

Standard Construction Specifications

For

SJWD Water District
Lyman, South Carolina

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SECTION 02000

CODES & STANDARDS

01. CODES AND STANDARDS: Except as modified herein, the following codes and standards shall be governing. All codes and regulations shall be the latest approved edition or tentatively adopted editions published at the date of receipt of bids, unless specifically stated otherwise.

- A. **Materials Standards** - Pipe, fittings, packing, jointing materials, valves and fire hydrants shall conform to Section C of the American Water Works Association (AWWA) Standards. All materials or products which come into contact with drinking water shall be certified as meeting the specifications of the American National Standard Institute/National Sanitation Foundation Standard 61, Drinking Water System Components - Health Effects. The certifying party shall be accredited by the American National Standards Institute. In the absence of American Water Works Association (AWWA) Standards, materials meeting applicable Product Standards and acceptable to SJWD and DHEC may be selected.

Asbestos cement pipe shall not be used except in the repair of existing asbestos cement lines. Metallic pipe and fittings shall be lead free in accordance with the State Primary Drinking Water Regulations R.61-58.4(F). Thermoplastic pipe shall not be used above grade.

- B. **Construction Standards** - All construction shall be in accordance with AWWA C600, AWWA C651, and the specifications included herein.

END OF SECTION

SECTION 02100

SITE WORK

01. **SCOPE OF WORK:** The CONTRACTOR shall furnish all labor, equipment, tools, and materials necessary to perform all tasks required to complete the site work. Work shall include, but is not limited to clearing and grubbing of the project area and the line rights of way within the limits shown on the plans and as required to perform the WORK, in coordination with other WORK that may be in the same contract or of different contracts, and in coordination with the required relocation and protection of existing structures and utilities. All incidental work, material, or appurtenances not specifically shown but necessary for completion of the WORK, shall be furnished by the CONTRACTOR at no additional expense to the District. No WORK shall proceed prior to approval of the District.

02. **COORDINATION WITH PUBLIC UTILITIES:** It is intended that construction occur in the location indicated on the drawings, which is in close proximity to existing utilities. The CONTRACTOR'S attention is directed to the General Conditions regarding protection of WORK, property, and persons.

It shall be the CONTRACTOR'S responsibility to coordinate the WORK with other utilities and to arrange for the relocation of power poles, telephone poles, telephone cables, telephone pedestals, and all other utilities' facilities as necessary to complete the WORK. CONTRACTOR shall be responsible for proper shoring and bracing of power poles, telephone poles, telephone cables, telephone pedestals, gas lines, and all other utilities' facilities whether they have been relocated or not relocated. Requirements of public utilities shall govern relocation, shoring, and bracing work. All costs associated with coordination with public utilities, relocation, shoring, and bracing of utilities' facilities, whether the costs are CONTRACTOR'S costs or costs payable to other public utilities, shall be borne by the CONTRACTOR, and shall be included in the CONTRACTOR'S bid price.

03. **PROTECTION OF WORK AREA:** All WORK is to be performed in accordance with OSHA requirements and State and local rules and regulations. Barricades and other protective devices shall be used to prevent damage to existing structures, equipment, utilities, pavement, fencing, and property, as well as to prevent damage to ongoing work.

Adjacent property is to be protected from damage from equipment, clearing and grubbing operations, disposal of materials, drainage from the construction site, and storage of dirt and debris.

Any ongoing work, existing structures piping, utilities, equipment, and property damaged during the site work is to be immediately restored to its original or better condition at the expense of the CONTRACTOR.

Trees and vegetation remaining in place are to be protected from damage from skinning, cutting, or breakage of limbs, bark, and roots, stockpiling of construction or excavated materials within the drip line, and compaction of soil within the drip line due to vehicular or foot traffic. Temporary barricades, fencing or any other appropriate means of protection are to be used. Damaged trees and vegetation are to be restored under the supervision of a tree surgeon or replaced by the CONTRACTOR at no additional expense to the District.

The CONTRACTOR shall conduct all WORK with full consideration of all proper and legal rights of the District, adjacent property owners and the public and with the least possible amount of inconvenience to them.

04. CLEARING AND GRUBBING: All trees, stumps, roots, weeds, grass, and other vegetation are to be cleared from the project site and rights-of-way within the limits shown on the plans and as specified herein. All stumps, logs, brush, and other debris resulting from the cleaning operation are to be disposed of by hauling from the site.

Water line rights-of-way off public road rights-of-way are to be completely cleared and grubbed a width of ten (10) feet on either side of the centerline of the entire length of the water line unless otherwise noted or specified. With prior approval of the District, additional width is to be cleared and grubbed if, in the opinion of the District, it is required for construction of the water line. All cleared areas are to be grubbed and grassed. Water lines along highway rights-of-way are to be cleared only as required for construction. Planted bushes, shrubs and trees are to be protected from damage as well as any item specifically marked for protection.

05. REMOVAL OF EXISTING STRUCTURES: Existing structures, pavement, walks, gutters, fences, planted trees, bushes, shrubbery, and all other items within the project limits and interfering with the construction work shall be temporarily removed from the construction site and replaced in equal or better condition by the CONTRACTOR.

06. DISPOSAL OF DEBRIS: All debris and material resulting from the site work must be hauled from the site and disposed of in a proper and legal manner. Burning of cleared and grubbed material shall not be allowed. All debris and cleared material shall be removed from the job site within ten (10) days and properly disposed of.

07. CONDITION OF RIGHT OF WAY: All rights-of-way shall be cleared, graded, drainage improved, as required by the Engineer and the governing jurisdiction or authority, grassed and generally left in better condition than originally found prior to beginning construction.

08. GRASSING AND SODDING: All areas disturbed during construction are to be grassed as part of completing the WORK. Sodding shall be required in established lawn areas or where seeding will not remain due to washing or where it is apparent that sod was present.

The CONTRACTOR shall unconditionally guarantee a uniform stand of grass by seeding or sodding in all seeded areas that is capable of resisting erosion and is reasonably free of weeds. The grass shall be an average of two (2) inches tall for acceptance with a minimum height in any area of one (1) inch. All bare areas shall be reworked and reseeded as soon as practical. No disturbed area shall remain unseeded or unsodded in excess of thirty (30) days. Where this is not practical, temporary seeding shall be performed at the CONTRACTOR'S expense.

09. EROSION CONTROL: The provisions and standards of the state of South Carolina, Spartanburg County and local governing body shall be strictly adhered to.

END OF SECTION

SECTION 02200

GRADING, FILLING & EXCAVATION

01. SCOPE OF WORK: The CONTRACTOR shall furnish all labor, equipment, tools, and materials necessary to perform all tasks required to complete all excavation and backfilling and grading of the project site as shown on the drawings and as specified herein. The CONTRACTOR shall be responsible for coordination with other work. All incidental work, material labor and appurtenances not specifically shown but necessary for completion of the WORK shall be furnished and installed by the CONTRACTOR at no additional expense to the District.

02. GENERAL: Excavation, grading and trenching is to take place within the limits indicated on the drawings. The CONTRACTOR shall maintain proper site drainage at all times so that water does not pond or damage adjacent property. Erosion and sediment control measures are to be initiated at the beginning of the construction and maintained throughout the duration of the Project in accordance with state and local rules, regulations and recommendations.

03. CLASSIFICATION OF EXCAVATED MATERIALS: All grading and excavation shall be considered unclassified. Classification of excavated materials shall be made as follows:

A. ROCK: Rock is defined as being sandstone, limestone, flint, granite, quartzite, slate, hard shale, or similar material in masses more than ½ cubic yard in volume or in ledges six (6) inches or more in thickness. It is further defined as materials and obstructions that cannot be excavated with a track mounted power excavator, equivalent to Caterpillar Model No. 21 5C LC, 32,000 pound drawbar pull and equipped with a short stick and a 42 inch wide, short tip radius rock bucket rated at 0.81 cubic yard (heaped) capacity.

Intermittent drilling, blasting, or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.

B. EARTH: All material not classified as rock.

04. BLASTING: The CONTRACTOR shall be responsible for all damage caused by blasting operations. CONTRACTOR shall be responsible for pre-blasting inspection. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench.

All rock, which cannot be handled and compacted as earth, shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed.

Unless otherwise approved, blasting or other use of explosives for excavation will not be permitted within ten (10) feet of existing structures or piping. In these areas rock removal by mechanical or non-explosive means will be required.

The CONTRACTOR shall receive and maintain all permits required prior to blasting work.

05. SHEETING AND SHORING: Except where banks are cut back on a stable slope, excavation and filling for structures and trenched shall be sheeted, braced and shored in strict accordance with OSHA regulations and safe practices as required for protection of ongoing work, existing structures, piping, utilities, and personnel. Water line trenches in streets shall not be laid back but cut vertically.

06. GRADING: Grading is to be completed within the limits and the elevations and grade shown on the drawings and as described in other sections of these specifications. The CONTRACTOR shall be responsible for staking all water lines and all other units of construction, for the purpose of establishing proper locations and elevations of the units. Grading shall be conducted in such a manner as to minimize filling.

A. PROTECTION: The CONTRACTOR is responsible for maintaining all existing utilities, roads, structures, construction staking and property corners from damage. The CONTRACTOR shall be responsible for verifying the location and existence of all structures and utilities within or adjacent to the project area. The CONTRACTOR, at his own expense, shall promptly repair any item that is damaged during construction to its original or better condition unless otherwise directed by the District.

