

SECTION NO. 1

SANITARY SEWERS

1.01 PURPOSE

This Section of the Specifications describes products and construction practices to be incorporated into construction of sanitary sewers. The Developer shall furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.

1.02 GENERAL

- A. Applicable Standards: When the standards set forth in this manual are more restrictive than those required by any statute, ordinance or regulation applicable within Newton County, Georgia, the requirements of this manual shall govern. When the provisions of any other statute ordinances or regulation require more restrictive standards than required by this manual, the more restrictive standards shall apply.
- B. Definitions: Where the following words or the pronouns used in their stead occur herein, they shall have the following meaning:
1. " Authority " shall mean Newton County Water & Sewerage Authority, or its authorized and legal representatives.
 2. "Developer" shall mean any party, owner or citizen wishing to expand, extend or improve the wastewater system, or the authorized and legal representative, contractor, or engineer of such party.
 3. "Provide" shall mean to furnish and install.
 4. "Drawings" shall mean the approved plans prepared by the Developer.
 5. "Standard Details" shall mean those drawings of specific construction details included in the appendix or on file at the Authority.
 6. "NCWSA" shall mean Newton County Water & Sewerage Authority

1.03 SUBMITTAL REQUIREMENTS AND PROCEDURES

- A. All parties wishing to expand, extend, or connect to the Newton County Water & Sewerage Authority Wastewater System shall follow these procedures.

B. Pre-Construction: Before construction, plans shall be reviewed and approved by the Newton County Water & Sewerage Authority.

1. Preliminary Plat: Prior to design of the wastewater system, the Developer shall prepare a preliminary plat for review. The plan shall be prepared on a topographical map indicating the location of the new development and location of the new sewers. The plan shall be accompanied by any required information regarding wastewater flows needed to determine if the Authority has sufficient hydraulic and treatment capacity at the wastewater treatment plant (WWTP) to which the wastewater will be conveyed. If the Authority declines to review the preliminary plat due to insufficient information or capacity, the Developer may request a hearing before the Water & Sewer Authority to discuss the review denial. This hearing shall be scheduled through the Director.

The appropriate provisions of these specifications are applicable to the following sanitary sewer system installations:

- a. Any sanitary sewer system connected to or discharging into the sewer system already owned, maintained or operated by the Authority will be subject to these specifications. These systems will become the property of the Authority and will be maintained by the Authority after the specified developer maintenance period and final acceptance.
- b. Any proposed development located within the same drainage basin as an existing sanitary sewer line and located within the maximum distance (Detailed in the table below) of an existing sanitary sewer line is required to serve the development with sanitary sewers and to connect to the Authority's system. Subdivisions in which all lots are over one acre in area shall be exempt from this requirement. All proposed lots shall be served. Under ordinary circumstances, the entire cost of the sanitary sewer system installation to and within the development will be borne by the owner/developer. Reimbursement of the initial costs of trunk sanitary sewers extended to serve the development may be possible in accordance with the Authority's Sewer Extension Policy outlined in Section 302.14.

Subdivision Size Maximum Distance From
(Number of Lots) Existing Sanitary Sewer

Under 25 500'

25 to 501000'

51 to 751500'
76 to 1002000'
Over 1002500'

- c. All commercial, institutional or industrial developments shall be required to serve the development with sanitary sewers and connect to the Authority's sanitary sewer system, unless they receive a waiver as stipulated in Section 101.02.2e.
 - d. Any sanitary sewer system serving a development located within a drainage basin served by the Authority shall be designed and installed in accordance with these specifications.
 - e. Waiver of the above requirements to connect to the sewer system will be considered on a case by case basis for individual residential, commercial, institutional or industrial sites when the nearest connection point to a sewer line is more than 500 feet from a property line, when such developments are to be used for single-family dwellings or other use where the wastewater generation is no more than that of a single-family dwelling (approximately 400 GPD). Requests for waiver must be accompanied by appropriate documentation as required by local public health officials.
2. Construction Drawings: A full set of drawings showing the new development or extension shall be prepared, stamped and signed by a Registered Professional Engineer currently licensed to practice in the State of Georgia. The drawings shall be submitted to the Newton County Water & Sewerage Authority. The drawings shall be prepared on 24 x 36-inch mylar and shall be submitted in blue-line form. Two (2) copies shall be submitted. As a minimum, the following information shall be shown:
- Project Name
 - Land lot, district, county
 - 1" = 2000' Location Map with North Arrow
 - Name, Address, and Telephone number of Owner, Developer, Engineer and Surveyor
 - 1" = 100' (minimum scale) plan of existing and proposed roads, with road names and State Route numbers, streets, lots, owner and street addresses of properties, right-of-ways, land lots, districts, high and low spot elevation, topographic features, utilities and existing structures or objects which would affect the construction or design of the sewer main. Profiles should be included for all mains and they should have a horizontal scale of not more than 1" = 50' and a vertical scale of not more than 1" = 10'. The plan view should be drawn to a corresponding horizontal scale. The plan view should normally be

