WASTE WATER SPECIFICATIONS

FOR

THE CITY OF TIFTON, GEORGIA

SECTION 1.01

SEWERS and ACCESSORIES

1.01 SCOPE: This section of the Specifications describes material and equipment to be incorporated into the sewers and piping systems and the requirements for the installation and use of thesesystems. Where the term "Contractor" is used, this term shall refer to the City of Tifton forces as well as to Contractors and/or Subcontractors employed by the City.

1.02 GENERAL: All materials shall be supplied and all work performed in accordance with applicable American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards shall be applicable. Manufacturers of materials shall submit evidence, if requested by the Engineer, of having consistently produced materials of satisfactory quality and in service performance results for a period of at least over two years.

1.03 PIPE and ACCESSORIES: Pipe, joint material, and made up joints shall be tested by an independent testing laboratory approved by the Engineer. Materials, absorption, crushing (where applicable), and hydrostatic leakage tests shall be conducted on pipe of each size and type in accordance with applicable specifications. Each length of concrete pipe shall be stamped by a regular employee of the approved testing laboratory. Independent of the laboratory test, all pipe shall be subject to the inspection of the Engineer at the pipe plant, trench, or other point of delivery for the purpose of culling and rejecting pipe which does not conform to the requirements of these specifications. Inspection items shall include but not be limited to; laboratory stamp, shape, cracks, uniformity, blisters and imperfect surfaces, harruner test, damaged ends and gasket grooves. Repaired pipe or patched pipe or repairs to or patching of gasket grooves or shoulders will not be permitted.

(a) Reinforced Concrete Pipe: Reinforced concrete pipe shall be supplied in lengths of at least six feet.

(1) Pipe: Pipe shall be reinforced concrete bell and spigot conforming to ASTM C 76, Wall B pipe. For pipe with a diameter of 30 inches or greater, acceptance shall be on the basis of material tests and inspection of manufactured pipe for defects and imperfections as defined in Paragraph 4.1.2 of ASTM C 76. Acceptance of smaller pipe shall be on the basis of plant load bearing tests, material tests, and

inspection of manufactured pipe for visual defects and as described in Paragraph 4.1.1 of ASTM C 6.

(2) Joints: Pipe shall have rubber gasket type joints conforming to ASTM C 443. A rectangular groove shall be supplied in the spigot end to receive the rubber gasket, and it shall be so formed that when the joint is complete the gasket will be deformed to a rectangular shape and confined on all four sides.Bell and spigot surfaces shall be accurately formed and smooth to provide a close sliding fit with a nominal clearance of 1/16 of an inch.

(b) Vitrified Clay Pipe: Delete this section in its entirety.

(c) Ductile Iron Pipe: Ductile iron pipe may be utilized in force mains, stream crossings, highway and railroad crossings, and other applications (such as casings) as may be shown on any job specific drawings. All pipe shall be furnished in lengths of at least 18 feet.

(1) Pipe: Ductile iron pipe shall conform to AWWA C 151 and shall be class 50 unless otherwise specified or shown on job specific drawings. Pipe and fittings shall be cement lined in accordance with AWWA C 104. Fittings shall conform to AWWA C 110 with a rated working pressure of 150 PSI. Pipe and fittings shall be furnished with a bituminous outside coating.

(2) Joints: Joints shall be push-on type for pipe and standard mechanical joints for fittings. Joints shall conform to ASA 21.11. Restrained joint pipe shall be American “LOCK-FAST”, U.S. Pipe “LOK-TYTE”, “Clow SUPER-LOCK," or approved equal.

(d) Polyvinyl Chloride Gravity Sewer Pipe: PVC gravity sewer pipe shall be utilized in various diameters and shall be supplied in lengths not longer than 20 feet. When installed in a casing, the pipe shall be supported by wooden skids strapped to the pipe barrel (or some similar arrangement acceptable to the Engineer) to preclude contact between the pipe bell or coupling and the casing wall. All PVC gravity sewer pipe shall be laid with a minimum of Class· "B" bedding. The installation- shall conform to the requirements of ASTM 2321.

(1) Pipe: PVC gravity sewer pipe shall be SDR 35 pipe, manufactured in accordance with ASTM *D* 3034. Acceptance shall be on the basis of certification by the

manufacturer that the pipe supplied conforms to these requirements.

(2) Joints: Joints for pipe and fittings shall be of the bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage. The joint system shall be subject to the approval of the Engineer and shall be identical for pipe and fittings. Fittings for pipe eight inches and less in diameter shall be one piece with no solvent-welded joints. Fittings for pipe ten inches in diameter and larger may be fabricated using solvent welding; however, no field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings delivered ready for use.

(e) Polyvinyl Chloride Pressure Pipe: PVC pressure pipe shall be utilized in force mains and in certain other applications specifically shown on the job drawings, but shall not be substituted for cast or ductile iron pipe specified for stream crossings. When installed in a casing, the pipe shall be supported by wooden skids strapped to the pipe barrel (or some similar arrangement acceptable to the Engineer) to preclude contact between the pipe bell or coupling and the casing wall.

(f) Pipe: All PVC pressure pipe shall conform to ASTM D 2241. PVC used in the manufacture of the pipe shall be PVC 1120. The pipe shall have SDR of 21 and shall be capable of withstanding a working pressure of 200 PSI or greater. Pipe shall be supplied in lengths of at least eighteen (18) feet.

