (Texoka) 1.6
9 (Waco)	Green Sprangletop 0.3 Bermudagrass 1.8 Buffalograss (Texoka) 1.6 Sideoats Grama (Haskell) 4.5	Green Sprangletop 0.3 Buffalograss (Texoka) 1.6 Bermudagrass 3.6 Sand Dropseed (Borden Co.) 0.4
10 (Tyler)	Green Sprangletop 0.3 Bermudagrass 2.4 Sideoats Grama (Haskell) 4.5	Green Sprangletop 0.3 Bermudagrass 5.4
11 (Lufkin)	Green Sprangletop 0.3 Bermudagrass 2.4 Sideoats Grama (Haskell) 4.5	Green Sprangletop 0.3 Bermudagrass 5.4
12 (Houston)	Green Sprangletop 0.3 Sideoats Grama (Haskell) 4.5 Bermudagrass 2.4	Green Sprangletop 0.3 Bermudagrass 5.4
13 (Yoakum)	Green Sprangletop 0.3 Sideoats Grama (South Texas) 4.5 Bermudagrass 2.4	Green Sprangletop 0.3 Bermudagrass 5.4
14 (Austin)	Green Sprangletop 0.3 Bermudagrass 2.4 Sideoats Grama (South Texas) 3.6 Buffalograss (Texoka) 1.6	Green Sprangletop 0.3 Bermudagrass 4.8 Buffalograss (Texoka) 1.6
15 (San Antonio)	Green Sprangletop 0.3 Sideoats Grama (South Texas) 3.6 Bermudagrass 2.4 Buffalograss (Texoka) 1.6	Green Sprangletop 0.3 Bermudagrass 4.8 Buffalograss (Texoka) 1.6
16 (Corpus Christi)	Green Sprangletop 0.3 Sideoats Grama (South Texas) 3.6 Bermudagrass 2.4 Buffalograss (Texoka) 1.6	Green Sprangletop 0.3 Bermudagrass 4.8 Buffalograss (Texoka) 1.6
17 (Bryan)	Green Sprangletop 0.3 Bermudagrass 2.4 Sideoats Grama (Haskell) 4.5	Green Sprangletop 0.3 Bermudagrass 5.4
18 (Dallas)	Green Sprangletop 0.3 Sideoats Grama (El Reno) 3.6 Buffalograss (Texoka) 1.6 Bermudagrass 2.4	Green Sprangletop 0.3 Buffalograss (Texoka) 1.6 Bermudagrass 3.6 Sand Dropseed (Borden Co.) 0.4
19 (Atlanta)	Green Sprangletop 0.3 Bermudagrass 2.4 Sideoats Grama (Haskell) 4.5	Green Sprangletop 0.3 Bermudagrass 5.4
20 (Beaumont)	Green Sprangletop 0.3 Bermudagrass 2.4 Sideoats Grama (Haskell) 4.5	Green Sprangletop 0.3 Bermudagrass 5.4
21 (Pharr)	Green Sprangletop 0.3 Sideoats Grama (South Texas) 3.6 Buffalograss (Texoka) 1.6 Bermudagrass 2.4	Green Sprangletop 0.3 Buffalograss (Texoka) 1.6 Bermudagrass 3.6 Sand Dropseed (Borden Co.) 0.4
22 (Laredo)	Green Sprangletop 0.3 Sideoats Grama (South Texas) 4.5 Buffalograss (Texoka) 1.6 Bermudagrass 1.8	Green Sprangletop 0.3 Buffalograss (Texoka) 1.6 Bermudagrass 3.6 Sand Dropseed 0.4
23 (Brownwood)	Green Sprangletop 0.3 Sideoats Grama (Haskell) 3.6 Bermudagrass 1.2 Blue Grama (Hachita) 0.9	Green Sprangletop 0.3 Buffalograss (Texoka) 1.6 Bermudagrass 3.6 Sand Dropseed (Borden Co.) 0.4

Table 2 (continued)
Permanent Urban Seeding Mix

District	Clay Soils Species and Rates (lb. PLS per acre)	Sandy Soils Species and Rates (lb. PLS per acre)
24 (El Paso)	Green Sprangletop 0.3	Green Sprangletop 0.3
	Sideoats Grama (South Texas) 3.6	Buffalograss (Texoka) 1.6
	Blue Grama (Hachita) 1.2	Sand Dropseed (Borden Co.) 0.4
	Buffalograss (Texoka) 1.6	Blue Grama (Hachita) 1.8
25 (Childress)	Green Sprangletop 0.3	Green Sprangletop 0.3
	Sideoats Grama (El Reno) 3.6	Sand Dropseed (Borden Co.) 0.4
	Blue Grama (Hachita) 1.2	Buffalograss (Texoka) 1.6
	Buffalograss (Texoka) 1.6	Bermudagrass 1.8

Table 3
Temporary Cool Seeding Mix

District	All Soils Species and Rates (lb. PLS per acre)
1 (Paris), 2 (Fort Worth), 3 (Wichita Falls), 4 (Amarillo), 5 (Lubbock), 6 (Odessa), 7 (San Angelo), 8 (Abilene), 18 (Dallas), 19 (Atlanta), 23 (Brownwood), 24 (El Paso), 25 (Childress)	Oats 30.0 Wheat 30.0 Little Barley 5.0 Western Wheatgrass 5.0
9 (Waco), 10 (Tyler), 11 (Lufkin), 12 (Houston), 13 (Yoakum), 14 (Austin), 15 (San Antonio), 16 (Corpus Christi), 17 (Bryan), 20 (Beaumont), 21 (Pharr), 22 (Laredo)	Oats 40.0 Little Barley 5.0

Table 4
Temporary Warm Seeding Mix

District	All Soils Species and Rates (lb. PLS per acre)
All	Brownton Millet 20.0

Table 5
Flower Seeding Mix

District	All Soils Species and Rates (lb. PLS per acre)
1 (Paris), 10 (Tyler), 11 (Lufkin), 12 (Houston), 17 (Bryan), 19 (Atlanta), 20 (Beaumont)	Herbaceous Mimosa (Crockett) 1.5 Illinois Bundleflower (Sabine) 1.5 Thickspike Gayfeather (Pineywoods) 1.5 Purple Prairie Clover (Kaneb) 0.6 Rio Grande Clammyweed (Zapata) 2.0
2 (Fort Worth), 3 (Wichita Falls), 4 (Amarillo), 5 (Lubbock), 6 (Odessa), 7 (San Angelo), 8 (Abilene), 9 (Waco), 18 (Dallas), 23 (Brownwood), 25 (Childress)	Engelmann Daisy (Eldorado) 1.5 Awnless Bushsunflower (Plateau) 1.5 Partridge Pea 1.5 Illinois Bundleflower (Sabine) 1.5 Rio Grande Clammyweed (Zapata) 2.0
13 (Yoakum), 14 (Austin), 15 (San Antonio), 16 (Corpus Christi), 21 (Pharr), 22 (Laredo), 24 (El Paso)	Indian Blanket (Fuego) 1.0 Awnless Bushsunflower (Venado) 0.4 Prostrate Bundleflower (Balli) 1.5 Orange Zexmenia (Goliad) 0.4 Rio Grande Clammyweed (Zapata) 2.0

- 2.2. **Fertilizer.** Use fertilizer in accordance with Article 166.2., "Materials."
- 2.3. **Water.** Use water in accordance with Article 168.2, "Materials."
- 2.4. **Highly Erodible Land (HEL).** Add Bermudagrass to the mix shown in Table 1 at 1.0 PLS per acre if shown on the plans.

