ITEM NO. 812
WATER MAIN INSTALLATION

812.1 DESCRIPTION: This item shall consist of water main installation in accordance with these specifications and as directed by the Inspector.

812.2 SUBMITTALS: Contractor shall submit manufacturer’s product data, installation instructions, recommendations, shop drawings, and any required installer certification(s).

812.3 MATERIALS: The materials for water main installation shall conform to the specifications contained within the latest revision of SAWS Material Specifications "Ductile Iron Pipe," Item No. 05-11, "Steel Water Pipe," Item No. 05-30, "PVC C-900 Water Pipe," Item No. 05-12, “PVC C-905 Water Pipe,” Item No. 819-01, "PVC C-909 Water Pipe," Item No. 05-13, and "Reinforced Concrete Water Pipe Steel Cylinder Type", Item No. 05-20. The pressure rating for pipe materials apply to any work performed in SAWS Pressure Zones 9-16 shall be in accordance with Table HP-1, "High Pressure Zones." Minimum pressure rating for all pipes in high pressure zones shall be 200 psi.

1. PVC water pipe shall be blue in color. 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)
2. White-colored PVC pipe is acceptable if labeled in accordance with item 1.

812.4 CONSTRUCTION:

1. **Start of Work:** The Contractor shall start his work at a tie-in or point designated by the Inspector. Pipe shall be laid with bell ends facing in the direction of pipe laying, unless otherwise authorized or directed by the Inspector. All valves and fire hydrants must be installed as soon as pipe laying reaches their established location. All pipe shall be installed to the required lines and grades with fittings, valves, and hydrants placed at the required locations. Spigots shall be centered in bells or collars, all valves and hydrant stems shall be set plumb, and fire hydrant nozzles shall face as per SAWS standard details or as directed by the Engineer. No valve or other control on the existing system shall be operated for any purpose by the Contractor unless a representative of SAWS is present.

2. **Crossing Other Underground Lines:** New water mains crossing any other utility shall have a minimum of 30 inches of cover over the top of the pipe, unless otherwise waived or modified by the Engineer. Excavation around other utilities shall be done by hand for at least 12 inches all around. Any damage to the protective wrap on gas lines or electrodes shall be reported immediately to the CPS Energy, phone (210) 353-4357. Any damage to other utilities shall be reported to their proper governing entity. In both these cases of utility damage, Contractor shall also promptly notify the Inspector.

3. **Pipe Separation - Parallel Lines:**

   a. Where a new potable waterline parallels an existing, non-pressure or pressure-rated wastewater main or lateral and the licensed professional engineer licensed in the State of Texas is able to determine that the existing wastewater main or lateral is not leaking, the new potable waterline shall be located at least two feet above the existing wastewater main or lateral, measured vertically, and at least four feet away, measured horizontally, from the existing wastewater main or lateral. Every effort shall be exerted not to disturb the bedding and backfill of the existing wastewater main or lateral.
b. Where a new potable waterline parallels an existing pressure-rated wastewater main or lateral and it cannot be determined by the licensed professional engineer if the existing line is leaking, the existing wastewater main or lateral shall be replaced with at least 150 psi pressure-rated pipe. The new potable waterline shall be located at least two feet above the new wastewater line, measured vertically, and at least four feet away, measured horizontally, from the replaced wastewater main or lateral.

c. Where a new potable waterline parallels a new wastewater main, the wastewater main or lateral shall be constructed of at least 150 psi pressure-rated pipe. The new potable waterline shall be located at least two feet above the wastewater main or lateral, measured vertically, and at least four feet away, measured horizontally, from the wastewater main or lateral.

4. Pipe Separation - Crossing Lines:

a. Where a new potable waterline crosses an existing, non-pressure-rated wastewater main or lateral, one segment of the waterline pipe shall be centered over the wastewater main or lateral such that the joints of the waterline pipe are equidistant and at least nine feet horizontally from the centerline of the wastewater main or lateral. The potable waterline shall be at least two feet above the wastewater main or lateral. Whenever possible, the crossing shall be centered between the joints of the wastewater main or lateral. If the existing wastewater main or lateral is disturbed or shows signs of leaking, it shall be replaced for at least nine feet in both directions (18 feet total) with at least 150 psi pressure-rated pipe.