(1) Joints for pipe and fittings shall be of the bell and spigot-type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage. The joint system shall be subject to the approval of the Engineer and shall be identical for pipe and fittings. Fittings for pipe eight inches and less in diameter shall be one piece with no solvent-welded joints. Fittings for pipe ten inches in diameter and larger may be fabricated using solvent welding; however, no field fabrication of fittings will be allowed.All such fabrication shall be performed at the factory and the fittings delivered ready for use. Special adaptors shall be provided as recommended by the manufacturer to adapt the PVC pipe to mechanical jointing with cast iron pipe, fittings, or valves.

(g) Steel Pipe: Steel pipe shall be fabricated electrically welded steel water pipe manufactured in accordance with AWWA C 201. Steel plate used in the fabrication shall be ASTM A 283 Grade "B". Inside diameter and wall thickness are shown on the appropriate job drawings. Sections of steel pipe shall be joined with couplings equal to Dresser Style 38. Pipe shall be coated and wrapped in accordance with AWWA C 203. All joints, couplings, and abraded areas shall be touched-up before backfilling the trench.

(h) Materials and Manholes: Materials for construction of manholes should be as follows:

(1) Precast Concrete Sections: Manholes shall be constructed of precast concrete sections which meet the requirements of ASTM C 473. The minimum compressive strength of the concrete in precast sections shall be 4000 PSI. The minimum shell thickness shall be one twelfth of the inside diameter of the riser of the largest cone diameter. Joints between precast sections shall be sealed by means of rubber "O" ring gaskets or flexible plastic gaskets as manufactured by Ram-Nek or approved equal.

(2) Brick and Mortar: Brick shall be whole and hardburned conforming to ASTM C 32 Grade MS.Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement and sand shall conform to requirements of Paragraph 1.11.

(3) Iron Castings: Cast iron manhole frames, covers, and steps shall be gray iron, conforming to ASTM A 48 for Class 25B gray iron and all applicable local standards. All castings shall he tough, close grained, smooth and free from blow holes, blisters, shrinkage, strains, cold shots, and other imperfections. No casting will be accepted which weighs less than 95% of the design weight. Shop drawings shall indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins. Manhole frames and covers shall be equal to the following: Standard - 350# - Neenah R-1700 Traffic - 450# Neenah R-1712BWatertight - 370# - Neenah R-1915-H2 Watertight Traffic - 440# - Neenah R-1915-G. All

frames and covers shall have machined horizontal bearing surfaces. Bolt-down covers shall be equipped with four 1/2 inch stainless steel bolts and a 1/8 inch red rubber or rubber "O" ring gasket. Covers shall be rotatable and interchangeable. Bolt holes shall be bored through so that debris entering the bolt hole will fall into the manhole. All manholes shall have standard frames and covers except where specifically shown otherwise on the job drawings.

(4) Manhole steps of polypropylene molded around a steel rod, manufactured by M.A. Industries or equal may be used.

1.04 LOCATION and GRADE: The line and grade of the sewer and the position of the manholes and other appurtenances will be as shown on the job drawings. The grade line shown on the profile and/or called for in the specifications is the grade of the invert of the pipe. The Contractor shall cooperate with the Engineer in the following sequence of events relative to the location and grade of the sewer line:

(a) The Contractor will provide for the location and identify the centerline of the sewer in a manner which will allow the clearing of the construction area.

(b) After clearing is completed, the Contractor will provide for a temporary bench mark in the vicinity of each manhole or other major structure and a hub at the centerline of each manhole and at all other locations where the alignment of the sewer changes.

(c) Prior to beginning construction of any section of the sewer line, the Contractor shall prepare cut sheets and submit them to the Engineer for approval.

(d) During the construction, the Contractor shall be responsible for the following:

(1) Protection of the bench marks and verifying their location if the surrounding area is disturbed.

(2) Preserving the location of the hubs in order to maintain accurate sewer alignment.

(3) Providing all other construction lines and grades.

(e) Recommended Minimum Slopes:

(1) 8 Inch 00.40 %

(2) 10 Inch 00.28 %

(3) 12 Inch 00.21 %

(4) 15 Inch 00.18 %

(5) 18 Inch 00.15 %

(6) 24 Inch 00.12 %

(7) 30 Inch 00.09 %

(8) 36 Inch 00.06 %

(f) High Velocity Protection: Where velocities greater than 15 feet per second are attained, due to high slopes, special provisions shall be made to protect displacement of solids.

(g) Steep Slope Protection: Sewers on 20% slopes or greater shall be anchored securely with concrete, or equal, with anchors spaced as follows:

a. Not over 36 feet center to center on grades 20% and up to 35%.

b. Not over 24 feet center to center on grades 35% and up to 50%; and

c. Not over 16 feet center to center on grades 50% and greater.

1.05 EXISTING UNDERGROUND UTILITIES and OBSTRUCTIONS:

Before beginning any construction work, the Contractor shall call the Georgia Utilities Location group (1-800-282-7411 or 811) a minimum of forty eight (48) working hours prior to beginning construction for locates on all utilities in the construction area. Certain existing water lines, sewer lines, gas lines, underground telephone lines, underground electric lines, underground fiber optic cables, culverts, and cross drains are shown on the Drawings, according to the best information available to the Owner. The Drawings indicate the pipe lines to be laid over, under, or around underground utilities or obstructions that are known to exist. Where these or unforeseen underground utilities are encountered, the location and alignment of the proposed sewer line may be changed, upon written approval of the Engineer, to avoid interference.

(a) Electronic Pipe and Cable Locator: The Contractor shall furnish and have available at all times an Electronic Pipe and Cable Locator in working order, for the purposes of locating existing pipe lines or other obstructions in the way of or along the route of the new work.