- 2.5. **Mulch.**
- 2.5.1. **Straw or Hay Mulch.** Use straw or hay mulch in accordance with Section 162.2.5., “Mulch.”
- 2.5.2. **Hydro Mulch.** Use mulches that are on the Approved Products List. Submit one full set of manufacturer’s literature for the selected material. Keep mulch dry until applied. Do not use molded or rotted material.
- 2.6. **Tacking Methods.** Use a tacking agent applied in conformance with the manufacturer’s recommendations or by a crimping method on all straw or hay mulch operations. Use tacking agents as approved or as shown on the plans.

3. CONSTRUCTION

Scarify the area to a depth of 4 in. before placing the seed, unless otherwise directed. Use approved equipment to vertically track the seedbed as shown on the plans or as directed. Scarify the seedbed to a depth of 4 in. or mow the area before placement of the permanent seed mix when performing permanent seeding after an established temporary seeding. Plant the seed mix specified and mulch, if required, after the area has been completed to lines and grades as shown on the plans.

Apply fertilizer in accordance with Article 166.3., “Construction.” Grass seed, flower seed, and fertilizer may be distributed simultaneously during dry seeding operations, provided each component is applied at the specified rate. Do not combine fertilizer and seed in the same slurry during hydro mulch seeding operations. Apply half of the required fertilizer during the temporary seeding operation and the other half during the permanent seeding operation when temporary and permanent seeding are both specified for the same area.

Water the seeded areas at the rates and frequencies as shown on the plans or as directed.

Distribute the seed or seed mixture uniformly over the areas shown on the plans. Provide equipment with an agitator or method to maintain a uniform seed mixture during distribution.

- 3.1. **Planting Season.**
- 3.1.1. **Temporary Seed.** Plant cool seeding mix September 1–January 31. Plant warm seeding mix February 1–August 30.
- 3.1.2. **Permanent Seed.** End planting season for all Districts by May 15. Begin planting season for each District based on the following.
- **January 15.** 1 (Paris), 10 (Tyler), 11 (Lufkin), 12 (Houston), 13 (Yoakum), 15 (San Antonio), 16 (Corpus Christi), 17 (Bryan), 19 (Atlanta), 20 (Beaumont), 21 (Pharr), and 22 (Laredo).
 - **February 1.** 2 (Fort Worth), 3 (Wichita Falls), 6 (Odessa), 7 (San Angelo), 8 (Abilene), 9 (Waco), 14 (Austin), 18 (Dallas), 23 (Brownwood), 24 (El Paso), and 25 (Childress).
 - **February 15.** 4 (Amarillo) and 5 (Lubbock).
- 3.2. **Broadcast Seeding.** Use hand or mechanical distribution or hydro-seeding on top of the soil unless otherwise directed. Apply the mixture to the area to be seeded within 30 min. of placement of components in the equipment when seed and water are to be distributed as a slurry during hydro-seeding. Roll the planted area using a light roller or other suitable equipment. Roll sloped areas along the contour of the slopes.
- 3.3. **Straw or Hay Mulch Seeding.** Plant seed in accordance with Section 164.3.2., “Broadcast Seeding.” Apply straw or hay mulch uniformly over the seeded area immediately after planting the seed or seed mixture. Apply straw or hay mulch in accordance with Section 164.3.6., “Straw or Hay Mulching.” Apply tack in accordance with Section 164.2.6., “Tacking Methods.”

- 3.4. **Hydro Mulch Seeding.** Plant seed in accordance with Section 164.3.2, "Broadcast Seeding," before placing mulch. Apply mulch uniformly over the seeded area immediately after planting the seed or seed mixture at the following rates.
- **Sandy Soils with Slopes of 3:1 or Less.** 2,500 lb. per acre.
 - **Sandy Soils with Slopes Greater than 3:1.** 3,000 lb. per acre.
 - **Clay Soils with Slopes of 3:1 or Less.** 2,000 lb. per acre.
 - **Clay Soils with Slopes Greater than 3:1.** 2,300 lb. per acre.
- Mulch rates are based on dry weight of mulch per acre. Mix mulch and water to make a slurry and apply uniformly over the seeded area using suitable equipment.
- 3.5. **Drill Seeding.** Plant at a depth of 1/4–1/3 in. using a pasture- or rangeland-type drill unless otherwise directed. Plant seed along the contour of the slopes.
- 3.6. **Straw or Hay Mulching.** Apply straw or hay mulch uniformly over the area as shown on the plans. Apply straw mulch at 2–2.5 ton per acre. Apply hay mulch at 1.5–2 ton per acre. Use a tacking method over the mulched area in accordance with Section 164.2.6., "Tacking Methods."

4. MEASUREMENT

This Item will be measured by the square yard or by the acre.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Broadcast Seeding (Perm)" of the rural or urban seed mixture and sandy or clay soil specified, "Broadcast Seeding (Temp)" of warm or cool season specified, "Straw or Hay Mulch Seeding (Perm)" of the rural or urban seed mixture and sandy or clay soil specified, "Straw or Hay Mulch Seeding (Temp)" of warm or cool season specified, "Hydro Mulch Seeding (Perm)" of the rural or urban seed mixture and sandy or clay soil specified, "Hydro Mulch Seeding (Temp)" of warm or cool season specified, "Drill Seeding (Perm)" of the rural or urban seed mixture and sandy or clay soil specified, "Drill Seeding (Temp)" of warm or cool season specified, and "Straw or Hay Mulching." This price is full compensation for furnishing materials, seeding mix, flower seeding mix, HEL seeding mix, water for hydro-seeding and hydro-mulching operations, mowing, tacking, labor, equipment, tools, supplies, and incidentals.

Fertilizer will not be paid for directly, but will be subsidiary to this Item.

Water for irrigating the seeded area, when specified, will be paid for under Item 168, "Vegetative Watering."