b. Where a new potable waterline crosses an existing, pressure-rated wastewater main or lateral, one segment of the waterline pipe shall be centered over the wastewater main or lateral such that the joints of the waterline pipe are equidistant and at least nine feet horizontally from the centerline of the wastewater main or lateral. The potable waterline shall be at least six inches above the wastewater main or lateral. Whenever possible, the crossing shall be centered between the joints of the wastewater main or lateral. If the existing wastewater main or lateral shows signs of leaking, it shall be replaced for at least nine feet in both directions (18 feet total) with at least 150 psi pressure-rated pipe.
c. Where a new potable waterline crosses a new, non-pressure-rated wastewater main or lateral and the standard pipe segment length of the wastewater main or lateral is at least 18 feet, one segment of the waterline pipe shall be centered over the wastewater main or lateral such that the joints of the waterline pipe are equidistant and at least nine feet horizontally from the centerline of the wastewater main or lateral. The potable waterline shall be at least two feet above the wastewater main or lateral. Whenever possible, the crossing shall be centered between the joints of the wastewater main or lateral. The wastewater pipe shall have a minimum pipe stiffness of 115 psi at 5.0% deflection. The wastewater main or lateral shall be embedded in cement stabilized sand for the total length of one pipe segment plus 12 inches beyond the joint on each end.

d. Where a new potable waterline crosses a new, non-pressure-rated wastewater main or lateral and a standard length of the wastewater pipe is less than 18 feet in length, the potable water pipe segment shall be centered over the wastewater line. The materials and method of installation shall conform with one of the following options:

(1) Within nine feet horizontally of either side of the waterline, the wastewater pipe and joints shall be constructed with pipe material having a minimum pressure-rating of at least 150 psi. An absolute minimum vertical separation distance of two feet shall be provided. The wastewater main or lateral shall be located below the waterline.

(2) All sections of wastewater main or lateral within nine feet horizontally of the waterline shall be encased in an 18-foot (or longer) section of pipe. Flexible encasing pipe shall have a minimum pipe stiffness of 115 psi at 5.0% deflection. The encasing pipe shall be centered on the waterline and shall be at least two nominal pipe diameters larger than the wastewater main or lateral. The space around the carrier pipe shall be supported at five-foot (or less) intervals with spacers or be filled to the springline with washed sand. Each end of the casing shall be sealed with watertight non-shrink cement grout or a manufactured watertight seal. An absolute minimum separation distance of six inches between the encasement pipe and the
waterline shall be provided. The wastewater line shall be located below the waterline.

5. **Pipe Grade:** Water mains 16" or smaller shall have a minimum of 48 inches of cover from the proposed final finish ground/street/elevation and 60 inches of cover when the main is installed in an unpaved area or under the pavement where there are no existing/proposed curb or existing drainage facilities. Water mains 20" and above shall have a minimum of 60 inches of cover over the top of the pipe from the proposed final finish ground/street/elevation unless otherwise waived or modified by the Engineer. Pipe grades shall be as required by the plans or as directed by the Engineer. Grades shall be met as specified by Item No. 804 “Excavation, Trenching and Backfilling.” Precaution shall be taken to ensure that the pipe barrel has uniform contact with the cushion material for its full length except at couplings. The couplings shall not be in contact with the original trench bottom prior to backfilling. Cushion material shall be placed under the coupling and compacted by hand prior to backfilling so as to provide an even bearing surface under the coupling and pipe. Changes in grade shall be made only at joints.

6. **Cushion and Cushion Materials:** Prior to placing pipe in a trench, the trench shall have been excavated to the proper depth as required in Item No. 804 "Excavation, Trenching, and Backfilling." Approved imported materials or Engineer-approved materials selected from suitable fines derived from the excavation shall be smoothly worked across the entire width of the trench bottom to provide a supporting cushion.

7. **Structures to Support Pipe:** When either the Inspector or Engineer note that the material at the bottom of a trench is unstable or unsuitable, it shall be removed and replaced with approved material which may be properly compacted in place to support the pipe. The Contractor shall also construct a foundation for the pipe consisting of piling, concrete beams, or other supports in accordance with plans prepared by the Engineer. Extra compensation will be allowed for the Contractor for the additional work done. All claims for extra compensation must first be agreed to by SAWS, prior to any such work occurring. In this event it shall be paid for in accordance with the provisions of ARTICLE VI. CONTRACT CHANGES of the General Conditions of the Contract.