(b) Relocation of Services: Before the sewer line is laid, the Contractor shall locate water and other utility services to avoid interference with such services or to determine whether services should be relocated. The Contractor shall be responsible for and shall repair any damage done to utilities services or pipe lines resulting from the work of locating services or resulting from the construction operation. The Engineer shall have the right to determine the services which are to remain in place and the services which shall be relocated. Where the Engineer determines that the services shall be relocated, the Utility will make the necessary changes without cost to the Contractor.

1.06 CONSTRUCTION ALONG HIGHWAYS, STREETS, and ROADWAYS: The Contractor shall install sewer lines and appurtenances along highways, streets, and roadways in accordance with applicable regulations and requirements of the Georgia Department of Transportation, Tift County, and the City of Tifton with reference to construction operations, safety, traffic control, road maintenance, and repair. The Contractor shall provide required signs, barricades and lights for protection of traffic in locations where traffic may be endangered by construction operations. All highway signs removed for construction shall be replaced as soon as the condition which warranted their removal has been cleared. No highway, street or roadway shall be closed without first obtaining permission from the proper authorities. Any portion of the trench excavated shall be backfilled and tamped during the same work day and no portion shall be allowed to remain open overnight. Sufficient barricades and warning lights shall be provided and at least one traffic lane will remain unobstructed during construction. Flagmen shall be provided by the Contractor as required.

1.07 EXCAVATION: All excavation shall be by open cut. The top portion of the trench may be excavated with vertical or sloping sides to any width within the construction easement which will not cause unnecessary damage to adjoining structures, roadways, pavements, utilities, trees, or private property. The slope of the sides of an un-shored trench and the size and spacing of members used to shore a trench excavated with vertical sides shall be in accordance with the Occupational Safety and Health Act of 1970 (PL 91596).The width of the

lower portion of the trench to a height of two feet above the top of the pipe shall not exceed the outside diameter of the pipe plus eighteen (18) inches. If trenches are excavated to width in excess of the above limitations or collapse because of inadequate or improperly placed bracing or sheeting, pipe shall be laid in accordance with the requirements of at least the next better class of bedding at the expense of the Contractor. Excavation in excess of the depths required for manholes and other structures shall be corrected by pouring a sub foundation of concrete at the Contractor's expense.

(a) Bracing and Sheeting: The sides of all trenches and excavation for structures shall be securely held by stray bracing, or by skeleton or solid sheeting and bracing, as required by soil conditions encountered.

(1) Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good serviceable condition. Size and spacing shall be in accordance with OSHA requirements as cited above. Bracing and sheeting may be removed in units when the level of the backfilling has reached the point necessary to protect the pipe and adjacent property. When in the opinion of the Engineer sheeting and bracing cannot be safely removed, it shall be left in place. Sheeting so left in place shall be cut off at least two feet below the surface.

(2) Steel Sheet Piling: Continuous lock joint steel sheet piling may be substituted for timber sheeting when approved by the Engineer. Steel piling may be removed, without cutting, provided the rate of removal is kept in pace with the tamping and backfilling operations to assure complete filling of the void created by the withdrawal of the piling. Complete withdrawal of the piling in advance of tamping and backfilling will not be permitted. Piling, where ordered to be left in place by the Engineer for reasons of safety, will be cut off where directed.

(b) Dewatering Trenches: All excavation shall be dewatered immediately prior to laying pipe. Where running sand is encountered, dewatering shall be done by well pointing wherever possible. Where soil conditions are not favorable for use of well point, french drains of

crushed stone or gravel shall be constructed to suitably located sumps and the water removed by bailing or pumping.

(c) Crushed Stone Stabilization: Wherever the sub grade is by nature too soft or mucky, in the opinion of the Engineer, for the proper installation of the sewer, he may order the Contractor to undercut the trench and backfill with crushed stone or gravel (No. 57 or equal). The stone so placed shall be brought to the sub grade required by the class of bedding specified for the particular location and compacted.

1.08 BEDDING OF SEWER: Stone or gravel bedding materials shall consist of crushed stone or gravel, (No. 57 or equal). Bedding material shall be placed on a flat bottom trench and thoroughly compacted by tamping or slicing with a flat bladed shovel.

(a) Classes of Pipe Bedding: All pipe shall be laid on foundations prepared in accordance with the various classes of bedding required by the trench width and depth for the size of the pipe to be laid. Bell holes shall be provided in all classes of bedding so as to relieve pipe bells of all load, but small enough to insure that support is provided throughout the length of the pipe barrel. All pipe shall be laid with minimum Class “C” bedding unless specified otherwise.

(1) Class "A": Bedding shall be concrete cradle. The trench shall excavated to a depth of one-fourth the nominal diameter of the pipe below grade and the pipe laid to line and grade on concrete blocking. Class "C" concrete shall then be poured to the full width of the trench to a height of one-fourth the outside diameter of the pipe above the invert.

(2) Class "B": Bedding shall be placed in the following manner. The bottom of the trench shall be excavated flat at a level a minimum distance, as shown on the job drawings, below the bottom of the pipe barrel. The pipe bed shall be brought to the proper grade and then to the bottom one-half of the outside pipe diameter with compacted crushed stone or gravel.

(3) Class "C": Bedding shall be placed in the following manner. The bottom of the trench shall be excavated flat at a level a minimum distance, as shown on the job drawings, below the bottom of the pipe barrel. The pipe bed shall be brought to the

proper grade and then to the bottom one-fourth of the outside pipe -diameter with compacted crushed stone or gravel.