shown on the same sheet as the profile. In any case both the plan and profile view should have line designations, station numbers, manhole numbers and any other indexing necessary to easily correlate the plan and profile view.

- Plans and profiles shall show: Location of streets, sanitary and storm sewers, and related easements. Include profile of ground surface, the grade of the sanitary sewer between each two adjacent manholes, size and material of pipe, length between manholes, invert of sanitary sewer in and out of each manhole, and ground surface elevation at each manhole. All manholes shall be numbered on the plan and correspondingly numbered on the profile and station numbers will be shown for each manhole. The profile of adjacent parallel stream beds and of adjacent lake surfaces, low buildings, and lots shall be shown on the profile. Locations of all special features such as connections to existing sanitary sewers, service laterals, concrete encasements, collar walls, ductile iron pipe sections, elevated sanitary sewers, piers, air and vacuum relief valve assemblies (to be installed at high points of force mains), thrust blocks where used, special manhole covers such as vented outfall covers or sealed covers, stream crossings, casings under roadways, drop manhole connections, etc. All known existing structures both above and below ground which might interfere with the proposed construction, particularly water mains, gas mains, storm drains, utility conduits, etc.

 - Preliminary design of proposed wastewater system showing all existing and proposed mains, services, connections, materials and Standard Details

 - Dollar amount of maintenance bond taken from Maintenance Bond Schedule, shown in Appendix A
3. Preliminary Design Review: The drawings will be reviewed for adherence to specifications and design criteria. After review, a "marked-up" set of drawings with any comments or required changes will be returned through for revision, within 14 days.

 4. Final Design: Following incorporation of any required changes, the plans shall be stamped "Construction Plans" and three (3) copies submitted directly to the Authority. The "marked-up" Preliminary Design drawings shall also be returned. Copies of all required GA. DOT permits or applications shall also be submitted. The "Check Lists" shown in Appendix C must be completed for and they apply to all development plans submittal for approval for any infrastructure to be dedicated to the Authority.

 5. Any changes to the design must be resubmitted and approved by NCWSA before changes are made in the field.

C. Construction Phase: During the construction phase the Developer must satisfy the following requirements:

1. Pre-construction Conference: The Developer or the Contractor responsible for constructing the proposed improvements shall pick up an approved copy of the Construction Plans from the Authority prior to start-up. A pre-construction conference will be held at this time between the Authority's inspector and the Contractor. The Contractor shall retain an approved copy of the Construction Plans throughout the construction phase and have them available on the job site at all times. The preconstruction conference is required to be attended before the issuance of the Newton County Water & Sewerage Authority construction permit. No water or sanitary sewer construction shall be allowed until the permit is issued and is displayed at the project site.

The Developer and Contractor responsible for constructing the improvements shall pick up an approved copy of the Construction Plans from the County before start-up. A pre-construction conference will be held at this time between the Authority and the Developer. The Developer shall retain an approved copy of the Construction Plans throughout the construction phase and have them available on the job site at all times.

A Constuction and Maintenance Agreement will be executed at the end of the conference.