8. **Lowering Pipe and Appurtenances into Trench:** Proper implements, tools, and facilities satisfactory to the Inspector shall be provided and used by
the Contractor for the safe and convenient completion of work. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench piece by piece, by means of a derrick, ropes, or other suitable tools or equipment in such a manner as to prevent damage to water main materials and protective coatings, polywrap sleeving, and linings. Under no circumstances shall water main materials, pipes, fittings, etc., be dropped or dumped into the trench. Extreme care shall be taken to avoid damaging polywrap films. No chains or slings shall be allowed unless the entire sling is wrapped with a protective nylon web sock.

9. **Pipe Laying**: Every precaution shall be taken to prevent foreign material from entering the pipe during installation. Under adverse trenching conditions, work stoppage for more than 24 hours and/or as otherwise required by the Engineer, a manufactured cap/plug is to be used to prevent any foreign type material entering the pipe. The cap/plug shall be left in place until it is connection to an adjacent pipe. The interior of each pipe shall be inspected for foreign material or defects, and the pipe shall be cleaned or rejected if any defects are found, respectively.

After placing a length of pipe in the trench, the jointed end shall be centered on the pipe already in place, forced into place, brought to correct line and grade, and completed in accordance with these requirements. The pipe shall be secured in place with approved backfill material tamped around it. Pipe and fittings which do not allow a sufficient and uniform space for joints shall be rejected by the Engineer and/or Inspector and shall be replaced with pipe and fittings of proper dimensions. Precautions shall be taken to prevent dirt or other foreign matter from entering the joint space.

At times when pipe laying is halted, the open end of pipe in the trench shall be closed by a watertight plug or other means approved by the Inspector. Pipe in the trench which cannot temporarily be jointed shall be capped or plugged at each end to make it watertight. This provision shall apply during all periods when pipe laying is not in progress. Should water enter the trench, the seal shall remain in place until the trench is pumped completely dry. The Contractor shall provide all plugs and caps of the various sizes required.

10. **Deviations in Line or Grade**: Wherever obstructions not shown in the contract documents are encountered during the progress of the work and interfere to an extent that an alteration in the plan is required, the Engineer shall have the authority to change the plans and direct a deviation from the
line and grade or to arrange with the owners of the structures for the removal, relocation, or reconstruction of the obstructions. Any deviation from the line shall be accomplished by the use of appropriate bends unless such requirement is specifically waived by the Engineer. These deviations shall clearly and accurately be reflected in the Contractor's submittal of their redline drawings for permanent recording purposes.

Whenever it is necessary to deflect pipe from a straight line, the deflection shall be as directed by the Engineer and as described herein. In no case shall the amounts shown in Table 812-1, "Maximum Deflections of Ductile Iron Pipe" and Table 812-2, "Maximum Deflections of Concrete Steel Cylinder Pipe," be exceeded.

11. Cutting Pipe: The cutting of pipe for inserting valves, fittings, or closure pieces shall be accomplished in a neat and workmanlike manner so as to produce a smooth end at right angles to the axis of the pipe. The recommendations of the pipe manufacturer shall be strictly followed by the Contractor. Only qualified and experienced workmen shall be used and, under no circumstances, shall a workman not equipped with proper safety goggles, helmet and all other required safety attire be permitted to engage in this work.

Asbestos Cement (AC): No field cutting, breaking, or crushing will be allowed on AC pipe. Repairs to AC pipe shall be accomplished by removing one full joint of AC pipe and replacing with appropriate PVC or Ductile Iron pipe and fittings. All work associated with removing and disposing of AC pipe shall conform to the provisions of Item No. 3000, "Handling of Asbestos Cement Pipe."

All cuts made on ductile-iron pipe shall be done with a power saw. The cuts shall be made at right angles to the pipe axis and shall be smooth. The edges of the cut shall be finished smoothly with a hand or machine tool to remove all rough edges. The outside edge of pipe should be finished with a small taper at an angle of about 30 degrees. Solid sleeves or cast couplings shall be allowed on precast/prefab vaults only. All other fire line services shall be installed with full joints of pipe.

To facilitate future repair work on water mains, no sections less than 3 feet in length between fittings shall be allowed.