(b) Bedding of Manholes: Excavation for manholes shall extend a minimum of twelve (12) inches below the planned elevation of the base of the manhole. The bed shall then be brought to proper grade with crushed stone or gravel.

1.09 MANHOLES: Manholes shall be constructed in accordance with the job specific detail drawings at locations shown on the plans and where directed by the Engineer.

(a) Precast Concrete: Riser sections shall be handled carefully to prevent cracking or chipping. Particular attention shall be paid to achieving a uniform seating of the bottom riser on the bedding to prevent the development of cracks as further riser sections are added. If preformed openings must be enlarged or altered, or if new openings must be made in the field, care shall be taken to minimize the amount of material removed in order to provide closely matched surfaces for grouting. Gaskets shall be utilized in accordance with manufacturer's recommendations when placing riser and cone sections to produce a watertight structure.

(b) Brick Manholes: The bottom of each manhole shall be constructed of concrete as depicted on the job drawings. Every brick shall be embedded in mortar on its bottom and sides, and the walls shall be thoroughly plastered on the outside with a smooth coat of mortar, 3/4-inches thick. Inverts shall be carefully constructed, with special care exercised in laying the channels and adjacent pipes to grade. Channels shall be properly formed and rounded and shall be troweled smooth. The connection of the sewer with the wall and channel of the manhole shall be tight and smooth. Where shown on the plans, the first length of pipe for future lateral sewers of such size as may be designated shall be laid to proper grade and alignment and shall be plugged with a suitable pipe stopper. The top of manholes outside of streets, roads, and highways shall be built 13 inches above ground unless otherwise shown on the plans or directed by the Engineer. Manholes in streets, roads, etc., shall be built to existing grades. Manholes requiring drop connections are to be shown on the job

drawings. Drop connections shall be constructed of the same type and class of materials as the upstream sewer and in accordance with the details shown on the job specific drawings.

1.10 LAYING PIPE: All sewer pipe shall be laid upgrade with the spigots pointing downgrade. The pipe shall be so laid that after the sewer is completed, the invert line shall conform accurately to the grades and alignment fixed or given by the Engineer.

(a) Handling: Tools and equipment suitable for the safe and convenient-handling and laying of pipe shall be used and great care shall be taken to prevent the pipe from being damaged. All pipe shall be carefully examined for cracks and other defects, and no pipe or fitting shall be laid which is known to be defective. If any pipe or fitting is discovered to be cracked, broken, or defective after being laid, it shall be removed and replaced with sound material without further charge.

(b) Placing and Jointing: The interior of all pipes shall be cleaned of dirt and other foreign material as pipe laying proceeds. Prior to jointing, the surfaces of the pipe to be jointed, as well as the molded surfaces of the joint, shall be wiped free of dust, dirt, gravel, and other foreign substances. After thorough cleaning, the mating surfaces of the joint shall be brushed with the proper type of lubricant sealer as supplied by and in accordance with the recommendations of the manufacturer. The spigot end shall then be centered on grade into the bell of the preceding pipe and shoved home and properly seated with the application of a moderate force by a pry or lever device. Joints shall be made no later than five minutes after the application of the sealer. In the event that there is a delay of longer than five minutes between sealing and jointing, the lubricant sealer shall be applied again. Immediately after jointing, the lubricant sealer shall be applied again. Immediately after jointing, the last pipe shall be brought-to final alignment and grade. Defective joints discovered after laying shall be repaired and made tight.

(c) Force Mains: Provisions of (a) and (b) are applicable to laying force mains. In addition, the following requirements apply:

(1) All mechanical joints shall be made in accordance with the manufacturer's recommendations.

(2) The Contractor shall take special precautions to prevent damage to the cement lining of the pipe.

(3) The Contractor shall insure that the force main is installed at a flat or positive grade as shown on the Drawings. Pipe laid incorrectly at negative grade shall be removed and correctly placed at the Contractor's expense.

(4) Bedding for force mains shall be as shown on the job drawings.

1.11 CONCRETE ENCASEMENT COLLARS AND BLOCKING:

(a) Placement of Concrete: Where called for on the plans, or where otherwise directed by the Engineer, the pipe shall be completely encased with concrete. The trench shall first be excavated not less than 6 inches below the bell of the pipe and the pipe laid to line and grade on concrete blocking. Concrete then shall be poured to the full width of the trench, but ill no case less than 6 inches from the pipe bell on either side of the trench, and to a height of not less than 6 inches above the top of the pipe bell. No backfill material shall be placed in the trench for a period of at least 24 hours after the concrete encasement has been poured. Where called for on the plans and where required by the Engineer, reaction blocking shall be placed in a manner similar to encasement but to the thicknesses shown on the job drawings or specified by the Engineer. Collars shall be constructed in accordance with and in locations shown on the job drawings.

(b) Materials: Materials for use in concrete shall be in accordance with the following:

(1) Cement: All cement shall be on brand of Portland cement, shall be Type I, and shall meet the requirements of ASTM C 150. One bag shall be· considered to weigh 94 lbs. Minimum cement content shall be 376 lbs. (4 bags)/cu. yd.

(2) Aggregates: Aggregates shall conform to requirements of ASTM C 33.

(aa) Fine Aggregate: Fine aggregate shall be clean natural sand free of Sulphate or other injurious substances.

(bb) Coarse Aggregate: Coarse aggregate shall be clean gravel or crushed stone. Sizes of coarse aggregate shall be the largest which are obtainable from the producer

and which are readily workable.

(3) Water: Mixing water for concrete shall be fresh, clean and potable.