Item 506

Temporary Erosion, Sedimentation, and Environmental Controls



1. DESCRIPTION

Install, maintain, and remove erosion, sedimentation, and environmental control measures to prevent or reduce the discharge of pollutants and protect environmental resources in accordance with the Stormwater Pollution Prevention Plan (SWP3) and environmental layout shown on the plans. Comply with Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit (CGP) TXR150000 requirements. Control measures are defined as Best Management Practices (BMPs) used to prevent or reduce the discharge of pollutants and measures to protect environmental resources. Control measures include, but are not limited to, rock filter dams, temporary pipe slope drains, temporary paved flumes, construction exits, earthwork for erosion control, pipe, construction perimeter fence, sandbags, temporary sediment control fence, biodegradable erosion control logs, vertical tracking, temporary or permanent seeding, and other measures. Erosion and sediment control devices must be selected from the Erosion Control Approved Products List. Perform work in a manner to prevent degradation of receiving waters, protect environmental resources, facilitate project construction, and comply with applicable federal, state, and local regulations. Ensure the installation and maintenance of control measures are performed in conformance with the manufacturer's or designer's specifications.

2. MATERIALS

Furnish materials in accordance with the following.

- Item 161, "Compost"
- Item 432, "Riprap"
- Item 556, "Pipe Underdrains"

2.1. Rock Filter Dams.

2.1.1. **Aggregate.** Furnish aggregate with approved hardness, durability, cleanliness, and resistance to crumbling, flaking, and eroding. Provide the following.

- **Types 1, 2, and 4 Rock Filter Dams.** Use 3–6-in. aggregate.
- **Type 3 Rock Filter Dams.** Use 4–8-in. aggregate.

2.1.2. **Wire.** Provide minimum 20-gauge galvanized wire for the steel wire mesh and tie wires for Types 2 and 3 rock filter dams. Type 4 dams require:

- a double-twisted, hexagonal weave with a nominal mesh opening of 2-1/2 × 3-1/4 in.,
- minimum 0.0866-in. steel wire for netting,
- minimum 0.1063-in. steel wire for selvages and corners, and
- minimum 0.0866 in. for binding or tie wire.

2.1.3. **Sandbag Material.** Furnish sandbags meeting Section 506.2.8., "Sandbags," except that any gradation of aggregate may be used to fill the sandbags.

2.2. **Temporary Pipe Slope Drains.** Provide corrugated metal pipe, polyvinyl chloride (PVC) pipe, flexible tubing, watertight connection bands, grommet materials, prefabricated fittings, and flared entrance sections as shown on the plans. Recycled and other materials meeting these requirements are allowed if approved.

Furnish concrete in accordance with Item 432.

- 2.3. **Temporary Paved Flumes.** Furnish asphalt concrete, hydraulic cement concrete, or other comparable non-erodible material as shown on the plans. Provide rock or rubble with a minimum diameter of 6 in. and a maximum volume of 1/2 cu. ft. for the construction of energy dissipaters.
- 2.4. **Construction Exits.** Provide materials as shown on the plans and in accordance with this Section.
 - 2.4.1. **Rock Construction Exit.** Provide crushed aggregate for long- and short-term construction exits. Furnish aggregates that are clean, hard, durable, and free of adherent coatings such as salt, alkali, dirt, clay, loam, shale, soft or flaky materials, and organic and injurious matter. Use 4–8-in. aggregate for Type 1. Use 2–4-in. aggregate for Type 3.
 - 2.4.2. **Timber Construction Exit.** Furnish No. 2 quality or better railroad ties and timbers for long-term construction exits, free of large and loose knots and treated to control rot. Fasten timbers using nuts and bolts or lag bolts, of at least 1/2 in. diameter, unless otherwise shown on the plans or allowed. Provide plywood or pressed wafer board at least 1/2 in. thick for short-term exits.
 - 2.4.3. **Foundation Course.** Provide a foundation course consisting of flexible base, bituminous concrete, hydraulic cement concrete, or other materials as shown on the plans or directed.
- 2.5. **Embankment for Erosion Control.** Provide rock, loam, clay, topsoil, or other earth materials that will form a stable embankment to meet the intended use.
- 2.6. **Pipe.** Provide pipe outlet material in accordance with Item 556 and as shown on the plans.
- 2.7. **Construction Perimeter Fence.**
 - 2.7.1. **Posts.** Provide essentially straight wood or steel posts that are at least 60 in. long. Furnish soft wood posts with a minimum diameter of 3 in. or use nominal 2 × 4-in. boards. Furnish hardwood posts with a minimum cross-section of 1-1/2 × 1-1/5 in. Furnish T- or L-shaped steel posts with a minimum weight of 1.25 lb. per foot.
 - 2.7.2. **Fence.** Provide orange construction fencing as approved.
 - 2.7.3. **Fence Wire.** Provide 14-gauge or larger galvanized smooth or twisted wire. Provide 16-gauge or larger tie wire.
 - 2.7.4. **Flagging.** Provide brightly colored flagging that is fade-resistant and at least 3/4 in. wide to provide maximum visibility both day and night.
 - 2.7.5. **Staples.** Provide staples with a crown at least 1/2 in. wide and legs at least 1/2 in. long.
 - 2.7.6. **Used Materials.** Previously used materials meeting the applicable requirements may be used if approved.
- 2.8. **Sandbags.** Provide sandbag material of polypropylene, polyethylene, or polyamide woven fabric with a minimum unit weight of 4 oz. per square yard, a Mullen burst-strength exceeding 300 psi, and an ultraviolet (UV) stability exceeding 70%.

Use natural coarse sand or manufactured sand meeting the gradation shown in Table 1 to fill sandbags. Filled sandbags must be 24–30 in. long, 16–18 in. wide, and 6–8 in. thick.

Table 1
Sand Gradation

Sieve Size	Retained (% by Weight)
#4	Maximum 3%
#100	Minimum 80%
#200	Minimum 95%

Aggregate may be used instead of sand for situations where sandbags are not adjacent to traffic. The aggregate size must not exceed 3/8 in.

- 2.9. **Temporary Sediment Control Fence.** Provide a net-reinforced fence using woven geotextile fabric. Logos visible to the traveling public will not be allowed.
- 2.9.1. **Fabric.** Provide fabric materials in accordance with [DMS-6230](#), "Temporary Sediment Control Fence Fabric."
- 2.9.2. **Posts.** Provide essentially straight wood or steel posts with a minimum length of 48 in., unless otherwise shown on the plans. Furnish soft wood posts at least 3 in. in diameter or use nominal 2 × 4-in. boards. Furnish hardwood posts with a minimum cross-section of 1-1/2 × 1-1/2 in. Furnish T- or L-shaped steel posts with a minimum weight of 1.25 lb. per foot.
- 2.9.3. **Net Reinforcement.** Provide net reinforcement of at least 12.5-gauge (Standard Wire Gauge) galvanized welded wire mesh, with a maximum opening size of 2 × 4 in., at least 24 in. wide, unless otherwise shown on the plans.
- 2.9.4. **Staples.** Provide staples with a crown at least 3/4 in. wide and legs 1/2 in. long.
- 2.9.5. **Used Materials.** Use recycled material meeting the applicable requirements if approved.
- 2.10. **Biodegradable Erosion Control Logs.**
- 2.10.1. **Core Material.** Furnish core material that is biodegradable or recyclable. Use compost, mulch, aspen excelsior wood fibers, chipped site vegetation, agricultural rice or wheat straw, coconut fiber, 100% recyclable fibers, or any other acceptable material unless specifically shown on the plans. Permit no more than 5% of the material to escape from the containment mesh. Furnish compost in accordance with Item 161.
- 2.10.2. **Containment Mesh.** Furnish containment mesh that is 100% biodegradable, photodegradable, or recyclable, such as burlap, twine, UV photodegradable plastic, polyester, or any other acceptable material.
- Furnish biodegradable or photodegradable containment mesh when log will remain in place as part of a vegetative system.
- Furnish recyclable containment mesh for temporary installations.
- 2.10.3. **Size.** Furnish biodegradable erosion control logs with diameters as shown on the plans or as directed. Stuff containment mesh densely so logs do not deform.