12. Joint Assembly:
Rubber Gasketed Joints: The installation of pipe and the assembly of rubber gasketed joints for ductile iron pipe, concrete and steel cylinder pipe shall conform to the pipe manufacturer's assembly instructions. The method of inserting spigot ends of pipe in bells or collars known as "stabbing" shall not be permitted with pipe larger than 6 inches in size. Spigot ends of pipe larger than 6 inches in size must be properly inserted in the joint by means of suitable pushing/pulling devices or an approved manufacturer's method.

Mechanical Couplings: Mechanical couplings shall be assembled and installed according to the standards recommended by the manufacturer.

Mechanical coupling consists of a cylindrical steel middle ring, two steel follower rings, two rubber compound gaskets, and a set of steel bolts. The middle ring is flared at each end to receive the wedge-shaped gasket which is compressed between the middle ring flare and the outer surface of the pipe by pressure exerted on the follower rings through the bolt circle.

Prior to the installation of the mechanical coupling, the pipe ends shall be cleaned by wire brush or other acceptable method to provide a smooth bearing surface for the rubber compression gasket. The pipe shall be marked to align the end of the coupling which will center it over the joint. After positioning, the nuts shall be drawn up finger tight. Uniform pressure on the gaskets shall be applied by tightening alternate bolts on the opposite side of the circle in incremental amounts. Final tensioning shall be accomplished with a torque wrench and in a manner similar to the tightening procedure. The coupling shall then be left undisturbed for 24 hours to allow the gaskets to "pack in." Final torque check shall then be made prior to coating and wrapping the joint. Table 812-3 ("Torque for Mechanical Couplings),” sets forth the proper torque for various sized mechanical couplings and is included for the convenience of the Contractor.

Restraint Joints: Restraint Joints shall be installed as shown on the plans or as directed by the Engineer. Installation shall conform to the manufacturer's recommendation.

Abandonment/Removal of Old Mains: Regarding planned main
abandonment, the Contractor shall accomplish all cutting, capping, plugging, and blocking necessary to isolate those existing mains retained in service from those abandoned. The open ends of abandoned mains and all other openings or holes in such mains occasioned by cutting or removal of outlets shall be blocked off by manually forcing cement grout or concrete into and around the openings in sufficient quantity to provide a permanent substantially watertight seal. Abandonment of old, existing water mains will be considered subsidiary to the work required, and no direct payment will be made.

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

14. **Abandoned Valves:** Valves abandoned in the execution of the work shall have the valve box and extension packed with sand to within 8 inches of the street surface. The remaining 8 inches shall be filled with 2,500 psi concrete or an equivalent sand-cement mix and finished flush with the adjacent pavement or ground surface. The valve covers shall be salvaged and returned to the Owner.

15. **New/Existing Valves:** At no time during the project work shall any valves be covered or rendered inaccessible for operation due to any activities by the Contractor. Any work during construction activities will be suspended until this requirement is met. No claims for cost or schedule delays will be accepted.

812.5 **MEASUREMENT:** Water main installed will be measured by the linear foot for each size and type as follows:

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.

Measurements will also be between the center line intersection of runs and branches of tees. Where the branch is plugged for future connection, the measurement will include the entire laying length of the branch or branches of the fitting.

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. Lines leading to a tapping connection with an existing main will be measured to the center of the main tapped.

812.6 **PAYMENT:** Payment for 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. Such payment shall also include excavation, selected embedment material, backfill, compaction, polyethylene sleeve, hauling and disposition of surplus excavated material, including all existing pipe, fittings, appurtenances to be abandoned or removed (where specified or shown in the contract documents)

Removed AC pipe shall be manifested and disposed of in accordance with Item No. 3000, "Handling Asbestos Cement Pipe."

<table>
<thead>
<tr>
<th>Nominal Pipe Diameter</th>
<th>Maximum Deflection Angle</th>
<th>Maximum Deflection In Inches</th>
<th>Approximate Radius Of Curve In Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>18 Ft.</td>
<td>20 Ft.</td>
</tr>
<tr>
<td>6&quot;</td>
<td>4°25'</td>
<td>16.7</td>
<td>18.5</td>
</tr>
<tr>
<td>8&quot;</td>
<td>3°51'</td>
<td>14.6</td>
<td>16.2</td>
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<tr>
<td>10&quot;</td>
<td>3°42'</td>
<td>14.0</td>
<td>15.5</td>
</tr>
<tr>
<td>12&quot;</td>
<td>3°08'</td>
<td>11.9</td>
<td>13.2</td>
</tr>
<tr>
<td>16&quot;</td>
<td>2°21'</td>
<td>8.8</td>
<td>9.7</td>
</tr>
<tr>
<td>20&quot;</td>
<td>1°55'</td>
<td>7.2</td>
<td>8.0</td>
</tr>
<tr>
<td></td>
<td>1°35'</td>
<td>6.0</td>
<td>6.7</td>
</tr>
</tbody>
</table>
### TABLE 812-2