07. EXCAVATION AND BACKFILLING: Excavation and backfilling for structures and trenching for pipelines shall be made at the locations and sub grade shown on the drawings. The area to be excavated is to be cleared and grubbed prior to beginning work in accordance with Section 02100.

A. EXISTING UTILITIES: Before beginning any excavation, the CONTRACTOR shall be responsible for notifying the offices of all public utilities in the work area and locating all existing utilities and protecting such utilities from damage during construction. The drawings may not show the exact location of all utilities.

1. Failure to show existing utilities on the drawings shall not relieve the CONTRACTOR from the responsibility of locating and protecting all utilities from damage prior to and during construction.

2. Utilities damaged during construction shall be immediately repaired at the CONTRACTOR'S expense.
3. The CONTRACTOR shall be responsible for promptly providing temporary service in the event that utilities are damaged and service is interrupted. Such temporary service is to be approved by the Owner of the damaged utility.

B. STRUCTURAL EXCAVATION: Excavation of structures shall be made at the locations shown on the drawings and to the sub grade required. Excavation shall include the placement of suitable material as backfill and the proper and legal disposal of unsuitable or excess excavated material as approved by the District Engineer. Unless otherwise indicated, all structural excavation shall be unclassified for payment purposes.

1. The excavation shall be kept free of water at all times during construction. The surrounding area shall be graded to slope away from the excavation, or other suitable means shall be provided to prohibit surface drainage from entering the excavation. Groundwater entering the excavation shall be continuously pumped out so that water does not accumulate in any portion of the excavation.
 - a) If unsuitable structural sub grade conditions result from the CONTRACTOR'S failure to prohibit surface water from entering the excavation or failure to properly remove groundwater from the excavation, the sub grade shall be repaired to the satisfaction of the District Engineer and at the CONTRACTOR'S expense.
2. The bottom of the excavation shall be level and to the sub grade elevation shown on the drawings. The bottom at proper sub grade elevation shall be firm throughout and free of any soft or wet material.
 - a) Six (6) inches minimum of washed crushed stone shall be placed beneath all structural foundations. Sub grade elevations shall be adjusted to accommodate the placement of stone.
 - b) Whenever naturally occurring, soft or unsuitable sub grade material, (not indicated on the drawings) is encountered at the sub grade elevation, the CONTRACTOR, upon prior approval by the District Engineer, shall remove such soft or unsuitable material and replace it with acceptable compacted soil, crushed stone, or concrete as directed by the District Engineer. The CONTRACTOR shall be entitled to additional payment in accordance with specified change order procedures.

C. TRENCH EXCAVATION: Trenches are to be excavated open cut to the depth, grade and alignment shown on the drawings.

1. Trench depth, unless otherwise indicated, shall be sufficient to allow a minimum of four (4) feet of cover pipe six (6) inches in diameter and larger, and three (3) feet of cover over pipe less than six (6) inches in diameter.
2. Unless otherwise noted on the drawings, trench width shall be held to a minimum and in no case exceed, by the following dimensions, diameter of the pipe being placed:

<u>Outside diameter of pipe or conduit being placed</u>	<u>Excess trench width measured at the top of pipe or conduit</u>
32 inches or less	12-18 inches
36 inches or greater	24 inches

3. Trench walls are to be cut vertically from the trench bottom to a minimum level one (1) foot above top of the pipe. Trench walls may be laid back above the minimum vertical height to accommodate soil and working conditions except when located in street or road rights-of-way.
4. Where trenching takes place in existing concrete or asphalt roadway pavement, the pavement shall be saw cut a width two (2) feet wider than the top width of the trench, unless otherwise noted on the drawings. Ragged edges of pavement shall be recut as required prior to paving to form a straight and uniform alignment.
5. All trenches are to be excavated below the established sub grade, as required, for preparation of trench foundation as shown on the drawings. All bedding material shall be placed and compacted such that the load is supported along the entire length of the pipe barrel. Bell holes shall be excavated to prohibit additional loading on the bells and to provide for completion of joints. Class C bedding shall be used throughout except when the following conditions are encountered.
 - a) Where cover over the pipe exceed eighteen (18) feet or where specifically noted on the plans, Class B required.
 - b) Where groundwater is encountered, Class C Alternate required.
6. The trench shall be kept free of water at all times during pipe laying operations. Groundwater entering the excavation shall be continuously

pumped out so that water does not accumulate in trench or make the sub grade and pipe foundation unstable or soft.

D. BACKFILLING: Backfilling of structures and trenching is to be performed in such a manner as to provide a properly compacted backfill, free from rocks, organic matter, frozen material, excessively wet material, roots and other unsuitable debris. Suitable backfill material shall be borrowed from off site if necessary. Cost of all borrowed backfill material shall be included in the unit price for the pipe and structures.

1. Backfill of trenches is to be hand or tamped under and around the pipe in six (6) inch lifts to a depth of twenty-four (24) inches above the pipe. As material is placed, it shall be thoroughly compacted for the full width of the trench to provide support for the bottom and sides of the pipe. The remainder of the backfill is to be compacted throughout in eight (8) inch maximum lifts to the required density specified. Backfill under roads, pavement, sidewalks, parking areas and driveways is to be mechanically tamped throughout.
2. Backfill of all structures is to be mechanically tamped throughout in six (6) inch maximum lifts to obtain the compaction specified.
3. Backfill of all pipe shall be done in such a manner so that stones or debris are not bedded against the pipe.

08. COMPACTION: Placed fill material shall be soil free of roots, stones having a diameter greater than three (3) inches, trash and debris. Fill material is to be placed in horizontal layers no deeper than eight (8) inches and thoroughly compacted before placing additional layers. In-place moisture-density testing may be conducted at the recommendation of the District to insure that all placed and compacted material complies with the specification. Testing is to be performed by a licensed testing laboratory at locations to be determined by the District. Tests are to be paid for by the District. Work not complying with the specified compaction shall be removed, recompacted, and retested at the CONTRACTOR'S expense.

A. TRENCH BACKFILL: Compacted backfill will be required for the full depth of the trench above the embedment in all locations.

The top portion of backfill beneath established lawn areas shall be finished with at least 12 inches of topsoil corresponding to, or better than, that underlying adjoining lawn areas.

At the option of the CONTRACTOR, compacted backfill may be (a) suitable job excavated material; or (b) graded gravel as defined in the

latest South Carolina Highway Department Standard Specifications for Highway Construction for #57 or #67 washed stone.

The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe. Job excavated material shall be compacted to 95 percent of maximum density at optimum moisture content as determined by ASTM D698 when that test is appropriate, or to 70 percent relative density as determined by ASTM D4253 and D4254 when those tests are appropriate.

Compaction requirements for excavation under roads, drives, parking lots, or other areas where settlement may cause damage shall be to the degree required by the governing body or jurisdiction and in no case shall any settlement be accepted.

- B. STRUCTURE BACKFILL:** Backfill around structures shall be compacted to the extent necessary to prevent future settlement. Water settlement will be permitted only where no damage to the WORK could be caused thereby.

Material for backfill shall be composed of earth only and shall contain no wood, grass, roots, broken concrete, stones, trash, or debris of any kind. No tamped or otherwise mechanically compacted backfill shall be deposited or compacted in water.

END OF SECTION

SECTION 02450

GRASSING

01. SCOPE OF WORK: The CONTRACTOR shall furnish all labor, equipment, tools, and materials necessary to perform all tasks required to complete all grassing within the limits of right-of-way and other disturbed areas shown on the plans, in coordination with all other divisions of WORK. Any incidental work, material, or appurtenances not specifically shown, but necessary for completion of the WORK, shall be furnished as required. All unpaved areas cleared and grubbed, graded, filled, excavated, or otherwise disturbed during construction, both within and beyond the right-of-way limits shown on the plans, shall be grassed. Grassing includes both temporary and permanent grassing.

02. GENERAL: The CONTRACTOR shall be responsible for verifying the condition and suitability of areas to receive grassing. The WORK to be performed under this section consists of preparing the seedbed or area to be sodded, furnishing and placing sod, furnishing, placing, and covering limestone, fertilizer, and seed, compacting seedbeds, furnishing and securing mulch, mowing, and other operations necessary for the permanent establishment of grasses. All disturbed areas are to be grassed.

The CONTRACTOR shall adapt his operations to variations in the weather, seasons of the year, and soil conditions as necessary for the establishment of temporary and permanent grass cover.

Before acceptance and final payment is made for the grassing work, a complete and full coverage of all areas are to be filled, reseeded, and completely covered with grass.

Areas where washing is evident are to be regraded, stabilized with degradable woven mesh, secured with stakes in accordance with the manufacture's recommendations, and regrassed.

03. PERMANENT GRASSING: Permanent grassing shall be established on all unpaved areas graded or disturbed during construction.

A. MATERIALS: Materials shall be approved by the District Engineer prior to use and shall include limestone, fertilizer, seed, and mulching materials.

1. Fertilizer shall be an acceptable commercial fertilizer having the following percentages of phosphorous, nitrogen, and potassium by weight: phosphorous 10%, nitrogen- 10%, potassium-10%.
2. Limestone shall be agricultural grade limestone containing no less than 85 percent by weight of combined calcium and magnesium

carbonate. All limestone shall be graded so the 100 percent will pass through U.S. Standard 10 mesh screen and 40 percent will pass through U.S. Standard mesh screen. Any hardened or caked limestone shall be pulverized to its original condition before being used.