3. QUALIFICATIONS, TRAINING, AND EMPLOYEE REQUIREMENTS

- 3.1. **Contractor Responsible Person Environmental (CRPE) Qualifications and Responsibilities.** Provide and designate in writing at the preconstruction conference a CRPE and alternate CRPE who have overall responsibility for managing environmental compliance. The CRPE will implement stormwater and erosion control practices, oversee and observe stormwater control measure monitoring and management, oversee environmental compliance requirements, and monitor the project site daily and produce daily monitoring reports as long as there are BMPs in place or soil disturbing activities are evident to ensure compliance with the SWP3 and TPDES CGP TXR150000. Take required training in accordance with Section 7.7.4.4, "Training."

Maintain daily monitor reports and make them available within 24 hr. upon request. During time suspensions when work is not occurring or on Contract non-work days, daily inspections are not required unless a rain event has occurred. The CRPE will provide recommendations on how to improve the effectiveness of control measures. Attend the Department's preconstruction conference for the project.

Ensure training is completed in accordance with Section 7.7.4.4., "Training," by all applicable personnel before employees work on the project. Document, maintain, and make available within 24 hr. of a request, a list, signed by the CRPE, of all applicable Contractor and subcontractor employees who have completed the training. Include the employee's name, the training course name, and the date the employee completed the training.

- 3.2. **Contractor Superintendent Qualifications and Responsibilities.** Provide a superintendent who is competent, has experience with and knowledge of stormwater management, and is knowledgeable of the requirements and the conditions of the TPDES CGP TXR150000. The superintendent will manage and oversee the day-to-day operations and activities at the project site, work with the CRPE to provide effective stormwater management at the project site, represent and act on behalf of the Contractor, and attend the Department's preconstruction conference for the project. Take training as required in Section 7.7.4.4., "Training."

4. CONSTRUCTION

- 4.1. **Contractor Responsibilities.** Implement the SWP3 for the project site in accordance with the plans and specifications, TPDES CGP TXR150000, and as directed. Coordinate stormwater management with all other work on the project. Develop and implement an SWP3 for project-specific material supply plants within and outside the Department's right of way in conformance with the specific or general stormwater permit requirements. Prevent water pollution from stormwater associated with construction activity from entering any surface water or private property on or adjacent to the project site.
- 4.2. **Implementation.** The CRPE, or alternate CRPE, must be accessible by telephone and able to respond to project-related stormwater management or other environmental emergencies 24 hr. per day.
- 4.2.1. **Commencement.** Implement the SWP3 as shown on the plans and as directed. Contractor-proposed recommendations for changes will be allowed as approved. Conform to the established guidelines in the TPDES CGP TXR150000 to make changes. Do not implement changes until approval has been received and changes have been incorporated into the plans. Minor adjustments to meet field conditions are allowed and will be recorded in the SWP3.
- 4.2.2. **Phasing.** Implement control measures before the commencement of activities that result in soil disturbance. Phase and minimize the soil disturbance to the areas shown on the plans. Coordinate temporary control measures with permanent control measures and all other work activities on the project to assure economical, effective, safe, and continuous water pollution prevention. Provide control measures that are appropriate to the construction means, methods, and sequencing allowed by the Contract. Exercise precaution throughout the life of the project to prevent pollution of ground waters and surface waters. Schedule and perform clearing and grubbing operations so that stabilization measures will follow immediately thereafter if project conditions permit. Bring all grading sections to final grade as soon as possible and implement temporary and permanent control measures at the earliest time possible. Implement temporary control measures when required by TPDES CGP TXR150000 or otherwise necessitated by project conditions.
- Do not prolong final grading and shaping. Preserve vegetation where possible throughout the project, and minimize clearing, grubbing, and excavation within stream banks, bed, and approach sections.
- 4.3. **General.**
- 4.3.1. **Temporary Alterations or Control Measure Removal.** Altering or removal of control measures is allowed when control measures are restored within the same working day.

- 4.3.2. **Stabilization.** Initiate stabilization for disturbed areas no more than 14 days after the construction activities in that portion of the site have temporarily or permanently ceased. Establish a uniform vegetative cover or use another stabilization practice in accordance with TPDES CGP TXR150000.
- 4.3.3. **Finished Work.** Remove and dispose of all temporary control measures upon acceptance of vegetative cover or other stabilization practice unless otherwise directed. Complete soil disturbing activities and establish a uniform perennial vegetative cover. A project will not be considered for acceptance until a vegetative cover of 70% density of existing adjacent undisturbed areas is obtained or equivalent permanent stabilization is obtained in accordance with TPDES CGP TXR150000. The Engineer may accept the work before vegetative cover of 70% density of existing adjacent undisturbed areas. An exception will be allowed in arid areas as defined in TPDES CGP TXR150000.
- 4.3.4. **Restricted Activities and Required Precautions.** Do not discharge onto the ground or into surface waters any pollutants such as chemicals, raw sewage, fuels, lubricants, coolants, hydraulic fluids, bitumens, or any other petroleum product. Operate and maintain equipment onsite to prevent actual or potential water pollution. Manage, control, and dispose of litter onsite such that no adverse impacts to water quality occur. Prevent dust from creating a potential or actual unsafe condition, public nuisance, or condition endangering the value, utility, or appearance of any property. Wash out concrete trucks only as described in TPDES CGP TXR150000. Use appropriate controls to minimize the offsite transport of suspended sediments and other pollutants if it is necessary to pump or channel standing water (i.e., dewatering). Immediately address chemical and hydrocarbon spills caused by the Contractor. Keep a spill kit onsite. Prevent discharges that would contribute to a violation of Edwards Aquifer Rules, water quality standards, the impairment of a listed water body, or other state or federal law.
- 4.4. **Installation, Maintenance, and Removal Work.** Perform work in accordance with the SWP3, in conformance with manufacturers' guidelines, and in accordance with TPDES CGP TXR150000. Install and maintain the integrity of temporary erosion and sedimentation control devices to accumulate silt and debris until soil disturbing activities are completed and permanent erosion control features are in place, or the disturbed area has been adequately stabilized as approved.