2. 24 hours advance notice to the Department inspector is required before construction may begin.
3. The inspector shall be given 24 hours advance notice prior to inspecting the following operations:
 - Connection to existing sewers or manholes
 - Infiltration/air testing
 - Pipe deflection/mandrel testing
 - Road crossings

D. Post-Construction Phase: After all previous inspections have been satisfied, the following requirements must be met by the Developer prior to acceptance by the Authority.

1. Record Drawings: Record drawings, based on "as-built" survey by a

registered surveyor, shall be prepared and submitted to the Authority on a mylar sepia with three prints attached. Electronic files shall also be submitted in AUTOCAD 2005 format. Record drawing precision shall be 0.01 foot for elevations and distances and 00 degrees 01 minutes for angles.

2. Construction Inspection: The Authority will perform an inspection after receiving the record drawings. Any deficiencies found shall be reported to the Developer and satisfied prior to issuing written acceptance of the work.
3. Colored Close Circuit Television (CCTV) inspection shall be performed by the contractor/developer prior to final approval of any 8" or larger sewer system being dedicated to the Authority.

The CCTV inspection will consist of a detailed computerized written report along with a VHS or DVD recording. The information on the report must coincide with the recording. The start screen of the recording shall have the project name, date, pipe size, contractors name and developer's name. The inspection shall start at the most upstream manhole and work towards the most down stream or existing manhole.

Report Information:

- Manholes: The report and recording shall start with zero (00+00) station numbers at each manhole upstream and end with the station number at the next down stream manhole. (If an inspection has to be performed starting at the down stream manhole a written explanation must be submitted to the inspector with the report and recording. All manhole numbers to be the same as indicated on the as-built.
- Pipe Line: Provide start and end station numbers for pipe material changes.
- Taps: Each tap shall have a station number shown on the recording and coincide with the report and as-built. The report and recording shall indicate the lot number and/or address the tap is intended to serve.
- Dead Ends or Abandonment's: If a future stub, dead end or obstruction cause (not ending in a manhole) or abandonment of video do to obstruction etc, a still image shall be shown on the report and recording for inspection. The report and recording shall show an explanation for what is shown.
- Existing Sewer System: The existing sewer system must be inspected and shown on the report. This shall be from the tie-in manhole to the next down stream manhole.

The Authority reserves the right to request additional CCTV information or reinsertion to insure an acceptable completion. The project inspector also has the right to request an Authority CCTV crew to inspect any and/or all of the

proposed system. If for any reason the contractor/developer neglects to complete this requirement the Authority will conduct the CCTV inspection at the cost as approved in the rate schedule.

4. Final Inspection: The Authority will perform a final inspection upon completion of the project but prior to acceptance by The Authority. Within subdivision developments, all utilities shall be in place prior to this inspection. This inspection shall include clean up, smoothing, grading, service location, accuracy and precision of record drawings, and compliance with all specifications. The Developer shall be responsible for any corrections necessary for the work to meet specifications, including damages caused by the construction activities of other utility construction. Two sets of as-built drawings (paper copies), and one electronic copy on CD in .dwg format must be submitted to the Authority immediately after the completion of construction. These as-built drawings shall include: locations of manholes, lines, services, line sizes, types of materials, manhole invert elevations, and line grades. The Authority shall have the right to withhold water/sewer tap permits until the as-builts have been submitted as required.
5. Warranty: The Developer shall provide a two (2) year maintenance period. The maintenance period shall begin on the date that written final acceptance is issued by The Authority. The Developer shall submit a maintenance bond to the Authority in an amount determined during the initial plan submittal to the Authority. The bond shall remain in effect from the date of written final acceptance by the Authority for 24 consecutive months. The bond shall be in the form of that shown in Appendix A, A11 – A12.
7. Developer shall execute the Dedication Agreement.
8. Final Acceptance: The Authority will provide written final acceptance of the sewer system improvements through route sheet submittal to the appropriate City or County Planning and Development Department and by letter of acceptance to the Developer.