(a) Mixing: The water cement ratio of the mix shall be established in the design and shall be based on the established relationship between the water cement ratio and the strength of the concrete, and shall be such as to produce the required strength of the concrete with the least amount of water consistent with the workability of the mix. Surface water contained in the aggregate shall be included as part of the mixing water in computing the water content. The design shall provide for a slump of 3" minimum, 5" maximum.

1.12 BACKFILLING: Backfill underlying pavement and backfill under dirt and gravel roads shall be compacted to 95% of the maximum, dry density as determined by the Standard Proctor Compaction Test (ASTM D 698).

(a) Selected: Selected backfill material shall consist of finely selected earth, stone dust, sand or other approved material, carefully placed about the pipe in uniform 6-inch layers to a depth of at least 18 inches above the pipe bell. Each layer shall be thoroughly compacted with proper hand tools in such a manner as not to disturb or damage pipe. Backfilling shall be carried on simultaneously on both sides of the pipe so that damaging side pressures do not occur. If suitable select materials are not available from trench excavation, the Contractor will be required to obtain them elsewhere at his own expense.

(b) General: After selected backfill material has been placed and tamped, the remainder of the trench may be backfilled with general excavated -material, provided such material shall not contain more than-1/3 broken rock, of which no single stone or boulder shall weigh more than 50 pounds. Backfill material shall be placed in uniform layers thoroughly compacted with heavy duty power tamping tools of the "Wacker" type, to the full satisfaction of the Engineer. Whenever the trenches have not been properly filled or settlement occurs, they shall be refilled, smoothed off and finally made to conform to the surface of the ground. Backfilling shall be carefully performed and the original surface restored to the full satisfaction of the Engineer. Surplus material shall be disposed of as directed by the Engineer.

1.13 SEQUENCE OF WORK: Excavation, cleaning, laying, jointing, and backfilling shall be performed as promptly as possible upon completion of the previous operation. In no case shall pipe be left in the trench over- night without completing jointing. Trenches shall be backfilled immediately after pipes are laid and joints inspected by the Engineer, unless other protection of the pipeline is directed. Normally, back- filling shall not follow jointing and final alignment of pipe by more than three lengths of pipe. The completed pipe line shall never be left exposed in the trench unnecessarily. Each day at the close of work, and at all times when laying is not in progress, the exposed end of the pipe line in the trench shall be closed by the use of an approved head or barrier of wood or metals. If at any time it becomes necessary to cover the end of an uncompleted pipe line with backfill, the end of the pipe shall be closed using a mechanical joint plug for ductile iron pipe or a suitable closure for concrete or clay pipe.

1.14 REMOVING AND REPLACING PAVEMENT:

(a) Removing Pavement: The Contractor shall remove existing pavement as necessary for installing the new sewer lines and appurtenances.

(1) Marking: Before removing any pavement, the pavement shall be marked for cuts neatly paralleling pipe lines and existing street lines. The marks shall be spaced the width of the trench.

(2) Breaking: Asphalt pavement shall be broken along the marked lines 9Y use of jack hammers or other suitable tools. The concrete pavement within the limits of the trench may be broken along the marked cuts by use of jack hammers or by scoring to a depth of approximately 1-1/2 inches with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.

(3) Machine Pulling: No pavement shall be machine pulled until completely broken and separated along the marked Cuts.

(4) Damage to Adjacent Pavement: The pavement adjacent to pipe line trenches must not be disturbed or damaged. If the adjacent pavement is disturbed or damaged, due to any cause such a caving ditch banks, indiscriminate use of construction machinery, etc., the Contractor shall remove the damaged pavement and shall replace it at his own expense.

(5) Sidewalk: Sidewalks shall be removed and replaced for their full width.

(6) Curbs: The Contractor shall remove and replace or tunnel under any curb encountered.

(b) Replacing Pavement: Upon completion of backfilling and consolidation of backfill, the Contractor shall promptly replace all pavements, sidewalks and curbs removed for construction of the pipe lines and appurtenances, and restore all pavements adjacent to pipe trenches which may have been disturbed or damaged as the result of construction operations.

(1) Supervision and Approval: State Highway pavement restoration shall be under the supervision of the Highway Division of the Department of Transportation. It shall be the Contractor1 s responsibility to obtain from the Highway Division approval of pavement restorations, before final payment is made under this Contract. County road pavement restoration shall be under the supervision of the County Engineer. It shall be the Contractor's responsibility to obtain from the County Engineer approval of pavement restorations before final payment ·is made under this Contract. County road pavement restoration shall be under the supervision of the County Engineer. It shall be the Contractor's responsibility to obtain from the County Engineer approval of pavement restorations before final payment is made under this Contract. All other pavement restoration shall be under supervision of and meet the approval of the Owner and Engineers. Pavement restoration shall follow the backfilling operation as closely as is practicable. If, in the opinion of the Engineers, the repaving program is allowed to lag, the Engineers shall order work stopped on other sections of the Contract until the repaving operation shows adequate progress.

(2) Replacement: Prior to replacing pavement, the Contractor shall make a final cut in concrete pavement nine inches back from the edge of damaged pavement. The cut shall be made using a rotary saw. Asphalt pavement shall be removed similarly using jack hammers or other suitable tools. This pavement shall be removed to provide a firm be.nch for placement of the new pavement. All street and roadway

replacement shall be as detailed on the Drawings. Driveways, sidewalks, and curbs shall be replaced with the same material and to the same dimensions as existing.

(3) Failure of Pavement: Should any pavement restoration or repairs fail or settle during the life of the contract, including the bonded period, the Contractor shall promptly restore or repair such pavement to the satisfaction of the Engineers.