The Department will inspect and document the condition of the control measures at the frequency shown on the plans and will provide the Construction SWP3 Field Inspection and Maintenance Reports to the Contractor. Make corrections as soon as possible before the next anticipated rain event or within 7 calendar days after being able to enter the worksite for each control measure. The only acceptable reason for not accomplishing the corrections within the timeframe specified is when site conditions are considered "too wet to work." Take immediate action if a correction is deemed critical as directed. When corrections are not made within the established timeframe, all work will cease on the project and time charges will continue while the control measures are brought into compliance. Commence work once the Engineer reviews and documents the project is in compliance. Commencing work does not release the Contractor of the liability for noncompliance with the SWP3, the plans, or TPDES CGP TXR150000.

The Engineer may limit the disturbed area if the Contractor cannot control soil erosion and sedimentation resulting from the Contractor's operations. Implement additional controls as directed.

Remove devices upon approval or as directed. Finish-grade and dress the area upon removal. Stabilize disturbed areas in accordance with TPDES CGP TXR150000, and as shown on the plans or directed. Materials removed are considered consumed by the project. Retain ownership of stockpiled material and remove it from the project when new installations or replacements are no longer required.

- 4.4.1. **Rock Filter Dams for Erosion Control.** Remove trees, brush, stumps, and other objectionable material that may interfere with the construction of rock filter dams. Place sandbags as a foundation when required or at the Contractor's option.

Place the aggregate to the lines, height, and slopes specified, without undue voids for Types 1, 2, 3, and 5. Place the aggregate on the mesh and then fold the mesh at the upstream side over the aggregate and secure it to itself on the downstream side using wire ties, or hog rings for Type 2 and Type 3, or as directed.

Place rock filter dams perpendicular to the flow of the stream or channel unless otherwise directed. Construct filter dams in accordance with the following criteria unless otherwise shown on the plans.

4.4.1.1.

Type 1 (Non-Reinforced).

- **Height.** At least 18 in. measured vertically from existing ground to top of filter dam.
- **Top Width.** At least 2 ft.
- **Slopes.** No steeper than 2:1.

4.4.1.2.

Type 2 (Reinforced).

- **Height.** At least 18 in. measured vertically from existing ground to top of filter dam.
- **Top Width.** At least 2 ft.
- **Slopes.** No steeper than 2:1.

4.4.1.3.

Type 3 (Reinforced).

- **Height.** At least 36 in. measured vertically from existing ground to top of filter dam.
- **Top Width.** At least 2 ft.
- **Slopes.** No steeper than 2:1.

4.4.1.4.

Type 4 (Sack Gabions). Unfold sack gabions and smooth out kinks and bends. Connect the sides by lacing in a single-loop-double-loop pattern on 4–5-in. spacing for vertical filling. Pull the end lacing rod at one end until tight, wrap around the end, and twist four times. Fill with stone at the filling end, pull the rod tight, cut the wire with approximately 6 in. remaining, and twist wires four times.

Place the sack flat in a filling trough, fill with stone, connect sides, and secure ends as described above for horizontal filling.

Lift and place without damaging the gabion. Shape sack gabions to existing contours.

4.4.1.5.

Type 5. Provide rock filter dams as shown on the plans.

4.4.2.

Temporary Pipe Slope Drains. Install pipe with a slope as shown on the plans or as directed. Construct embankment for the drainage system in 8-in. lifts to the required elevations. Hand-tamp the soil around and under the entrance section to the top of the embankment as shown on the plans or as directed. Form the top of the embankment or earth dike over the pipe slope drain at least 1 ft. higher than the top of the inlet pipe at all points. Secure the pipe with hold-downs or hold-down grommets spaced at most 10 ft. on center. Construct the energy dissipaters or sediment traps as shown on the plans or as directed. Construct the sediment trap using concrete or rubble riprap in accordance with Item 432, when shown on the plans.

4.4.3.

Temporary Paved Flumes. Construct paved flumes as shown on the plans or as directed. Provide excavation and embankment (including compaction of the subgrade) of material to the dimensions shown on the plans unless otherwise indicated. Install a rock or rubble riprap energy dissipater, constructed from the materials specified above, to a minimum depth of 9 in. at the flume outlet to the limits shown on the plans or as directed.

4.4.4.

Construction Exits. Prevent traffic from crossing or exiting the construction site or moving directly onto a public roadway, alley, sidewalk, parking area, or other right of way areas other than at the location of construction exits when tracking conditions exist. Construct exits for either long- or short-term use.

4.4.4.1.

Long-Term. Place the exit over a foundation course as required. Grade the foundation course or compacted subgrade to direct runoff from the construction exits to a sediment trap as shown on the plans or as directed. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed.

4.4.4.1.1.

Type 1. Construct to a depth of at least 8 in. using crushed aggregate as shown on the plans or as directed.

- 4.4.4.1.2. **Type 2.** Construct using railroad ties and timbers as shown on the plans or as directed.
- 4.4.4.2. **Short-Term.**
- 4.4.4.2.1. **Type 3.** Construct using crushed aggregate, plywood, or wafer board. This type of exit may be used for daily operations where long-term exits are not practical.
- 4.4.4.2.2. **Type 4.** Construct as shown on the plans or as directed.
- 4.4.5. **Earthwork for Erosion Control.** Perform excavation and embankment operations to minimize erosion and to remove collected sediments from other erosion control devices.
- 4.4.5.1. **Excavation and Embankment for Erosion Control Features.** Place earth dikes, swales, or combinations of both along the low crown of daily lift placement, or as directed, to prevent runoff spillover. Place swales and dikes at other locations as shown on the plans or as directed to prevent runoff spillover or to divert runoff. Construct cuts with the low end blocked with undisturbed earth to prevent erosion of hillsides. Construct sediment traps at drainage structures in conjunction with other erosion control measures as shown on the plans or as directed.
- Create a sediment basin, where required, providing 3,600 cu. ft. of storage per acre drained, or equivalent control measures for drainage locations that serve an area with 10 or more disturbed acres at one time, not including offsite areas.
- 4.4.5.2. **Excavation of Sediment and Debris.** Remove sediment and debris when accumulation affects the performance of the devices, after a rain, and when directed.
- 4.4.6. **Construction Perimeter Fence.** Construct, align, and locate fencing as shown on the plans or as directed.
- 4.4.6.1. **Installation of Posts.** Embed posts 18 in. deep or adequately anchor in rock, with a spacing of 8–10 ft.
- 4.4.6.2. **Wire Attachment.** Attach the top wire to the posts at least 3 ft. from the ground. Attach the lower wire midway between the ground and the top wire.
- 4.4.6.3. **Flag Attachment.** Attach flagging to both wire strands midway between each post. Use flagging at least 18 in. long. Tie flagging to the wire using a square knot.
- 4.4.7. **Sandbags for Erosion Control.** Construct a berm or dam of sandbags that will intercept sediment-laden stormwater runoff from disturbed areas, create a retention pond, detain sediment, and release water in sheet flow. Fill each bag with sand so that at least the top 6 in. of the bag is unfilled to allow for proper tying of the open end. Place the sandbags with their tied ends in the same direction. Offset subsequent rows of sandbags 1/2 the length of the preceding row. Place a single layer of sandbags downstream as a secondary debris trap. Place additional sandbags as necessary or as directed for supplementary support to berms or dams of sandbags or earth.
- 4.4.8. **Temporary Sediment Control Fence.** Provide temporary sediment control fence near the downstream perimeter of a disturbed area to intercept sediment from sheet flow. Incorporate the fence into erosion control measures used to control sediment in areas of higher flow. Install the fence as shown on the plans, in accordance with this Section, or as directed.
- 4.4.8.1. **Installation of Posts.** Embed posts at least 18 in. deep or adequately anchor, if in rock, with a spacing of 6–8 ft., and install on a slight angle toward the runoff source.
- 4.4.8.2. **Fabric Anchoring.** Dig trenches along the uphill side of the fence to anchor 6–8 in. of fabric. Provide a minimum trench cross-section of 6 × 6 in. Place the fabric against the side of the trench and align approximately 2 in. of fabric along the bottom in the upstream direction. Backfill the trench, then hand-tamp.