3. Seed shall be a mixture of Fescue and Annual Rye Grass with a purity of no less than 90 percent and a germination rate of no less than 80 percent and conforming to state laws.
4. Mulch shall consist of small grain straw or bahiagrass hay. The material must be dry and free of coarse stems, mold damage, and noxious weeds.

B. SEEDBED PREPARATION: The seedbed shall be prepared in topsoil placed by the CONTRACTOR. The soil shall be scarified or otherwise loosened to a depth of five (5) inches or more. All clods are to be broken up and all rocks and debris removed. The upper three (3) inches of soil shall be worked into an acceptable seedbed by the use of pulverizers, drags, or harrow. Seeding and fertilizing shall not be done during periods of such severe drought, high winds, or excessive moisture, as determined by the Engineer, that satisfactory results are not likely to be obtained.

1. Fertilizer shall be uniformly distributed at a minimum amount of 1000 pounds per acre.
2. Limestone shall be uniformly applied at a minimum rate of 2000 pounds per acre and worked into the soil prior to incorporation of the seed.
3. Fertilizer, limestone, and seed shall be applied within 24 hours of completing seedbed preparation.

C. SEEDING: Seed shall be uniformly distributed over the seedbed and immediately harrowed, dragged, raked, or otherwise worked into the seedbed so as to cover the seed with a layer of soil compatible with germination requirements. Immediately after the seed has been removed, the seedbed shall be compacted in a manner compatible with standard grassing practices. Seed shall be applied to the seedbed in the following amounts:

Fescue -----150 pounds per acre
Annual Rye Grass-----100 pounds per acre

D. MULCHING: Mulch shall be applied to the seedbed area within 36 hours after completion of the seeding operation.

1. Prior to applying mulch, all roots, debris, and rocks greater than two (2) inches in diameter are to be removed from the seedbed area.
2. Care shall be taken not to displace soil or seed during mulching operations.
3. Mulch shall be spread uniformly by hand or by mechanical spreaders and blowers in the amount of 60 bales per acre.
4. Mulch on slopes greater than 5 percent is to be held in place by applying emulsified asphalt in the amounts of 250 gallons of emulsified asphalt per acre or shall be held in place by woven mesh properly staked.
5. Mulch in ditch lines is to be held in place by woven mesh and replaced as required if washed away by heavy rains.

Other suitable means of holding the mulch in place may be used with prior approval of the District Engineer.

E. MAINTENANCE OF SEEDING AND MULCHING: Areas where seeding and mulching have been performed shall be maintained by the CONTRACTOR until an acceptable grass cover has been obtained and accepted by the District.

1. Maintenance shall include mowing, repair of areas of erosion and washing, repair of damaged areas, areas of soft material likely to cause rutting, and reseeded as necessary to establish a sufficient uniform grass cover.

04. SODDING: Sodding shall be required in established lawn areas or where seeding will not remain due to washing. All sod shall comply with State Seed Laws of the State of South Carolina. Sod shall be of similar variety of that displaced.

Sod shall be cut in strips or rectangular sections which may vary in length, but shall be of equal width and of a size that will permit the sections to be lifted and rolled without breaking. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected. When the soil is too dry, the sod shall be cut only after the CONTRACTOR has watered the sod sufficiently to moisten the soil to a depth at which the sod is to be cut. Torn or unevenly cut strips or sections will not be acceptable.

Sod shall be placed after the soil has been prepared as specified. Care shall be exercised at all times to retain the native soil on the roots of the sod during the

process of stripping, transporting, and planting. Dumping from vehicles will not be permitted. The sod shall be transplanted within 24 hours from the time of stripping, unless stored in a satisfactory manner. During delivery and while in stacks, the sod shall be kept moist and shall be protected from exposure to the air and sun.

Sod shall be laid smoothly, edge to edge, with staggered joints. The sod shall immediately be pressed firmly into contact with the sod bed by tamping or rolling with acceptable equipment so as to eliminate all air pockets, provide a true and even surface, and assure knitting. Small gaps or voids remaining after the sod is laid shall be filled with topsoil.

Staking of sod on slopes will not be required; however, the CONTRACTOR shall be solely responsible for replacing sod displaced by erosion or other causes.

After rolling, sod shall be irrigated to a depth sufficient that the underside of the sod section and the soil four (4) inches below the sod is thoroughly wet. Sod shall be watered during the first three to four weeks as necessary to maintain moist soil to a depth of at least two (2) inches.

05. TEMPORARY GRASSING: Temporary grassing shall be performed in selected areas in advance of permanent grassing operations for the purpose of minimizing erosion in graded and disturbed areas during construction operation. Temporary grassing is considered to be a supplement to and not a substitute for, permanent grassing operations, erosion, or sediment control measures. The WORK shall include preparing seedbeds; furnishing, placing, and covering fertilizer and seeds; mowing; and any other operations necessary for establishing temporary grassing of the required areas.

Temporary Grassing shall be done promptly at the location and times directed by the District Engineer and under the following conditions:

1. When a graded area cannot be brought to final grade and remain undisturbed and permanently grassed during construction, temporary grassing shall be provided until final grade can be obtained and the graded area permanently grassed.
2. When washing or erosion can occur on disturbed areas where temporary suspension of construction activity has taken place.
3. When an immediate ground cover is desirable to minimize washing, erosion, sedimentation, or pollution on any area.
4. When the season of the year is not suitable for establishing permanent grassing.

Areas to be grassed shall be loosened to a depth of five (5) inches. The surface to be seeded shall have adequate terraces and other irregularities in which seed and fertilizer can lodge so that the grassing materials cannot be easily dislodged by wind, rain, or surface runoff.

Seed and Fertilizer shall be applied uniformly at the required application rates over the prepared area to be grassed.

10-10-10 Fertilizer shall be applied at a rate of 500 pounds per acre.

Mulch shall be spread uniformly by hand or by mechanical spreader and blowers in the amount of 60 bales per acre.

Areas of Temporary Grassing shall be maintained in satisfactory condition until being permanently grassed. The maintenance shall include repair of erosion, reseeding, and mowing. All WORK to maintain areas of temporary seeding shall be done promptly at the direction of the District Engineer.

END OF SECTION

SECTION 02500

PAVING AND SURFACING

01. SCOPE OF WORK: The CONTRACTOR shall furnish all labor, equipment, tools, and materials necessary to perform tasks required to complete all paving and surfacing as shown on the drawings and specified herein, in coordination with all other divisions of work and in coordination with required relocation and protection of existing utilities. Any incidental work, material, or appurtenances not specifically shown, but necessary for completion of the WORK, shall be furnished by the CONTRACTOR as required. WORK under this section covers paving and surfacing of roads, drives, and parking areas.

02. MATERIALS:

A. AGGREGATE BASE COURSE: Base course material shall consist of crushed stone, or gravel having hard, strong, durable particles free from adherent coatings. The crushed stone or gravel shall be graded downward from 1 1/2 inches as follows:

<u>GRADUATION SIZE</u>	<u>PERCENT PASSING</u>	<u>TOLERANCE</u>
1 ½ INCH	100%	±0%
1 INCH	86%	±11%
½ INCH	67%	±12%
NO.4	45%	±10%
NO. 10	35%	±10%
NO. 40	22%	± 8%
NO. 200	8%	± 4%

B. PAVEMENT: All pavement shall be Bituminous Plant Mix Pavement unless otherwise noted or specified herein. All pavement shall conform to the requirements of the latest South Carolina Highway Department Standard Specifications for Highway Construction.

03. CONSTRUCTION: Areas to be paved and surfaced will consist of road patching, road resurfacing, drives and parking areas. All trench excavation sub grade, in paved areas, shall be prepared in accordance with Section 02200 and paved in accordance with the details shown on the plans. The sub grade for all paved areas shall be compacted to a minimum of 95% prior to placement of crushed stone. Paving and surfacing details are detailed at the end of this section.

A. PAVEMENT PLACEMENT: Bituminous Plant Mix Pavement shall be placed and compacted to a minimum depth of two (2) inches with steel

drum and rubber tire rollers in accordance with the requirements of the South Carolina Highway Department. The pavement is not to be placed during rainy weather, when the sub grade or base course is frozen, or when moisture on the surface to be paved would prohibit proper bond. Pavement shall not be placed when the air temperature, as measured in the shade away from artificial heat, is less than 35° Fahrenheit. In the event that paving operations have started, paving may continue until the air temperature drops to 32° Fahrenheit at which time the paving must immediately cease. The compacted pavement shall be no less than two (2) inches. The entire area to be paved or resurfaced (including edges of existing pavement) shall be primed with an acceptable asphalt prime coat just prior to placing the new hot mix asphalt pavement.

Pavement shall be mechanically tamped and thoroughly compacted around fence posts, structures, and all other areas not accessible to a wheeled roller.

04. CLEAN UP: At the completion of the paving operation the paved areas and areas adjacent to the paved areas are to be cleaned, left in good condition, and free from debris. All loose aggregate is to be removed and the area surrounding the pavement graded smooth to drain.

05. CONNECTION TO EXISTING PAVEMENT: When new pavement is to be tied to existing pavement, the existing pavement is to be saw cut in a true line to eliminate all ragged edges, the base course refilled and mechanically compacted, and a tack course applied prior to placement and compaction of a new pavement.