ONE-YEAR MAINTENANCE BOND: The developer shall provide a maintenance bond in accordance with Appendix B and shall maintain the improvements in his development for a period of one year from the date the Authority issues written conditional approval of the improvements. The developer shall be notified of the inspection results in writing including a list of deficiencies for immediate correction. If repairs are needed for the development to meet Authority specifications, the developer shall be required to make such repairs within 60 days, after written notification by the Authority. Should any developer/contractor fail to comply with the specifications and regulations of the Authority or fail to correct deficiencies identified by the Authority, a hold may be placed on any remaining meters or sewer taps or, when appropriate, approval will not be given on any future proposals by the developer/contractor until all previous projects of the developer are in compliance with these regulations. If the work is free from defects, or after the required repairs have been completed to the satisfaction of the Authority, a

letter of final acceptance will be issued to the Developer. The letter will state that the one year maintenance period has expired and that the Authority is now the owner of the water and sewer facilities and is responsible for all future maintenance of these facilities. After the water main is operational and throughout the one year maintenance period, the Developer will be responsible for locating all water and sewer facilities when called upon by the Utilities Protection Center or the Authority. These utilities must be marked within 72 hours of the time notified. Any water or sewer facilities cut by others will be repaired by the Developer's contractor at the Developer's expense if the lines are not located or if they are improperly located.

1.04 DESIGN CRITERIA

A. Sewer Sizes

1. General: Sewers shall be designed with a capacity to handle the wastewater generated by the drainage area above the sewer for the ultimate density of that land. All sanitary sewer sizes and wastewater flow projections shall be in conformance with the Wastewater Management Master Plan, latest version.

The sanitary sewer system should be designed for the estimated ultimate tributary population. Tributary population is considered to be all areas upstream of the discharge point of the system being designed. Sewers will be designed and installed to the uppermost property line of the development being served. Consideration should be given to the maximum anticipated capacity of institutions, industrial parks, etc.

In determining the required capacities of sanitary sewers, the following factors should be considered:

1. Maximum hourly sewage flow.
2. Additional maximum sewage or waste flow from industrial plants.
3. Ground water infiltration.
4. Topography of the area.
5. Depth of excavation.

New sanitary sewer systems shall be designed on the basis of an average daily flow of sewage of not less than 400 gallons per household per day. Normally, all sanitary sewers shall be designed with a peaking factor of not less than four (4) and this may be increased as required by the Authority. Peak factors will be higher for smaller basins. Sanitary sewers should be designed to carry the peak flow when flowing at a depth of 2/3 pipe diameter. When deviation from the foregoing per capita rates are demonstrated, a description of the procedure used for design shall be included. No sewer main shall be less than 8"; No service lateral shall be less than 6".

The Newton County land use plan should be consulted and special consideration given to commercial and industrial areas. Where developers are installing major

trunk lines or interceptor sewers, the county's long range plan should be consulted as a guide and the sanitary sewer should as a minimum be of the size called for in the long range plan. If proposed land use conditions have changed subsequent to the plan, these changes should be factored into the determination.

2. Wastewater Flow Projections (Minimum)

- a. Wastewater flows for areas zoned residential shall be projected based on 100 gallons per day per capital at 2.9 persons per housing unit. Undeveloped residential areas upstream shall be assumed to have a density of one unit per acre. An allowance shall be added for inflow and infiltration at a rate of 100 gallons per day per acre.
- b. Wastewater flows for areas zoned commercial/office/and industrial shall be projected based on the square footage of proposed buildings, allowing 25 gallons per day per employee and 250 square feet of building per employee. Undeveloped commercial/office/and industrial areas upstream shall be projected with 2,000 gallons per day per acre.
- c. Additionally, where at least 25 percent of a drainage area is already developed, a population density equal to that of the existing development shall be used for the entire drainage area.
- d. Peak flow shall be determined by multiplying the wastewater flows determined above by 2.5 and then adding the projected inflow and infiltration flow projections.

3. Minimum Slopes: The following are the minimum slopes which should be provided; however, slopes greater than these are desirable:

<u>Sewer Size</u>	<u>Minimum Slope, foot per 100 feet</u>
8	0.40
10	0.28
12	0.22
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
30	0.08
36	0.08

4. Sewer Capacity: Sanitary sewers shall be sized in a manner to provide the required flow capacity for peak flow conditions. Sewers 15-inches in diameter and smaller shall be designed flowing half full. Larger sewers shall

be designed flowing three-quarters full. The minimum size sewer shall be 8-inches. Smaller sewers shall be considered house connections with a limit of one housing unit per house connection.