4.4.8.3. **Fabric and Net Reinforcement Attachment.** Attach the reinforcement to wooden posts using staples, or to steel posts using T-clips, in at least four places equally spaced unless otherwise shown on the plans. Sewn vertical pockets may be used to attach reinforcement to end posts. Fasten the fabric to the top strand of reinforcement using hog rings or cord every 15 in. or less.

4.4.8.4. **Fabric and Net Splices.** Locate splices at a fence post with a minimum lap of 6 in. attached in at least six places equally spaced unless otherwise shown on the plans. Do not locate splices in concentrated flow areas.

Requirements for installation of used temporary sediment control fence include the following:

- fabric with minimal or no visible signs of biodegradation (weak fibers),
- fabric without excessive patching (more than one patch every 15–20 ft.),
- posts without bends, and
- backing without holes.

4.4.9. **Biodegradable Erosion Control Logs.** Install biodegradable erosion control logs near the downstream perimeter of a disturbed area to intercept sediment from sheet flow. Incorporate the biodegradable erosion control logs into the erosion measures used to control sediment in areas of higher flow. Install, align, and locate the biodegradable erosion control logs as specified below, as shown on the plans, or as directed.

Secure biodegradable erosion control logs in a method adequate to prevent displacement resulting from normal rain events, to prevent damage to the logs, and as approved, such that flow is not allowed under the logs. Temporarily removing and replacing biodegradable erosion logs to facilitate daily work is allowed at the Contractor's expense.

4.4.10. **Vertical Tracking.** Perform vertical tracking on slopes to temporarily stabilize soil. Provide equipment with a track undercarriage capable of producing a linear soil impression measuring at least 12 in. long × 2–4 in. wide × 1/2–2 in. deep. Do not exceed 12 in. between track impressions. Install continuous linear track impressions where the 12-in. length impressions are perpendicular to the slope. Vertical tracking is required on projects where soil disturbing activities have occurred, unless otherwise approved.

4.5. **Monitoring and Documentation.** Monitor the control measures daily as long as there are BMPs in place or soil disturbing activities are evident to ensure compliance with the SWP3 and TPDES CGP TXR150000. During time suspensions when work is not occurring or contract non-work days, daily inspections are not required unless a rain event has occurred. Monitoring will consist of, but is not limited to, observing, inspecting, and documenting site locations with control measures and discharge points to provide maintenance and inspection of controls in accordance with the SWP3. Keep written records of daily monitoring. Document in the daily monitoring report the control measure condition, the date of inspection, required corrective actions, the responsible person for making the corrections, and the date corrective actions were completed. Maintain records of all monitoring reports at the project site or at an approved place. Provide copies within 7 days. Together, the CRPE and an Engineer's representative will complete the Construction Stage Gate Checklist periodically as directed.

5. MEASUREMENT

5.1. **Rock Filter Dams.** Installation or removal of rock filter dams will be measured by the foot or by the cubic yard. The measured volume will include sandbags, when used.

5.1.1. **Linear Measurement.** When rock filter dams are measured by the foot, measurement will be along the centerline of the top of the dam.

5.1.2. **Volume Measurement.** When rock filter dams are measured by the cubic yard, measurement will be based on the volume of rock computed by the method of average end areas.

5.1.2.1. **Installation.** Measurement will be made in final position.

- 5.1.2.2. **Removal.** Measurement will be made at the point of removal.
- 5.2. **Temporary Pipe Slope Drains.** Temporary pipe slope drains will be measured by the foot.
- 5.3. **Temporary Paved Flumes.** Temporary paved flumes will be measured by the square yard of surface area. The measured area will include the energy dissipater at the flume outlet.
- 5.4. **Construction Exits.** Construction exits will be measured by the square yard of surface area.
- 5.5. **Earthwork for Erosion and Sediment Control.**
- 5.5.1. **Equipment and Labor Measurement.** Equipment and labor used will be measured by the actual number of hours the equipment is operated and the labor is engaged in the work.
- 5.5.2. **Volume Measurement.**
- 5.5.2.1. **In Place.**
- 5.5.2.1.1. **Excavation.** Excavation will be measured by the cubic yard in its original position and the volume computed by the method of average end areas.
- 5.5.2.1.2. **Embankment.** Embankment will be measured by the cubic yard in its final position by the method of average end areas. The volume of embankment will be determined between:
- the original ground surfaces or the surface upon which the embankment is to be constructed for the feature and
 - the lines, grades, and slopes of the accepted embankment for the feature.
- 5.5.2.2. **In Vehicles.** Excavation and embankment quantities will be combined and paid for under "Earthwork (Erosion and Sediment Control, In Vehicle)." Excavation will be measured by the cubic yard in vehicles at the point of removal. Embankment will be measured by the cubic yard in vehicles measured at the point of delivery. Shrinkage or swelling factors will not be considered in determining the calculated quantities.
- 5.6. **Construction Perimeter Fence.** Construction perimeter fence will be measured by the foot.
- 5.7. **Sandbags for Erosion Control.** Sandbags will be measured as each sandbag or by the foot along the top of sandbag berms or dams.
- 5.8. **Temporary Sediment Control Fence.** Installation or removal of temporary sediment control fence will be measured by the foot.
- 5.9. **Biodegradable Erosion Control Logs.** Installation or removal of biodegradable erosion control logs will be measured by the foot along the centerline of the top of the control logs.
- 5.10. **Vertical Tracking.** Vertical tracking will not be measured or paid for directly, but will be subsidiary to this Item.