1.15 ROADWAY CROSSING: The Contractor shall furnish and install tunnel liner and pipe casing and install the sewer line therein in accordance with the drawings and the following specifications:

(a) Tunnel: The Contractor shall install the tunnel liner in strict accordance with The Department of Transportation (DOT) and/or Railroad Company requirement. The Contractor shall submit evidence of his experience with shop drawings for review by the Engineer. Tunnel excavation shall be by full face, heading and bench, or multiple drift procedures. Any procedure utilizing a full or partial shield,· a tunneling machine or other equipment which exerts a force on the liner plates for the purpose of propelling, steering or stabilizing the equipment will not be allowed. Prior to any work involving explosives, the Contractor shall make application to DOT for a special permit which will be in addition to any tunneling permit not involving explosives. The Contractor shall comply with all requirements and conditions of the permit and shall be responsible for submission of all required data. The Contractor shall schedule his work so as not to interfere with or in any way endanger traffic flow on the highway or railway. The Contractor shall also provide all required safety measures as specified in the Georgia Manual on Uniform Traffic Control Devices.

(1) Materials: Tunnel liner plates shall be manufactured from steel conforming to ASTM A 569 with the following mechanical properties before cold forming: Minimum tensile strength= 42,000 psi, Minimum yield strength = 28,000 psi, Elongation, 2 inches= 30 % Liner plates shall be 10 gauge with the neutral axis diameter shown on the Drawings for each crossing. All plates shall be formed to provide circumferential flanged joints. Longitudinal joints may be flanged or offset lap seam type. All plates shall be punched for bolting on both longitudinal and circumferential seams and joints. Bolt spacing in circumferential flanges shall e in accordance with the manufacturer's standard spacing and shall be a multiple of the plate length so that plates having the same curvature shall be

interchangeable and will permit staggering of the longitudinal seams. Bolt spacing at flanged longitudinal seams shall be in accordance with the manufacturer's standard_ spacing. For lapped longitudinal seams, bolt size and spacing shall be in accordance with the manufacturer's standard but not less than that required meeting the longitudinal seam strength requirements of Section 13 of AASHO Standard Specifications for Highway Bridges. All liner plates in one tunnel shall be the same type. Liner plates shall be hot-dip galvanized in accordance with ASTM A 123 abd bituminous coated. Bolts shall conform to ASTM A 307 Grade A, and shall be hot-dip galvanized in accordance with ASTM A 153. Grout nipples shall be 2-inch minimum diameter tapped couplings welded into place over holes cut in the liner plate. Grout shall consist of 1 part Portland cement, 1 parts masonry lime, 4 parts mortar sand, 2% of an approved admixture, i.e. Bentonite, Septamine Stearex, or Hydrocide Liquid, and where required, a retardant. The quantity of mixing water used shall be that which will produce a workable mixture of grout capable of being pumped into the voids created by the tunneling. Brick and mortar shall meet the requirements for Manhole Materials.

(2) Construction of Tunnel: Tunnel construction shall be accomplished so that no settlement of the over passing roadway or railway section will occur. In order to prevent such settlement, the use of poling plates, brest boards, shields, and soil solidification or a combination of these methods may be necessary. Steel liner plates shall be installed as soon as possible, but no more than 5 feet of tunnel shall remain unlined while tunneling operations are in progress. Not more than 1 foot of tunnel shall be left unlined at the end of the day's operation. Liner plates shall be installed in accordance with the manufacturer's recommendations and shall be self-supporting. The tunnel excavation shall have a diameter essentially the same as the outside diameter of the liner plates. Liner plates with grout couplings shall be located at the top of the tunnel at intervals not to exceed 10 feet. Additional plates with grout coupling shall be installed on each side of the tunnel between the top couplings. All voids in the area outside the plates shall be pressure grouted every 10 feet; at the end of the work shift; or more frequently if soil conditions dictate. Before grouting any segment of tunnel liner, that segment shall be sealed sufficiently between the liner plates and the surrounding soil to retain the grouting pressure. These seals shall be located as

follows: at the entrance of the tunnel; between grout couplings, and within one foot of the end of the tunnel at the end of the work shift. Pumping equipment shall be provided 'for grouting operations. Pump horsepower and the resulting pressure in the grouting line shall be sufficient to completely fill the voids without buckling or shifting the liner plates or damaging the roadway. The Contractor shall operate well points or drainage systems in the vicinity of the tunnel construction to prevent the accumulation of flood water in the tunnel-and to maintain the ground water table below the tunnel invert. Damaged spelter coating shall be repaired in accordance with DOT Specifications Section 645. Any plates having damaged spelter or bituminous coatings which, in the opinion of the Engineer cannot be satisfactorily repaired shall be replaced at no additional cost.

(3) Installation of Sewer: Upon completion of tunnel, the sewer line shall be installed by a method which has received prior approval of the Engineer. Tie-downs shall be installed as shown on the Drawings. The ends of the tunnel shall be closed with 3 course Brick walls, plastered with Portland Cement mortar and waterproofed with asphaltic roofing cement. The lowest closure shall have a 4” x 8” opening left at the bottom for drainage.

(4) Safety: The tunneling operation is to begin in a pit, sheeted and shored as necessary and begins at and proceeds from one end. All applicable requirements of DOT and Railroad regulations shall be observed. The Contractor shall conduct his operations in such a manner that all work will be performed below the level of the roadbed. The Contractor shall be responsible for coordinating and scheduling all work with the DOT. All tunneling work at one particular location shall be completed before work is started at another location. If, in the opinion of the Engineer, the tunnel installation work is being conducted in a manner detrimental to the over passing roadway or to the safety of the traveling public, all operations of tunneling shall cease until the necessary corrections have been made. In the event that distress occurs to-the roadway due to the tunneling, the Contractor shall be required to submit plan to repair the roadway. The plan must be acceptable to both DOT and the Engineer. A temporary bulkhead against the face of the excavation shall be provided and well braced during each cessation of work while the heading is within 20 feet of

railroad tracks of highway pavement.