END OF SECTION

SECTION 02600

PIPING GENERAL REQUIREMENTS

01. SCOPE OF WORK: This section covers the general requirements for installation of all piping, valves, and fittings. The CONTRACTOR shall furnish all labor, equipment, tools, and materials necessary to perform all tasks required to properly install all pipe work as shown on the drawings and specified herein, in coordination with all other work and in coordination with the required protection, relocation or connection to existing utilities. Any incidental work, material, or appurtenances not specifically shown, but necessary for the CONTRACTOR as required shall furnish completion of the work.

02. MATERIALS: All piping, including valves and fittings, shall be of the type and size as shown on the approved drawings or specified in other sections.

All material or products which come into contact with drinking water shall be third party certified as meeting the specifications of the American National Institute/National Sanitation Foundation Standard 61, Drinking Water System Components – Health Effects. The certifying party shall be accredited by the American National Standards Institute.

1. All pipe, fittings, packing, jointing materials, valves and fire hydrants shall conform to Section C of the AWWA Standards.
2. Water mains which have been previously used for conveying potable water may be reused provided they meet applicable criteria from AWWA Section C, ANSI/NSF 61, and ASTM D1785 or D2241. The mains must be thoroughly cleaned and restored practically to their original condition.
3. Asbestos cement pipe shall not be used in potable water systems except in the repair of existing asbestos cement lines.
4. Thermoplastic pipe shall not be used above grade.
5. Materials shall meet the following :
 - a. DIP: AWWA C150/A21.50 & AWWA C151/A21.51.
 - b. PVC: AWWA C900 Class 150 DR 18 and Class 200 DR 14 (for pipes 4 inches through 6 inches in diameter)
 - c. PVC: ASTM D1785 or ASTM D2241: SDR 26 Class 160 and SDR 21 Class 200 (for pipe less than 4 inches in diameter)
 - d. All pipe above 6" diameter must be DIP.
 - e. Steel: AWWA C200 or ASTM A53 or A120.
 - f. Valves: AWWA C500 (Metal Seated Gate Valve) , C504 (Butterfly Valve) or C509 (Resilient Seated Gate Valve).
 - g. Hydrants: AWWA C502
6. Natural rubber or other material which will support microbiological growth may not be used for any gaskets, O-rings, and other products used for jointing pipes, setting meters or valves, or other appurtenances which will expose the material to the water.

7. Lubricants which will support microbiological growth shall not be used for slip-on joints.
8. The use of vegetable shortening is prohibited.
9. The use of solvent-weld PVC pipe and fittings in water mains 4 inches and larger is prohibited.
10. Any pipe, solder, or flux which is used in the installation or repair of any public water system, used in any plumbing which provides water through connection to a public water system, for human consumption, shall be lead free. Lead free, for solder and flux, means those containing not more than 0.2% lead. Lead free, for pipes and pipe fittings, as those containing not more than 8.0% lead. Leaded joints necessary for the repair of CIP shall be exempt from the above.

03. EQUIPMENT PIPING: All piping necessary for proper installation and operation of equipment shall be installed as required to fit the equipment provided and shall be considered incidental to equipment. The CONTRACTOR shall be responsible for providing piping and support necessary for proper equipment installation and operation whether or not the required piping and pipe supports are shown on the drawings. All piping is to be properly installed and supported in accordance with equipment manufacturer's recommendations so as not to place strain on equipment or connections and to prevent excessive vibrations.

04. INSTALLATION: All piping shall be installed in a proper and workmanlike manner, properly protected and supported, free from leakage and meeting all requirements for inspection and testing as specified in other sections.

A. REACTION ANCHORAGE AND BLOCKING: All exposed piping with mechanical couplings, push-on or mechanical joints, or similar joints subject to internal pressure shall be blocked, anchored, or harnessed to preclude separation of joints. All push-on and mechanical joint tees, Y-branches, bends, and plugs which are installed in buried piping shall be provided with suitable reaction blocking, anchors' joint harness, or other acceptable means for preventing movement of the pipe caused by internal pressure.

Concrete blocking shall extend from the fitting to solid undisturbed earth and shall be installed so that all joints are accessible for repair. The dimensions of concrete reaction blocking shall be as indicated on the drawings or as directed by the District. If adequate support against undisturbed ground cannot be obtained, metal harness anchorages shall be installed to provide the necessary support. Metal harness anchorages shall consist of steel rods extending across the joint and securely anchored to pipe and fitting, or other adequate anchorage facilities shall be installed to provide the necessary support. If the lack of suitable solid vertical excavation face is due to improper trench excavation, metal

harness anchorages shall be furnished and installed by and at the expense of the CONTRACTOR.

Reaction blocking, anchorages, or other supports for fittings installed in fills or other unstable ground, above grade, or exposed within structures, shall be provided as required by the drawings or as directed by the District.

All steel clamps, rods, bolts, and other metal accessories used in tapping saddles, reaction anchorages, or joint harness subject to submergence or contact with earth or other fill material and not encased in concrete shall be protected from corrosion in concrete shall be protected from corrosion by two coats of thixotropic coal tar applied in the field to clean, dry metal surfaces. The first coat shall be dry and hard before the second coat is applied. Metal surfaces exposed above grade or within structures shall be painted in accordance with the painting section.

Concrete blocking shall be Class A-3000 psi concrete.

B. CONCRETE PROTECTION: Protection and encasement concrete shall be Class B (2500 psi) and provided where shown on the drawings, or as necessary for protection of existing piping or utilities as directed by the District. All pipe to be encased shall be suitably supported and blocked in proper position, and shall be anchored to prevent flotation.

C. INSTALLATION: All piping is to be installed to the line, grade, and elevations shown on the plans.

1. Water lines are to be installed in a true line and grade and in a manner so as to prevent high and low spots in the piping.
2. All fittings, valves, sleeves, couplings, and appurtenances are to be compatible with, and of equal pressure class as the piping being used.
3. No flushing device shall be directly connected to any sewer.
4. Air relief valve shall be provided in accordance with sound engineering practice at high points in water mains as required. Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur.
5. Chambers, pits or manholes containing valves, blow-offs, meters, air relief valves, or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer.

6. Installation of water mains and appurtenances shall be conducted in accordance with Section C of the AWWA Standards and/or manufacturer's recommended installation procedures.
7. Bedding
 - a. A continuous and uniform bedding shall be provided in the trench for all buried pipe.
 - b. Back-fill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe.
 - c. Stones, other than crushed bedding, shall not come in contact with the pipe and shall not be within 6 inches of the pipe.
8. All water mains shall be provided with a minimum of 30 inches of cover, unless pipe material is steel, concrete, DIP, or other approved material, and if exposed should be insulated to prevent freezing.
9. All tees, bends, plugs and hydrants on lines 2.5 inches in diameter and larger shall be provide with reaction blocking, tie rods, or other approved method of restraint.
10. All water mains shall be detectable within 3 feet with electronic locating equipment.
11. Non-metallic pipes shall be installed with copper wire or other means of detection.
12. Water mains shall be located out of contaminated areas, unless using pipe materials that will protect (i.e., DIP with chemical resistant gaskets). Re-route line if possible.
13. Cross Connection Control (Backflow Prevention Devices):
 - a. There shall be no connection between the distribution and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contamination materials may be discharged or drawn into the system .
 - b. No by-passes shall be allowed , unless the bypass is also equipped with an equal, approved back-flow prevention device.

- c. High hazard category cross connections shall require an air gap separation or an approved reduced pressure backflow preventer.
- d. Reduced pressure principal backflow prevention assemblies shall not be installed in any area location subject to possible flooding. This includes pits or vaults which are not provided with a gravity drain to the ground's surface that is capable of exceeding the discharge rate of the relief valve. Generally, if installed in a pit, the drain line shall be 2 times the size of the line entering the backflow prevention device. The drain cannot empty into any type of ditch, storm drain, or sewer, which could flood water back into the pit.
- e. All piping up to the inlet of the backflow prevention device must be suitable for potable water. The pipe must be NSF approved. Black steel pipe cannot be used on the inlet side of the device.
- f. Fire line sprinkler systems and dedicated fire lines, except those in the high hazard category shall be protracted by an approved double check valve assembly.

D. PIPEWORK IN STRUCTURES: Pipework in structures is to include all pipe, fittings, valves, sleeves, and supports necessary for complete installation. Piping is to be compatible with the equipment provided.

- 1. All piping through walls of manholes or other structures shall be adequately supported, and sealed watertight with non-ferrous, non-shrink grout.

05. TESTING: All piping shall be pressure and leak tested. Procedures for testing are specified in other sections.

All potable waterlines shall be disinfected in accordance with requirements of AWWA C651 and as described in other sections of these specifications.

06. SHOP DRAWINGS: Shop drawings shall be submitted on all pipe, fittings, valves, sleeves, couplings, supports, and appurtenances required for complete installation of the piping. Where material being utilized is the same as specified, the CONTRACTOR shall submit shop drawings and a verification statement that all piping is as specified.

07. CLEAN UP: All piping shall be thoroughly cleaned of concrete, mortar, mud, dirt debris, and rust prior to painting or coating. All areas of piping work shall be cleaned up after installation to remove debris, and discarded and unused piping. The area of piping is to be graded smooth to drain and left in a condition satisfactory to the District Engineer before piping shall be considered to be complete. All above ground metal piping is to be properly coated.

The OWNER reserves the right of all salvageable materials. The CONTRACTOR shall give the OWNER first refusal of all salvageable items.