6. PAYMENT

The following will not be paid for directly, but will be subsidiary to pertinent Items:

- erosion control measures for Contractor project-specific locations (PSLs) inside and outside the right of way (e.g., construction and haul roads, field offices, equipment and supply areas, plants, and material sources);
- removal of litter, unless a separate pay item is shown on the plans;
- repair to devices and features damaged by Contractor operations;

- added measures and maintenance needed due to negligence, carelessness, lack of maintenance, and failure to install permanent controls;
- removal and reinstallation of devices and features needed for the convenience of the Contractor;
- finish grading and dressing upon removal of the device; and
- minor adjustments including but not limited to plumbing posts, reattaching fabric, minor grading to maintain slopes on an erosion embankment feature, or moving small numbers of sandbags.

Stabilization of disturbed areas will be paid for under pertinent Items except vertical tacking, which will be subsidiary.

Furnishing and installing pipe for outfalls associated with sediment traps and ponds will not be paid for directly, but will be subsidiary to the excavation and embankment under this Item.

- 6.1. **Rock Filter Dams.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid as follows.

- 6.1.1. **Installation.** Installation will be paid for as "Rock Filter Dams (Install)" of the type and slope as specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals.

- 6.1.2. **Removal.** Removal will be paid for as "Rock Filter Dams (Remove)." This price is full compensation for furnishing and operating equipment, proper disposal, labor, materials, tools, and incidentals.

When the Engineer directs that the rock filter dam installation or portions thereof be replaced, payment will be made at the unit price bid for "Rock Filter Dams (Remove)" and for "Rock Filter Dams (Install)" of the type specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals.

- 6.2. **Temporary Pipe Slope Drains.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Pipe Slope Drains" of the size specified. This price is full compensation for furnishing materials, removal and disposal, furnishing and operating equipment, labor, tools, and incidentals.

Removal of temporary pipe slope drains will not be paid for directly, but will be subsidiary to the installation Item. When the Engineer directs that the pipe slope drain installation or portions thereof be replaced, payment will be made at the unit price bid for "Temporary Pipe Slope Drains" of the size specified, which is full compensation for the removal and reinstallation of the pipe drain.

Earthwork required for the pipe slope drain installation, including construction of the sediment trap, will be measured and paid for under "Earthwork for Erosion and Sediment Control."

Riprap concrete or stone, when used as an energy dissipater or as a stabilized sediment trap, will be measured and paid for in accordance with Item 432.

- 6.3. **Temporary Paved Flumes.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Paved Flume (Install)" or "Temporary Paved Flume (Remove)." This price is full compensation for furnishing and placing materials, removal and disposal, equipment, labor, tools, and incidentals.

When the Engineer directs that the paved flume installation or portions thereof be replaced, payment will be made at the unit prices bid for "Temporary Paved Flume (Remove)" and "Temporary Paved Flume (Install)." These prices are full compensation for the removal and replacement of the paved flume and for equipment, labor, tools, and incidentals.

Earthwork required for the paved flume installation, including construction of a sediment trap, will be measured and paid for under "Earthwork for Erosion and Sediment Control."

- 6.4. **Construction Exits.** Contractor-required construction exits from off right of way locations or on right of way PSLs will not be paid for directly, but will be subsidiary to pertinent Items.

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" for construction exits needed on right of way access to work areas required by the Department will be paid for at the unit price bid for "Construction Exits (Install)" of the type specified or "Construction Exits (Remove)." This price is full compensation for furnishing and placing materials, excavating, removal and disposal, cleaning vehicles, labor, tools, and incidentals.

When the Engineer directs that a construction exit or portion thereof be removed and replaced, payment will be made at the unit prices bid for "Construction Exit (Remove)" and "Construction Exit (Install)" of the type specified. These prices are full compensation for the removal and replacement of the construction exit and for equipment, labor, tools, and incidentals.

Construction of sediment traps used in conjunction with the construction exit will be measured and paid for under "Earthwork for Erosion and Sediment Control."

- 6.5. **Earthwork for Erosion and Sediment Control.**

- 6.5.1. **Initial Earthwork for Erosion and Sediment Control.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Excavation (Erosion and Sediment Control, In Place)," "Embankment (Erosion and Sediment Control, In Place)," "Excavation (Erosion and Sediment Control, In Vehicle)," "Embankment (Erosion and Sediment Control, In Vehicle)," or "Earthwork (Erosion and Sediment Control, In Vehicle)."

This price is full compensation for excavation and embankment, including hauling; disposal of material not used elsewhere on the project; embankments including furnishing material from approved sources and construction of erosion control features; and equipment, labor, tools, and incidentals.

Sprinkling and rolling required by this Item will not be paid for directly, but will be subsidiary to this Item.

- 6.5.2. **Maintenance Earthwork for Erosion and Sediment Control for Cleaning and Restoring Control Measures.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid under a Contractor Force Account Item from invoice provided to the Engineer.

This price is full compensation for excavation, embankment, and re-grading, including dewatering for removal of accumulated sediment, and the removal of accumulated sediment in various erosion control installations as directed, hauling, and disposal of material not used elsewhere on the project; excavation for construction of erosion control features; embankments, including furnishing material from approved sources and construction of erosion control features; and equipment, labor, tools, and incidentals.

Earthwork needed to remove and obliterate erosion control features will not be paid for directly, but will be subsidiary to pertinent Items unless otherwise shown on the plans.

Sprinkling and rolling required by this Item will not be paid for directly, but will be subsidiary to this Item.

- 6.6. **Construction Perimeter Fence.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Construction Perimeter Fence." This price is full compensation for furnishing and placing the fence; digging, fence posts, wire, and flagging; removal and disposal; and materials, equipment, labor, tools, and incidentals.

Removal of construction perimeter fence will not be paid for directly, but will be subsidiary to the installation Item. When the Engineer directs that the perimeter fence installation or portions thereof be removed and replaced, payment will be made at the unit price bid for "Construction Perimeter Fence," which is full compensation for the removal and reinstallation of the construction perimeter fence.

- 6.7. **Sandbags for Erosion Control.** Sandbags will be paid for at the unit price bid for “Sandbags for Erosion Control” (of the height specified when measurement is by the foot). This price is full compensation for materials, placing sandbags, removal and disposal, equipment, labor, tools, and incidentals.
- Removal of sandbags will not be paid for directly, but will be subsidiary to the installation Item. When the Engineer directs that the sandbag installation or portions thereof be replaced, payment will be made at the unit price bid for “Sandbags for Erosion Control,” which is full compensation for the reinstallation of the sandbags.
- 6.8. **Temporary Sediment Control Fence.** The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid as follows.
- 6.8.1. **Installation.** Installation will be paid for as “Temporary Sediment-Control Fence (Install).” This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals.
- 6.8.2. **Removal.** Removal will be paid for as “Temporary Sediment-Control Fence (Remove).” This price is full compensation for furnishing and operating equipment, proper disposal, labor, materials, tools, and incidentals.
- 6.9. **Biodegradable Erosion Control Logs.** The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid as follows.
- 6.9.1. **Installation.** Installation will be paid for as “Biodegradable Erosion Control Logs (Install)” of the size specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, staking, proper disposal, labor, materials, tools, and incidentals.
- 6.9.2. **Removal.** Removal will be paid for as “Biodegradable Erosion Control Logs (Remove).” This price is full compensation for furnishing and operating equipment, proper disposal, labor, materials, tools, and incidentals.
- 6.10. **Vertical Tracking.** Vertical tracking will not be measured or paid for directly, but will be subsidiary to this Item.