**MAXIMUM DEFLECTIONS OF CONCRETE STEEL CYLINDER**

<table>
<thead>
<tr>
<th>Nominal Pipe Diameter</th>
<th>Maximum Deflection Angle</th>
<th>Maximum Deflection In Inches</th>
<th>Approximate Radius Of Curve In Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>16 Ft.</td>
<td>20 Ft.</td>
</tr>
<tr>
<td>16&quot;</td>
<td>2°20'</td>
<td>--</td>
<td>9.8</td>
</tr>
<tr>
<td>20&quot;</td>
<td>1°52'</td>
<td>--</td>
<td>7.8</td>
</tr>
<tr>
<td>24&quot;</td>
<td>1°34'</td>
<td>--</td>
<td>6.6</td>
</tr>
<tr>
<td>30&quot;</td>
<td>1°16'</td>
<td>--</td>
<td>5.3</td>
</tr>
<tr>
<td>36&quot;</td>
<td>1°02'</td>
<td>--</td>
<td>4.3</td>
</tr>
<tr>
<td>42&quot;</td>
<td>0°54'</td>
<td>--</td>
<td>3.8</td>
</tr>
<tr>
<td>48&quot;</td>
<td>0°47'</td>
<td>2.6</td>
<td>--</td>
</tr>
<tr>
<td>54&quot;</td>
<td>0°44'</td>
<td>2.5</td>
<td>----</td>
</tr>
<tr>
<td>60&quot;</td>
<td>0°54'</td>
<td>3.0</td>
<td>1024</td>
</tr>
</tbody>
</table>

### TABLE 812-3

**TORQUE FOR MECHANICAL COUPLINGS**

<table>
<thead>
<tr>
<th>Bolt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
### San Antonio Water System Standard Specifications for Construction

<table>
<thead>
<tr>
<th>Coupling Size</th>
<th>Diameter</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot; to 24&quot;</td>
<td>5/8&quot;</td>
<td>75 ft-lb</td>
</tr>
<tr>
<td>2&quot; to 24&quot;</td>
<td>3/4&quot;</td>
<td>90 ft-lb</td>
</tr>
<tr>
<td>30&quot; &amp; 36&quot; (1/4&quot; x 7&quot; Middle Rings)</td>
<td>5/8&quot;</td>
<td>65 ft-lb</td>
</tr>
<tr>
<td>30&quot; thru 36&quot; (3/8&quot; &amp; heavier Middle Rings)</td>
<td>5/8&quot;</td>
<td>70 ft-lb</td>
</tr>
<tr>
<td>30&quot; to 48&quot;</td>
<td>3/4&quot;</td>
<td>80 ft-lb</td>
</tr>
<tr>
<td>48&quot; to 72&quot;</td>
<td>3/4&quot;</td>
<td>70 ft-lb</td>
</tr>
</tbody>
</table>

- End of Specification -
Trench Walls Must Be Vertical

Pay Limits For Pavement Replacement

- 24" Max.
- 18" Max.
- 6" Min.

Outside Diameter

- 18" Max.
- 6" Min.
- 6" Min.

(See Note 1)

- 10" A.T.B.

Secondary Backfill

- Initial Backfill

- Water Main

- Bedding

- 4' - 0" Min.

- 1' - 0" Min.

- 12" Min.

- 6" Min. 12" Max.

- 6" Min. 12" Max.

- 6" Min.

- 12" Min.

1) REPLACEMENT OF SURFACE LAYER SHALL BE OF THE TYPE AND THICKNESS BASED ON FUNCTIONAL CLASSIFICATION.

a. Min 2" HMAC Type "D" for trench repair in Local / Residential streets.

b. Min 3" HMAC Type "C" for trench repair in Collector / Arterial streets.