END OF SECTION

SECTION 02610

WATER LINES

01. SCOPE OF WORK: The CONTRACTOR shall furnish all labor, equipment, tools, and materials necessary to perform all tasks required to complete the construction of pressurized water line piping, valves, fittings, hydrants and appurtenances in accordance with the drawings and as specified herein, in coordination with all other divisions of work and in coordination with the required relocation of existing source of water. Any incidental work, material, or appurtenances not specifically shown, but necessary for completion of the work, shall be furnished by the CONTRACTOR at no additional cost to the District.

02. GENERAL: Work to install water lines, clearing and grubbing, grassing, trench excavation, and backfill shall be as specified in other sections. Testing, disinfection, and placement in service shall be considered an integral part of completion of the WORK. Inside of pipe shall be maintained in a manner to protect it from mud and foreign material. Pipe in ditch shall be plugged anytime pipe is unattended.

03. MATERIAL: Pipe material shall be as shown on the drawings, contained in the bid form and as specified herein. Valves, fittings, and appurtenances shall be the same type, size, and pressure class as the connecting piping. All piping material shall be certified by the AWWA and National Sanitation Foundation (NSF) for use as piping for potable water.

1. Ductile Iron Pipe & Fittings: Section 15020
2. PVC Pipe & Fittings: Section 15050
3. Valves, Hydrants, and Appurtenances: Section 02650.

All pipe material, solder and flux shall be lead free (less than 0.2 percent lead in solder and flux and less than 8 percent lead in pipes and fittings).

04. INSTALLATION: Piping, valves, fittings, and appurtenances shall be properly installed, sterilized, pressure tested, and certified for use by the District and South Carolina Department of Health and Environmental Control before the WORK shall be considered complete. Pipe is to be protected from mud, debris and other contaminants at all times.

A. TRENCH AND FOUNDATIONS: Trench and foundations for all underground water lines shall be Class C unless otherwise noted.

B. UNDERGROUND PIPING: All underground piping shall have a minimum cover of four (4) feet for six (6) inches diameter and larger and three (3)

feet of cover for pipe less than six (6) inches in diameter unless otherwise noted.

C. SEPARATION: Separation between water lines and sewer lines shall be in accordance with the most recently adopted State Primary Drinking Water Regulations and the latest edition of "Recommended Standards for Sewage Works". The following criteria shall be met unless referenced documents are more stringent:

1. Parallel Installation - Water mains shall be laid at least ten (10) feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation, the District may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least eighteen (18) inches above the top of the sewer.
2. Crossings - Water mains crossing sewers shall be laid to provide a minimum vertical separation of eighteen (18) inches between the outside of the water main and the outside of the sewer. This shall be the case whether the water main is either above or below the sewer line. Whenever possible, the water main shall be located above the sewer line. Where a new water main crosses a new sewer line, a full length of pipe shall be used for both the water main and sewer line and the crossing shall be arranged so that the joints of each line will be as far as possible from the point of crossing and each other. Where a new water main crosses an existing sewer line, one full length of water pipe shall be located so both joints will be as far from the sewer line as possible. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer line to prevent damage to the water main.
3. Special Conditions - When it is impossible to obtain the distances specified in 1 and 2 the District may allow an alternative design. Any alternative design shall:
 - a. maximize the distances between the water main and sewer line and the joints of each;
 - b. use materials which meet the Districts requirements
 - c. allow enough distance to make repairs to one of the lines without damaging the other.

4. Force Mains - There shall be at least a ten (10) foot horizontal separation between water mains and sanitary sewer force mains. There shall be an eighteen (18) inch vertical separation at crossing as required in 1. and 2. above.
5. Sewer Manholes - No water pipe shall pass through or come in contact with any part of a sewer manhole. Water lines may come in contact with storm sewers or catch basins if there is no other practical alternative, provided that ductile iron is used, no joints of the water line are within the storm sewer or catch basin and the joints are located as far as possible from the storm sewer or catch basin.
6. Drain-fields and Spray-fields - Potable water lines shall not be laid less than twenty-five (25) feet horizontally from any portion of a wastewater tile-field or spray-field, or shall be otherwise protected by an acceptable method approved by the District.

D. SURFACE WATER CROSSINGS:

1. Above-water Crossings - The pipe shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement.
2. Underwater Crossings - A minimum cover of two (2) feet shall be provided over the pipe. When crossing water courses which are greater than fifteen (15) feet in width, the following shall be provided:
 - a. The pipe material and joints shall be designed appropriately;
 - b. Valves shall be located so that the section can be isolated for testing or repair; the valves shall be easily accessible, and not subject to flooding; and,
 - c. A blow-off shall be provided on the side opposite the supply service, sized to provide a minimum velocity of 2.5 feet per second in the line and a minimum residual pressure of 25 psi. Direct away from streams, over ground.
 - d. Use DIP with mechanical joints for any lines being installed in rock.

05. PIPELINE PRESSURE AND LEAKAGE TESTING: The pressure and leakage tests shall be performed on the entire line being installed under this contract. The test must be conducted in accordance with AWWA Standards C600. Unless otherwise specified, testing of pipelines shall be completed prior to final cleaning and disinfection.

All concrete reaction blocking and anchorage shall be in place and ready for use before the line is initially filled with water. Pressure and leakage tests are to be made prior to connections to existing water lines.

- A. WATER:** Water used for testing shall be furnished by the District. The CONTRACTOR shall be charged appropriately for any retests required due to CONTRACTOR operations.
- B. FILLING AND VENTING:** When filling the line with water, care shall be taken to ensure that all air release valves and other venting devices are properly installed and in the open position. Care shall be taken to ensure that the rate at which the line is filled with water does not exceed the venting capacity of the installed air vent valves and devices.
- C. TEST EQUIPMENT:** All necessary piping connections between the line to be tested and the water source, together with pumping equipment, water meter, pressure gauges, and all other equipment, materials, and facilities required to perform the specified tests, shall be provided by the CONTRACTOR. All flanges, valves, bulkheads, bracing, blocking, and other sectionalizing devices required shall also be provided by the CONTRACTOR. All temporary sectionalizing devices shall be removed by the CONTRACTOR upon completion of testing. Vents shall be provided in test bulkheads where necessary to expel air from the line to be tested.

Test pressures shall be applied by means of a force pump sized to provide and maintain the required pressure without interruption during the test.

Water meters and pressure gauges shall be accurately calibrated and shall be subject to review and acceptance by the Engineer.

- D. PRESSURE TESTING:** After the section of line to be tested has been filled with water' the test pressure shall be applied and maintained without interruption for two (2) hours.

If the pressure test discloses that repairs or replacements are needed, such repairs or replacements shall be made, the line refilled, and the test pressure applied as before. This operation shall be repeated until the line withstands the test pressure in a satisfactory manner.

1. The test pressure shall be 150 psi or 1.5 times the working pressure, but not less than 1.25 times the working pressure at the highest point in the test section.

E. LEAKAGE TESTING: Following completion of pressure testing the pipeline shall be subjected to a leakage test. The duration of the leakage test shall be two (2) hours.

1. The hydrostatic pressure maintained during the leakage test shall be the same as specified for pressure testing of the pipeline and shall be maintained within plus or minus five (5) percent during the entire time that leakage measurements are being performed.
2. Measurement of leakage shall not be attempted until all trapped air has been vented and a constant test pressure has been established. After the pressure has stabilized, line leakage shall be measured by means of a suitable water meter installed in the pressure supply piping on the pipeline side of the force pump.
3. The term "leakage", as used herein, shall be the total amount of water which must be introduced into the line during the leakage test to maintain the test pressure. The line will not be accepted if and while it has a leakage rate in excess of the allowable leakage.
 - a. The allowable leakage is defined by 67 percent of the following AWWA formula:

$$L = \frac{SD (P)^{1/2}}{133200}$$

$$L = \frac{ND (P)^{1/2}}{7400}$$

Where

Ductile Iron:

L = Allowable leakage in gallons per hour
P = Average test pressure in PSI
D = Diameter of the pipe in inches
S = Length of pipe in feet

PVC:

L = Allowable leakage in gallons per hour
P = Average test pressure in PSI
D = Diameter of the pipe in inches
N = # of joints of pipeline being tested

- b. If the amount of leakage exceeds the allowable limit, the CONTRACTOR shall locate and repair the leaks and shall retest the line using the same test procedures.

All joints in piping shall be watertight and free from visible leaks during the leakage test. Each leak discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of the CONTRACTOR regardless of any amount that the total line leakage rate, during the leakage test, may have been below the specified allowable leakage rate.

All costs associated with repairing the pipeline to pass the pressure and leakage tests, including, but not limited to, excavation, repairing and

replacing pipe, backfilling, and seeding, shall be borne by the CONTRACTOR.

The point of delivery shall be at the end of the existing water system owned and operated by the SJWD Water District.

06. DISINFECTION: After successful testing, all water lines shall be disinfected by the CONTRACTOR before being placed into service. The lines are to be thoroughly flushed out and cleaned of any dirt, mud, debris, and discoloration.

All pipelines shall be disinfected in accordance with the requirements of AWWA C651. Connection pieces shall be disinfected in accordance with the requirements of AWWA C651, Section 9.

Disinfection shall be in accordance with the South Carolina Department of Health and Environmental Control, and any and all requirements thereof which may be in conflict with the provisions of this specification shall govern.