ITEM

530 BARRICADES, SIGNS, AND TRAFFIC HANDLING

530.1. DESCRIPTION: *This item shall govern for providing, installing, moving, repairing, maintaining, cleaning and removing upon completion of work, all barricades, signs, cones, lights and other such type devices and of handling traffic as indicated on the plans or as directed by the Engineer.*

530.2. GUIDELINES FOR BARRICADING ON CITY RIGHT-OF-WAY: The barricade contractor must locally maintain sufficient materials in stock to accommodate three or more construction phases per project. These will include all applicable traffic control sign types, trucks, trailers, arrow boards, and all other traffic control devices assigned to the Contractor's barricading operation.

The *Texas Manual on Uniform Traffic Control Devices (TMUTCD)*, Section 6A-6, requires the appropriate training for all personnel who are involved in the selection, placement, and maintenance of traffic control devices on construction projects. The City of San Antonio requires that all personnel associated with barricading operations and traffic handling possess certificates from either of the two groups listed in Table 1 below. Each certificate will be valid for four years.

**Table 1
Barricading Training**

Texas Engineering Extension Service	American Traffic Safety Service Association
Work Zone Traffic Control	Training Course for Worksite Traffic Supervisors

The Contractor shall have a minimum of one barricade supervisor and three persons who are responsible for construction work zone traffic control. These persons shall be based in the San Antonio metropolitan area and their sole tasks shall be implementing and maintaining construction work zone traffic control devices.

The Contractor shall have a commercial telephone answering service during non-working hours. The Contractor shall provide the City during working hours with an office telephone number, pager number, and cellular telephone number to contact the barricading supervisor. The contractor must be able to respond to any call within two hours. The barricading contractor or General Contractor must possess liability insurance in the minimum amount of one million dollars. A copy of the liability policy must be sent to the City Traffic Engineer for approval 48 hours prior to starting barricading operations.

The contractor shall comply with all standards set forth in the plan barricade detail sheets. One noncompliance letter issued by the City to the Contractor in regard to construction work zone traffic control, and not corrected within 48 hours, will be cause for delay of payment for this item.

If the general contractor elects to do his own barricading, he must comply with all the foregoing requirements. Additionally, a general contractor will be required to submit a traffic control plan (TCP) at least 72 hours in advance (excluding weekends and holidays) of starting work in each construction phase. Upon satisfactory evidence of competent barricading expertise, this requirement for a traffic control plan may be waived by the City Traffic Engineer.

530.3. EQUIPMENT: Provide the machinery, tools and equipment necessary for proper prosecution of the work. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

530.4. CONSTRUCTION: All barricades, signs, and other types of devices listed above shall conform to the requirements of the TMUTCD. It is the contractor's responsibility to see that all traffic control devices are properly installed and maintained at the job site. If it is determined by the Traffic Engineering Representative that the traffic control devices do not conform to the established standards, or are incorrectly placed to protect the general public, the Traffic Engineer shall have the option to stop the work, at no expense to the City, until the situation is corrected by the Contractor. If it is determined that additional temporary traffic control devices, special directional devices, and/or business name signs are required, they will be provided by the contractor at no additional cost. As work progresses, the location of temporary traffic control devices will be adjusted and modified as necessary by the Contractor.

All retro reflective traffic control devices such as barricades, vertical panels, signs, etc., shall be maintained by cleaning, replacing or a combination thereof such that during darkness and rain, the retro reflective characteristics shall equal or exceed the retro reflective characteristics of the standard reflective panels in the Inspector's possession.

The contractor shall contact the City of San Antonio Traffic Operations Section prior to removing any traffic signs or traffic signals. Prior to completion of the contract and removal of barricades, all applicable permanent traffic signs and signals must be in place and functioning properly. All permanent signs or traffic control devices missing or damaged during construction shall be replaced at the contractor's expense. Permanent pavement marking shall be applied prior to the opening of any street to traffic. Temporary short-term expendable pavement markings may be provided prior to application of permanent markings.

The contractor must maintain all streets open to through traffic by repairing trenches, potholes, etc., at no direct payment. The contractor shall provide reasonable access to residences and all businesses within all phases of the work, as well as providing suitable access accommodations for school children, pedestrians, garbage pick-up and mail delivery by the US Postal Service. Temporary pedestrian crossing will be determined in the field by the Police Department School Services Unit. Temporary pedestrian crossings shall be 4 feet wide by 4 inches thick asphalt treated base or asphaltic concrete and will be paid for under Item 206, "Asphalt Treated Base" or Item 205, "Hot Mix Asphaltic Concrete Pavement," respectively.

When flagging is required by the plans or Traffic Control Plan, provide a Contractor representative who has been certified as a flagging instructor through courses offered by the Texas Engineering Extension Service, the American Traffic Safety Services Association, the National Safety Council, or other approved organizations. Provide the certificate indicating course completion when requested. This representative is responsible for training and assuring that all flaggers are qualified to perform flagging duties. A qualified flagger must be independently certified by one of the organizations listed above or trained by the Contractor's certified flagging instructor. Provide the Engineer with a current list of qualified flaggers before beginning flagging activities. Use only flaggers on the qualified list.

Flaggers must be courteous and able to effectively communicate with the public. When directing traffic, flaggers must use standard attire, flags, signs, and signals and follow the flagging procedures set forth in the TMUTCD.

530.5. MEASUREMENT: This item will be measured by "Lump Sum" as indicated on the plans.

530.6. PAYMENT: This item will be paid for at the contract lump sum price bid for “barricades, signs, and traffic handling”. This price shall be full compensation for furnishing all labor, materials, supplies, equipment and incidentals necessary. To complete the work as specified. The lump sum price will be pro-rated based on the number of workdays in the project contract. Failure to complete the work within time allowed in the project contract due to approving designs, testing, material shortages, closed construction season, curing periods, and testing periods will not qualify for additional compensation. When additional work is added by an approved field alteration or when work is suspended for the convenience of the City, through no fault of the contractor, additional compensation may be paid to the Contractors.

530.7. BID ITEM:

Item 530.1 - Barricades, Signs and Traffic Handling - lump sum