(b) Pipe Casing: The Contractor shall furnish all material and equipment and perform all labor required to install steel pipe casing at locations indicated on the Drawings and as specified.

(1) Boring: The steel casing pipe shall be Schedule 30 steel pipe manufactured from steel conforming to ASTM Designation A 139, Grade B. Size and thickness shall be as required by the Regulatory Agency in control of the right-of-way in which the casing is to be installed but in no case shall the wall thickness be less than 0.25 inch or the casing size less than the outside diameter of the carrier pipe plus two inches. The outside of the casing pipe shall be primed and coated with hot coal tar enamel a minimum of 3/32- inches thick. Only new primed and coated pipe shall be used. The steel pipe casing shall be installed by the dry boring method. The hole shall be bored and cased through the soil by a cutting head on a continuous auger mounted inside the casing pipe. The boring of the hole and installation of the casing pipe shall be simultaneous. Lengths of casing pipe shall be fully welded to the preceding section in accordance with AWS recommended procedures. After the boring and installation of the casing is complete, a cleaning plug shall be installed on the rig and the casing cleaned.

(2) Installation of Sewer: After installation of the casing is complete the sewer line shall be installed by a method which has received prior approval of the Engineer. The ends of the casing shall be closed with 4-inch brick walls, plastered with Portland Cement mortar and water proofed with asphaltic roofing cement. The lowest closure shall have 4" x 8" opening left at the bottom for drainage.

(3) Safety: The Contractor shall provide all necessary bracing bulk- heads, and shields to ensure complete safety to all traffic at all times during the work, and he shall perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it. If in the opinion of the Engineer the installation is being conducted in an unsafe manner, the Contractor will be required to stop work and bulkhead the heading until suitable agreements are reached between the Contractor and the Engineer. The Owner will not be responsible and shall be saved harmless in the event of delays to the Contractor’s work resulting from any cause whatsoever.

1.16 STREAM AND DITCH CROSSING:

(a) Rip Rap: At all points where banks of streams or drainage ditches are disturbed by excavation or where natural vegetation is removed, the Contractor shall carefully compact backfill and place rip rap to prevent subsequent settlement and erosion. This requirement applies equally to construction alongside a stream or drainage ditch as well as crossing stream or drainage ditch. Rip rap shall be placed a distance of not less than 10 feet upstream and 10 feet downstream from any disturbed area. Rip rap shall extend from 1 foot below streambed to top of bank and shall be placed to conform to the natural slope of the stream bank. The Contractor shall have the option as to using Method (1) or (2). Only one method shall be used throughout the job.

(1) Stone Rip Rap: All stone for rip rap shall be sound, tough, durable pieces, resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Specific gravity shall be 2.0 or higher. Minimum weight of individual stones shall be 50 pounds; dimensions of the smaller pieces having the least dimension a maximum size need not exceed 24n and 1211 for the two larger and a minimum of 6u. At least 50% of the pieces shall have a minimum dimension of 12". Stone rip rap shall be imbedded into place by hand so as to form a compact layer at least 12" thick. It shall be placed in such a way that the smaller stones are not segregated but evenly distributed. Chinking stones shall be placed in the crevices between the larger stones so that a dense, well graded ma s is produced.

(2) Sand-Cement Bag Rip Rap: The bags shall be cement sacks or burlap bags having a capacity of from 1 to 2 cubic feet. Bags previously used for sugar or chemicals shall not be used. The bags shall be filled with a mixture of one part Portland Cement to five parts sand. The bags shall be imbedded into place so as to form a compact layer at least 12' thick. The bags shall be placed by hand, laid with over lapping joints. The finished surface shall not deviate from that specified by more than 3 inches at any point.

(b) Concrete Piers: Piers shall be constructed as shown on the Drawings and in accordance with the following requirements:

(1) Material: Concrete used in the piers shall be 3000 psi concrete, containing not less than 5.5 bags/ cu. yd. Concrete shall meet

or exceed applicable requirements of Paragraph 1.11. Reinforcing steel shall conform to the requirements of ASTM A 615 for Grade 40 deformed billet steel reinforcing bars.

(2) Bearing:

(aa) Earth: Where excavation reveals undisturbed earth subsurface, footings shall be constructed in accordance with the job drawings.

(bb) Rock: Where excavation reveals or benched rock having a minimum safe bearing value of 20,000 Psi, piers shall bear directly on rock. No less than four dowels shall be grouted into holes drilled into rock under each pier. Dowels shall be Number 4 reinforcing bars and shall extend a minimum of 4 feet into holes a minimum of 6 inches in diameter. Holes shall be grouted from the bottom up using a grout pump. Extreme care shall be taken to insure that the entire hole is filled with grout prior to insertion of the dowel.