A disinfection solution of chlorine or calcium hypochlorite shall be introduced at one end of the water line as water is being withdrawn at the other end so that a minimum concentration of 25 mg/l of free chlorine is maintained throughout the entire water line. The chlorine solution shall remain in the piping for twenty-four hours, after which time the residual chlorine shall not have dropped below 10 mg/l. The chlorine residual must be measured and reported. If the chlorine residual has dropped below 10 mg/l, the line shall be flushed and a new disinfecting solution shall be introduced and the process repeated. The CONTRACTOR shall be responsible for installing all taps and fittings required to disinfect the line. The disinfecting solution shall be flushed from the system prior to sampling.

A. BACTERIOLOGICAL ANALYSIS: The contractor or owner shall collect a minimum of two (2) samples from each sampling site for total coliform analysis. The number of sites depends on the amount of new construction but must include all dead-end lines, be representative of the water in the newly constructed mains, and shall be collected a minimum of every 1,200 linear feet. Prior to sampling, the chlorine residual must be reduced to normal system residual levels or be non-detectable in those systems not chlorinating. Bacteriological samples must be collected at least twenty-four (24) hours apart and must show the water line to be absent of total coliform bacteria. Samples shall be analyzed by a South Carolina DHEC approved lab. If the non-coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated. If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must also be reported. These tests shall be conducted at the expense of the CONTRACTOR and not the District. Should the bacteriological analysis indicate that the

line is not disinfected as determined by the Local, State or Federal regulations, the CONTRACTOR shall repeat the disinfecting process as described above at no expense to the District.

All chemicals, taps, testing points, and apparatus required for disinfecting the lines shall be furnished by the CONTRACTOR.

All water for disinfection shall be furnished by the District as specified in the pressure and leakage tests. CONTRACTOR is to provide means of transporting water from Owner's delivery point to lines to be tested.

The District shall be responsible for the collection and delivery of water samples to be tested.

After chlorination, all treated water shall be flushed from the entire length of each line until the replacement water, on test, is satisfactory to the District.

The District shall be contacted for the required flushing sequence.

END OF SECTION

SECTION 02650

VALVES, HYDRANTS AND METERS

01. SCOPE OF WORK: Work furnished under this section shall consist of all valves, meters, hydrants, and appurtenances installed as part of the water line piping.

02. GENERAL: All valves, meters, hydrants, and appurtenances shall be furnished and installed in accordance with Section 02600 "Piping General Requirements", and as shown on the drawings. All material shall be equal to or greater pressure class than the adjoining pipe.

03. VALVES: Valves shall be provided as shown on the drawing and as specified herein. All valves shall have open and close direction indicator.

A. GATE VALVES: All gate valves shall have a minimum design working pressure of 150 psig and a test pressure of 300 psig.

2-inch gate valves installed below ground shall be threaded iron body with a 2" operator nut manufactured by Mueller or American Flow Control.

2-inch gate valves installed in pits shall be Crane 438 or Jenkins 270C with handwheel.

3-inch gate valves installed below ground shall be double-disk gate valves manufactured in accordance with ANSI/AWWA C500 with mechanical joints or threads as needed. Shall have a 2" operator nut and be manufactured by Mueller or American Flow Control.

3-inch gate valves installed in pits shall be iron body manufactured in accordance with ANSI/AWWA C500 with threaded, flanged, or mechanical joints as needed. Shall have a 2" operator nut and be manufactured by Mueller or American Flow Control.

Gate valves 4-inch through 1 2-inch shall be either double-disk or resilient seated gate valves.

Double disk gate valves shall conform to ANSI/AWWA Standard C500 and shall be manufactured by Mueller or American Flow Control.

Resilient seated gate valves shall conform to ANSI/AWWA Standard C509 and shall be the Metro Seal 250 manufactured by U.S. Pipe.

1. Gate valves shall be non-rising stem and shall open left unless otherwise noted. All operator nuts shall be 2-inch.

2. All interior and exterior ferrous metal surfaces of valves and accessories shall be shop coated for corrosion protection. The valve manufacturer's standard coating will be acceptable provided it is functionally equivalent to the specified coating and is compatible with the specified field painting.
3. The protective coating on interior surfaces of each valve shall be subjected to a non-destructive holiday test in accordance with ASTM G62, method A and shall be electrically void-free.
4. Exterior surfaces of valves coated with coal tar shall be field painted in accordance with the painting section. Field painting of valves coated with epoxy shall be limited to touch-up painting of damaged surfaces. Holiday testing of exterior coatings will not be required.
5. All valves and fittings greater than two (2) inches and installed above ground shall be flanged, ANSI Class 125, unless otherwise noted.
6. All valves installed below ground shall be mechanical joint and have a valve box.
7. Extension stems shall be furnished and installed where specified, indicated on the drawings, or otherwise required for proper valve operation. Extension stems shall be of solid steel and shall not be smaller in diameter than the valve stem. Extension stems shall be connected to the valve stem by means of a Lovejoy "Type D" single universal joint with grease-filled protective boot. All stem connections shall be pinned.

Extension stems shall be provided for buried valves when the valve operator is four (4) feet or more below finished grade. Each extension stem for a buried valve shall extend to within six (6) inches of the ground surface, shall be provided with spacers which will center the stem in the valve box, and shall be equipped with a wrench nut.

8. Valves greater than 12" shall be butterfly type as described further in this section.

B. BUTTERFLY VALVES: Butterfly valves shall be tight closing, rubber seat type with rubber seats that are securely fastened to the body. No metal to metal seating surfaces shall be accepted.

Butterfly valves shall meet the full requirements of the latest edition of ANSI/AWWA C504.

Valves shall be short body type, except where wafer type is specified, and constructed of cast iron ASTM A-126 Class B.

Valve discs shall be constructed of alloy cast iron ASTM A-436 Type 1. Disc shall be secured to shafts by means of solid, smooth sided, stainless steel or monel taper pins or dowel pins having a circular cross section through the shaft and shall be mechanically secured in place. The use of bolts, set screws, knurled or fluted dowel pins, expansion pins, roll pins, tension pins, spring pins, or other devices in lieu of the pins specified herein shall not be acceptable.

Valve shafts shall be fabricated of AISI Type 304 or 316 stainless steel shafts with 2" cast iron operating nut.

Valve ends shall be mechanical joint conforming to ANSI/AWWA C111/A21.11.

Acceptable valve seating surfaces mating with rubber are AISI Type 304 or 316 stainless steel, monel, or plasma-applied nickel-chrome overlay for all valves; bronze for 20 inch and smaller valves; and alloy cast iron for 20 inch and smaller manually operated valves.

Valve seat configurations which rely on the mating pipe flange to hold the seat in position in the valve body shall not be acceptable.

Shaft seals shall be of the chevron or O-ring type.

Each valve shall be provided with one or more thrust bearing in accordance with the governing standard. Thrust bearings which are directly exposed to line liquid and which consist of a metal bearing surface in rubbing contact with an opposing metal bearing surface shall not be acceptable.

Unless otherwise required by the District, the direction of rotation of the wrench nut to open each valve shall be to the left (counterclockwise). Each valve body or actuator shall have cast thereon the word "OPEN" and an arrow indicating the direction to open.

The housing of traveling-nut type actuators shall be fitted with a removable cover, which shall permit inspection and maintenance of the operating mechanism, without removing the actuator from the valve. Travel limiting devices shall be provided inside the actuator for the open and closed positions. Travel limiting stop nuts or collars installed on the

reach rod of traveling-nut type operating mechanisms shall be field adjustable and shall be locked in position by means of a removable roll pin, cotter pin, or other positive locking device.

Valves described in this paragraph shall be Henry Pratt, Mueller or American Darling.

- C. CHECK VALVES:** Check valves shall be the swing type manufactured and tested in accordance with the requirements of the latest revision to the AWWA Standard C-508.

Check valves larger than four (4) inches shall have an outside spring and lever, iron body, and shall be bronze mounted, full opening and suitable for minimum working pressures of 150 PSI unless noted otherwise.

Check valves three (3) inches and smaller shall be double check, all brass type with threaded connections.

- D. AIR RELEASE VALVE:** Individual air release valves shall be installed in the locations indicated on the drawings. Each valve assembly shall be installed complete with appurtenant piping and valves as specified or indicated on the drawings.

Individual air release valves shall have 1-inch inlet connections, and shall be air release/vacuum breaker type unless noted otherwise, and shall be GA Industries, Crispin, Valmatic, APCO, or Empire.

The valves shall be designed for a water working pressure of 300 PSI and shall have stainless steel floats. All working parts shall be constructed of brass, stainless steel, or other corrosion resistant materials.

The exhaust from each valve shall be piped to a suitable disposal point.

A shutoff valve shall be provided in the piping to each air release valve as indicated on the drawings.

- 04. VALVE BOXES:** Valve boxes shall be a 5 1/4 inch type P107 valve box designed for use in roads, driveways, and other areas experiencing heavy traffic.

Valve box base shall be round unless otherwise specified.

Lid shall be close fitting and have the letter "W" or the word "WATER" printed on the top.

Riser may be six (6) PVC if valve buried depth is less than four (4) feet unless otherwise noted.

Not more than one extension will be allowed with each slide type valve box.

Each valve buried to a depth greater than four (4) feet shall be provided with a valve box consisting of a cast iron cover and a six (6) inch cast iron pipe section. The pipe shaft shall be sized to extend from the valve to five (5) inches inside the valve box cover.

All parts of valve boxes, bases, and covers shall be shop coated by dipping in asphalt varnish.

Valves and valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves with the top of the box brought flush with the finished grade. After being placed in proper position, earth shall be filled in around each valve box and thoroughly tamped on each side of the box.

05. VALVE MARKERS: Valve markers are to be constructed of concrete as shown on the standard detail and shall be placed adjacent to each underground valve for the purpose of marking each valve.

Valve Marker is to note the distance from the marker to the valve.

Valve Markers are to be field located and placed in a spot that will not interfere with vehicular or pedestrian traffic. Location shall be approved by the District prior to installation.

06. FIRE AND POST HYDRANTS: Fire and Post hydrants shall be as follows:

A. FIRE HYDRANTS: All fire hydrants shall be 4 1/2 inch minimum nominal valve opening, National Standard Nozzle Threads and Operating Details, breakable ground flange, freeze proof, and conforming to AWWA Standard C-502. Fire hydrants shall open left (counterclockwise). Hydrants shall be Muller Centurion or American Darling Mark 73.

Three way hydrants shall have 2 (two) 2 1/2 inch and 1 (one) 4 inch nozzles and are to be used only in locations approved by the District.

Two way hydrants shall have 2 (two) 2 1/2 inch nozzles.

Hydrants shall be set so that at least the minimum pipe cover is provided for the branch supply line and the nozzles are at least 12 inches above finished grade. Each hydrant shall be blocked against the end of the trench with concrete or shall be otherwise suitably anchored. Thrust blocking should not block weep holes.

Hydrant drainage shall be provided by installing at least 7 (seven) cubic feet of gravel or crushed stone around the hydrant and below the top of the hydrant supply pipe. Hydrant drains shall not be connected to or located within ten (10) feet of sewer systems.

All hydrants shall stand plumb. Hydrants with pumper nozzles shall have hose nozzles parallel with, and the pumper nozzle perpendicular to, the edge of pavement.

Immediately before installation of a hydrant, the Following operations shall be performed: (a) the hydrant shall be thoroughly inspected; (b) the hydrant interior shall be thoroughly cleaned; and (c) the hydrant shall be opened and closed as many times as may be necessary to determine if all parts are in proper working order, with valves seating properly and the drain valve operating freely.

Hydrant is to be a center stem compression type hydrant, which opens against the pressure and closes with the pressure. Hydrant shall open by turning in a counterclockwise direction.

Hydrant body shall be all cast iron with 6 (six) inch mechanical joint, connecting shoe, glands, gasket and bolts with minimum 4 1/2" barrel.

Hydrant shall be furnished for a bury of 4' 0" unless otherwise specified.

Valve seat ring shall be bronze.

Fire hydrant shall be rated for 150 psi working pressure and 300 psi static pressure, unless otherwise noted.

Hydrants shall be provided with 6" hydrant lead, valve and valve anchoring tee.

B. POST HYDRANTS: Post hydrants shall meet all requirements of the related AWWA Standards and be self-draining and not-freezing with a single 2 1/2 inch nozzle. Hydrant drainage shall be as specified for fire hydrants.

Hydrant shoe shall be 2 (two) inch maximum diameter with IPT for connection to 2 (two) inch GIP blow off line and valve.

Post hydrant shall be manufactured by Mueller.

07. CORPORATION VALVES:

- A. 3/4 inch corporation valves are to be bronze 85-5-5-5 with IPS male threaded inlet and outlet suitable to, receive a 3/4" brass flare nut fitting for connection with a 3/4 inch type K copper water service line.

Corporation valves shall be rated for a working pressure of 250 psi.

- B. Corporation valves 1 (one) inch and larger are to be bronze 85-5-5-5 with a threaded male outlet for a brass flare nut.

- C. Corporation valves shall be Mueller H-15000 or Ford F-600.

08. TAPPING SLEEVES AND VALVES: Tapping sleeves for iron pipe shall be suitable for tapping all types of C.I. and D.I. pipe manufactured. For tap sizes 3-inch and larger Mueller H615 or American Darling mechanical joint tapping sleeve shall be used. Tapping sleeves for PVC pipe shall be suitable for tapping all types of PVC pipe manufactured. Each tapping sleeve shall be designed for a minimum working pressure of 150 psi and shall be tested at 300 psi. For tap sizes 3" and larger Ford Fast or Romac SST shall be used. For tap size 2" Ford FS1 or Romac SS1 shall be used.

09. TAPPING SADDLES: Tapping saddles shall have malleable iron (ASTM A47, Grade 32510) or ductile iron (ASTM A536) bodies. Two straps shall be provided, carbon steel (ASTM A307) electrogalvanized with dichromate seal. Nuts and washers shall be cold-formed, semi-finished heavy hex steel electrogalvanized with dichromate seal. Tapping saddles for iron pipe shall be suitable for tapping all types of C.I. and D.I. manufactured. For tap sizes 3/4" to 2" Ford 202, Rockwell 313, or Mueller service saddle double strap shall be used.

Tapping saddles for PVC pipe shall be suitable for tapping all types of PVC pipe manufactured. For tap sizes 3/4" and 1" Ford S70 shall be used.

Maximum working pressure shall be 300 psig.

Outlet size shall be threaded for 3/4 inch through 2 inch standard iron pipe thread dimensions.

10. TAPPING VALVES: Tapping valves shall conform to AWWA C500.

11. METER ASSEMBLY: Meter assemblies shall consist of all work required to properly furnish and install a water service meter box and meter.

- A. **METER BOX:** Meter box shall be a Ford Stretch Box LYLIV-P-221-233 or Ford Aqua Stretch Box 22A221 -33YNA-1 N.

Meter box shall have a cast iron base and lid and plastic top section. The box shall measure approximately 18" x 11" at the base with a cover opening of approximately 13 $\frac{3}{4}$ " x 6 $\frac{3}{4}$ ".

Meter boxes shall be suitable for installation of a standard plastic meter box extension. Meter box extensions shall be approximately 4 inches high and shall fit snugly in the meter box base for the purpose of raising the overall height of the meter box.

A brass "Ford" ball valve with locking wing nut suitable for connection to a $\frac{3}{4}$ inch flare nut shall be provided ahead of the meter. The flare nut shall be all brass.

Water meter couplings and nuts shall be furnished for the meter inlet and outlet. The tail piece is to have male iron pipe thread.

B. WATER METERS: Water meters shall be the positive displacement type meeting all requirements of AWWA Standards C-700.

Main case shall be bronze with graphite impregnated thermoplastic working chamber.

Lid and hinge shall be heavy duty nylon with brass pin.

Thimble shall be graphite impregnated nylon with high grade thermoplastic piston.

Shutter and driving bar shall be high-impact nylon.

Strainer shall be polyacetal resin.

Counter gearing shall be polyacetal resin with high-impact nylon spindals.

Counter case shall be high-impact reinforced nylon.

Number wheels shall be polyacetal resin.

Register dial shall be 3 inches in diameter with one sweep of hand registering 10 gallons.

C. DUAL CHECK VALVE: A 1" X 1" Watts No. 7 dual check valve (Model No. 7U45), or Aqua Pioneer (Model No. BU4-5) all brass body, is to be provided behind the water meter. The dual check valve shall be provided with a threaded female connection on the inlet side and a threaded male connection on the outlet side.

D. GATE VALVE: A brass $\frac{3}{4}$ inch gate valve is to be attached to the end of the brass $\frac{3}{4}$ inch nipple outside the meter box. A PVC valve box with lid is to be placed for operation of the gate valve. (Valves shall be Crane 438, Jenkins 270C, or Hammond IB645.)

E. SERVICE LINES: Service lines shall be $\frac{3}{4}$ inch type K copper pipe as manufactured by Cerro, Mueller, or Halstead.

END OF SECTION

SECTION 15020

DUCTILE IRON PIPE AND FITTINGS

01. SCOPE OF WORK: This section covers the material and installation of ductile iron pipe and fittings. Ductile iron pipe shall be furnished complete with all fittings, jointing materials, pipe hangers and supports, anchors, blocking encasement, and other necessary appurtenances.

Pipe shall be tested in accordance with the pipeline pressure and leakage testing section.

02. MATERIAL: Ductile iron pipe and fittings shall be as follows:

A. DUCTILE IRON PIPE:

Ductile iron pipe shall be ductile cast iron manufactured in conformance with AWWA C151 and ANSI Standards A21.51 and A21.52, with the thickness to be in conformance with ANSI A21.50. Acceptable manufacturers list are supplied by the District

Pipe three (3) inches and larger in diameter shall be minimum thickness Class 51 or pressure class 350, ductile iron, unless otherwise noted, having a 350 PSI pressure rating.

Pipe shall be suitable for push on joints or mechanical joints, conforming with requirements of ANSI/AWWA C11 1/A21.11, except gaskets shall be neoprene or other synthetic rubber.

Bolts shall be ASTM A307, chamfered or rounded ends projecting ¼ to ½-inch beyond outer face of nut.

Nuts shall be ASTM A307, hexagonal, ANSI 318.2.2, heavy, semi-finished pattern.

B. FITTINGS:

Fittings for push on and mechanical joints shall be ductile iron and have a pressure rating of 350 PSI and conform with requirements of ANSi/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. Flanged joints shall meet the same requirements except have a pressure rating of 250 psi. Acceptable manufacturers list are supplied by the District.

Fittings shall be coated the same as specified for ductile iron pipe.

All fittings shall be suitable for pipe to be furnished, both ductile iron and PVC pipe. Transition gaskets are to be provided when using cast or ductile iron fittings with PVC piping.