(3) Installation: Concrete form work shall be constructed by experienced form work carpenters and shall be sufficiently strong to resist movement or distortion during pouring and to protect the pier from caving in or lateral movement. Before placing concrete, the bottom of the hole shall be dewatered and cleaned of mud, loose earth and extraneous matter. Pier forms shall be filled with concrete as soon as possible after the forms have been approved. Excavation shall not be left open for prolonged periods of time and shall be adequately protected during rain. Water shall not be allowed to accumulate in the excavation or in surrounding areas. The Contractor shall take all necessary precautions to protect the work and personnel on the site. Open holes shall be kept covered while not in the actual process of construction. The Contractor shall examine ·all surrounding .excavations and embankments and shall not commit his personnel into a situation that he considers dangerous. Concrete shall not be placed in a hole while personnel are in holes less than forty feet away.

(4) Inspection: A consulting soil and foundation engineer will be selected by the Contractor, subject to approval by the Engineer,

and paid by the Contractor, subject to approval by the Engineer, and paid by the Contractor from the “soils testing” cash allowance. The duties of the foundation engineer shall include, but not be limited to, the following:

(aa) Inspection of the bearing material and evaluation of its suitability.

(bb) Inspection of pneumatically drilled grout holes where applicable.

(cc) Checking dimensions and plumbness of forms to insure conformity with Drawings and specifications.

(dd) Evaluation of material penetrated by excavation with regard to lateral stability and uplift resistance.

(ee) Recommending remedial measures should insufficient lateral stability or uplift resistance exist.

1.17 INSPECTION AND TESTING: Before acceptance of any sewer or system of sewers, the lines shall be cleaned and tested to the satisfaction of the Engineer. Where any obstruction is met, the Contractor will be required to clean the sewers by means of rods, swabs, or other instruments. Lines and manholes shall be flushed and washed down before final inspection at the request of the Engineer.

(a) Gravity Sewers: Pipe lines shall be straight and show a uniform grade between manholes. The Contractor will be required to correct any discrepancies which may be disclosed during inspection. The Contractor shall install suitable weirs in manholes selected by the Engineer to determine the leakage of ground water into the sewer. Leakage shall be measured only when all visible leaks have been repaired and the ground water is above the top of the pipe. If leakage in any section of the sewer line exceeds acceptable standards as defined by the Engineer, the Contractor shall locate and repair leaks by a method approved by the Engineer until a satisfactory leakage rate can be achieved. The Contractor shall furnish, install, and remove the necessary weirs, plugs, and bulkheads required to perform the leakage test. Where continuous monitoring of flow level is required, the Owner will provide and operate monitoring equipment. PVC gravity sewer shall be tested for excessive deflection by passing a "pig" through the line with a diameter equal to 95% of the inside diameter of the pipe.

Any section of pipe not passing this test shall be excavated, reinstalled properly, and retested until it passes. Video camering of the mains will be required as designated by the Engineer.

(b) Force Mains: Force mains shall be pressure tested at 150 psi. Leakage shall not exceed 0.12 gph/in. dia./1000 ft. Minimum test period shall be two hours. However, if in the opinion of the Engineer additional testing -is required, such additional testing shall be performed by the Contractor at no additional expense to the Owner. The Contractor shall furnish, install, and remove all temporary bulkheads; flanges or plugs required to perform the pressure tests and shall furnish all equipment and labor to carry out the tests. If joints or materials are found to be defective, they shall be remade and replaced until the line passes the specified test.

1.18 PROTECTION AND RESTORATION OF WORK AREA:

(a) General: It is the intent of these Specifications to return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.

(b) The Contractor shall be responsible for obtaining all permits with regards to Soil Erosion and Sedimentation and Storm Water Run-off and to comply with all requirements of the Soil Erosion and Sedimentation plans for the related work.

(c) Man-Made Improvements: The Contractor shall be responsible for protecting, removing and replacing, with the Engineer's approval, all fences, piers, docks, walkways, mail boxes, pipe lines, drain culverts, power and telephone lines and cables, and other improvements that may be encountered in the work.

(d) Cultivated Growth: Cultivated trees or shrubbery shall not be disturbed unless absolutely necessary, subject to the approval of the Engineer. Any such trees or shrubbery which must be removed shall be heeled in and replanted. Heeling in and replanting shall be done under the direction of an experienced nurseryman.

(e) Cutting Trees: No trees shall be cut for the performance of the work except as absolutely necessary. Trees that remain in the vicinity of the work shall be protected from damage from equipment and shall not have spoil from excavation stored against the trunks. Where excavated

material is stored over the root system of trees, it shall be removed within 30 days to allow proper natural watering of the root system. Any tree over 3-inches in diameter, not to be removed, that is damaged in the work will be repaired under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, wood piles, or trash piles will be permitted on the work site.

(f) Grassing: Grass removed or damaged in residential areas shall be replanted using the same -variety of grass and at the first appropriate season. Outside of residential areas, the entire area disturbed by the work shall be planted in rye, fescue, bermuda, clover or other suitable ground cover on completion of work in any area. In all areas, the Contractor shall be responsible for promptly establishing successful stands of grass. Contractor is required to install all required erosion and sedimentation control measures prior to initiation of any construction or clearing.

(g) Erosion Control: The Contractor shall so plan his excavation work to prevent erosion and the washing of soil into adjacent streams. This shall be accomplished by limiting the amount of open excavation at any one time, by placing spoil in the proper place and by keeping natural water routes open.

(h) Disposal of Rubbish: All materials cleaned and grubbed during the construction of the project will be disposed of by the Contractor in accordance with the applicable codes and rules of the appropriate regulatory agencies, county, state and federal.

1.19 ACCEPTANCE OF WORK: Piping and appurtenances will not be considered ready for acceptance until all provisions of these Specifications have been complied with, until all tests have been satisfactorily completed, and until final inspection of the work has been made. Flow shall not be diverted into piping until after final inspection of the lines has been made by the Engineer and permission granted therefore.