03. INSTALLATION: All pipe and fittings shall be installed in accordance with standards and recommended practices of the American Water Works Association (AWWA) and the Cast Iron Pipe Research Association and as specified in other sections of the specifications. Mechanical joints shall be used for pipe installed on piers. Push-on or mechanical joints shall be used for buried pipe installation. All fittings at bends, and tees shall be adequately blocked or restrained to prevent movement.

All fittings for PVC piping three (3) inches through eight (8) inches and installed underground shall be cast or ductile iron mechanical joint with appropriate transition gaskets provided to form a watertight joint.

END OF SECTION

SECTION 15050

PVC PIPE AND FITTINGS

01. SCOPE OF WORK: This section specifies the material and installation to be furnished for all PVC pipe & fittings as specified or shown on the plans.

02. MATERIAL:

A. PIPE:

1. PVC pressure pipe shall conform to AWWA C900 and ANSI/ASTM standard D2241 (PVC 1120) and shall bear the seal of the National Sanitation Foundation. PVC pressure piping shall be in accordance with ASTM D 1784 for PVC compounds, ASTM S-3139 for push on joints and ASTM F-477 for rubber gaskets. The pipe furnished will also meet the following specifications.
 - a. Unless otherwise specified all PVC water line piping 4 and 6 inches in diameter shall be AWWA C900 SDR 18, Pressure Class 150 or SDR 14, Pressure Class 200.
 - b. Unless otherwise specified all PVC water line piping less than 4 inches and larger shall be Class 200 PVC, SDR 21.
 - c. All PVC piping shall be provided with a continuous #14 gage, coated copper wire. The wire shall be placed directly under the pipe.

B. ACCEPTABLE MANUFACTURERS:

Acceptable manufacturers list are supplied by the District.

1. ALL PVC PRESSURE PIPING shall be installed and supported uniformly and continuously over its entire length on firm stable material. Backfill in contact with the pipe shall not contain rock or debris with a diameter greater than ½ inch. Installation shall be in accordance with ASTM D2774.
2. ALL PIPE shall be installed in accordance with Section #02600 "Piping General Requirements".

03. TESTING: The pipe furnished shall meet the following test limits:

Pipe will not fail when tested in accordance with AWWA C-900 and ASTM 2241 for sustained pressure, burst pressure, flattening and

extrusion quality. Each section of C-900 must pass a hydrostatic proof test at four times its rated class pressure for a minimum of five seconds.

The pipe manufacturer shall certify in writing and receive the District's approval, prior to shipment and delivery of pipe, that all pipe furnished meets the above test limits. Failure to provide the written certification shall be considered cause for rejection of the pipe by the District.

04. WARRANTY:

- A.** All pipe shall be fully warranted by the pipe manufacturer against defects in material for a period of one year from date of delivery to job site. All pipe determined by the District to be defective or pipe not meeting the above specifications shall be promptly replaced.
- B.** If during the warranty period and as a result of testing by the District, the pipe is found to not meet specified test conditions stated above, all pipe is to be dug up and replaced at the Contractor's expense, or at the MANUFACTURER'S EXPENSE if pipe is purchased and installed by District personnel.

END OF SECTION

SECTION 15060

BORE AND ENCASEMENT

01. SCOPE OF WORK: The CONTRACTOR shall furnish all labor, equipment, tools and materials necessary to perform all tasks to complete highway, railroad, or other bores as required.

02. GENERAL: Bores shall be in conformance with Section 02600. Clearing, grubbing, grassing, trench excavation and backfill shall be as specified in other sections. Testing, sterilization, and placement in service shall be considered as an integral part of the work to completely install the water lines. Boring and tunneling operations shall be performed in accordance with all requirements of the SCDOT or the railroad, as applicable, including insurance, inspection, temporary work, watchmen, flagmen, protection of personnel and property, work restrictions, and work scheduling. Unless otherwise specified or directed, the CONTRACTOR shall pay for all costs in connection with meeting these requirements. The CONTRACTOR shall be responsible for repair or replacement of all existing structures and facilities, including roadways damaged or disturbed as a result of the work within a period of two years after completion of boring and tunneling operations. Repairs shall be performed at no additional cost to the OWNER, Department of Transportation or railroad. All work shall be completed to the full satisfaction of the OWNER, Department of Transportation or railroad.

03. MATERIAL: Materials for carrier pipe and encasement pipe shall be as follows:

A. CARRIER PIPE: Ductile iron pipe and fittings shall be used on all highway and railroad bores as shown on the plans. Ductile iron pipe and fittings shall be as specified in Section 15020. The carrier pipe shall be restrained, as indicated in the drawings, throughout the casing pipe.

B. ENCASEMENT PIPE: Encasement pipe shall be provided on all railroad, S.C. Dept. of Highways and Public Transportation and Public Transportation encasement pipe shall be welded or seamless wrought steel pipe manufactured of Grade "B" steel in accordance with ASTM A 139 and shall be coated inside and out with two (2) coats of coal-tar epoxy. Pipe size and minimum wall thickness shall be as follows:

<u>CARRIER PIPE NOMINAL I.D.</u>	<u>CASING PIPE MINIMUM I.D.</u>	<u>MINIMUM WALL THICKNESS (INCHES)</u>
3"	12"	.250
6"	14"	.250
8"	16"	.3125

10"	18"	.3125
12"	20"	.375
16"	24"	.4375
24"	36"	.5625

Railroad encasement shall be as required by railroad permit.

C. CASING SPACERS: Casing spacers shall be prefabricated steel with polyethylene insulators capable of being securely fastened to the carrier piping by bolting methods. Casing spacers shall be Cascade, Advance Products, CMI Boyd's Spider Manufacturer or approved equal. A minimum of two spacers shall be used per pipe (see standard SJWD detail). Submittals for approval shall be made for the use of casing spacers.

E. END CLOSURE: Both ends of each casing conduit shall be closed with rubber casing boots with stainless steel straps as manufactured by Cascade or APS.

04. INSTALLATION: Unless otherwise specified or directed, encasement shall be welded steel pipe installed by boring and jacking. CONTRACTOR shall submit complete drawings, details and other data of the proposed method of construction, materials and equipment to the ENGINEER and department of transportation or railroad for review. No open excavation will be allowed within the limits of the encasement without the ENGINEER's approval. All sheeting, shoring and bracing shall be provided as necessary for the satisfactory and safe performance of the work, and will be subject to the approval of the ENGINEER and in accordance with the requirements of the department of transportation or railroad. All work areas shall be maintained in a suitable dry condition at all times, with methods of dewatering, draining, pumping and disposal of water subject to approval of the ENGINEER and department of transportation or railroad.

Boring and Jacking Encasement: Encasement pipe shall be installed by boring and jacking, with welded joints to the required lines and grades. The CONTRACTOR shall bear the cost of any corrective action required to meet the line and grade requirements shown on the plans. Welding shall conform to the requirements of the American Welding Society and the American Railway Engineering Association for this type of work. The distance to which boring is carried ahead of the pipe shall be not more than is absolutely necessary for installation purposes, and will be subject to approval of the ENGINEER. The work shall be performed so that no voids occur in the earth surrounding the pipe and so that ground settlement adjacent to and within the limits of the pipeline crossing is eliminated. If voids occur or are encountered outside the pipe, grout holes shall be drilled at 10-foot centers in the top of the encasement pipe and the voids filled with 1:3 Portland

cement grout applied at sufficient pressure to fill the voids and prevent embankment settlement. If it becomes necessary to abandon an incomplete or unacceptable bore, the abandoned encasement shall be capped and filled completely with 1:3 Portland cement grout. Abandonment procedures shall be completed prior to moving to another boring location. All costs in connection with an abandoned bore, including the construction cost and capping and filling costs, shall be the CONTRACTOR's expense.

Carrier Pipe Installation: Carrier Pipe shall be installed in a manner to provide proper line and grade. Carrier pipe shall be adequately supported in the encasement piping with stainless steel spacers to prevent movement, including floatation. Casing spacers shall be spaced a maximum of 10 FT. All carrier piping shall be restrained at each joint within the casing pipe. If no specific restraint is indicated in the drawings, the CONTRACTOR shall submit his proposed method of installation and details of restraint to the ENGINEER prior to installation. After the carrier pipe is installed, each end of the encasement shall be sealed with rubber casing boots with stainless steel straps as manufactured by Cascade or APS.

Directional Drilling: Where directionally drilled (without casing) of pipe under highways or railroads is indicated, the bore diameter shall be essentially the same as the outside diameter of the pipe to prevent settlement or caving. All borings under public roads shall comply with SCDOT regulations. If voids develop or if the bore diameter is greater than the outside diameter of the pipe by more than 1 inch, the voids shall be pressure grouted or other remedial measures as approved by the ENGINEER shall be taken at the CONTRACTOR's expense. Tracer wire shall be installed within the casing pipe and connected to the tracer wire for the non cased pipeline sections. Tracer wire shall be taped securely to the carrier piping prior to insertion in the casing.

Appurtenances: Vents and drains, where required, shall be provided where indicated on the plans. Vents shall consist of pipe as noted, and shall be located so as not to interfere with highway maintenance or be concealed by vegetation. Drains shall be provided at the lower end and shall consist of stone as noted on the plans.

05. INTERRUPTION OF TRAFFIC: No interruption of traffic will be permitted at any location where tunnels are required.

END OF SECTION