B. Sewer Location

1. Subdivisions
 - a. Along subdivision streets of new developments, sewers shall be laid straight along the road centerline.
 - b. Where crossing through proposed yards, the sewer shall be laid straight along creeks, draws, etc. When laid along creeks, the sewer and manholes shall be designed and installed a minimum of 25 feet from the top of the creek banks or a buffer variance obtained.
2. Existing City and County Right-of-Way: When paralleling an existing right-of-way, the sewer shall be designed and constructed a maximum of 5 feet inside the right-of-way limit.
3. Georgia Department of Transportation Right-of-Way: Along Georgia Department of Transportation right-of-way, sewers shall be located a maximum of 5 feet inside the right-of-way limit. A Utility Encroachment Permit shall be obtained from the Georgia Department of Transportation prior to construction. Permit application and required drawings shall be prepared by the Developer and sent through the Water Resources Department.
4. Roadway Crossings: Sewers and service lines crossing existing City, County or Department of Transportation paved streets and roadways shall be bored and cased. Permits are required from the proper authority prior to construction. Every effort shall be made to bore under roads, including moving to different boring locations. If subsurface conditions (rock) should prevent boring, then only by written permission from the proper authority shall the road be open-cut. Lines installed by open-cut without written permission shall not be accepted. Department of Transportation roadways shall not be open-cut under any circumstances.
5. Easements: All sewers not located within road right-of-ways shall be provided with an easement which has been properly recorded at the County Courthouse before final acceptance is given on the project. The easement shall have a minimum width of 20 feet, centered along the sewer. Where deemed necessary, the Authority may require additional easement width.
6. Railroad Crossings: When sewers are to cross right-of-ways owned by CSX

Transportation (formerly Seaboard Coast Line Railroad), an approved permit shall be required prior to construction. All fees associated with the railroad crossings shall be paid by the Developer.

7. **Depth of Cover:** Minimum depth of cover shall be 4 feet in all places and 6 feet under roads. Where this depth cannot be provided, the sewer shall be constructed of ductile iron pipe. Where a sewer parallels a creek or river, the crown of the sewer shall be designed a minimum of two feet below the bottom of the creek or river. In no case shall the depth of cover be less than 2 feet, except where aerial creek crossings are required. Aerial creek crossings shall be evaluated on a case by case basis.
8. **Protection of Water Supply:** There shall be no physical connection between a public or private potable water supply system and a sanitary sewer which would permit the passage of any sewage or polluted water into the potable supply. A horizontal separation of at least 10 feet is required between sanitary sewer lines and existing or proposed water mains (measured edge to edge). Should conditions prevent a separation of 10 feet, the lines shall be laid in separate trenches and sanitary sewers shall be ductile iron. Where sewer mains cross existing or proposed water lines, 18" vertical separation is required between the two mains (measured edge to edge). Whenever possible, the elevation of the crown of the sewer shall be at least 18 inches below the invert of the water main. The two pipes shall be installed such that a full length of pipe will be centered over the crossing so that all joints will be separated as much as possible. Ductile iron pipe shall be installed for both mains at points where the two lines cross. When sewers are laid within public streets, the manholes and lines shall normally be laid along the center of the street at a depth of not less than 6 feet below the road surface to the top of the pipe so that service laterals will have 6 feet of cover at the edge of the right-of-way. In curves and other areas where this is not possible, the lines and manholes are to be installed within the confines of the curb to avoid conflict with the curb and other utilities. Ductile iron pipe shall be used for sewer lines crossing storm sewers and at other locations specified by the Authority.

C. Sewer and Service Line Materials

1. **Gravity Sewers to 15-Inches:** Allowable gravity sewers and service line materials for pipe 15-inches in diameter and smaller, in order of preference, are ductile iron pipe, and polyvinyl chloride pipe.
2. **Gravity Sewers 16 to 21-Inches:** Allowable gravity sewer materials for pipe 16 to 21-inches in diameter, in order of preference, are ductile iron pipe, and polyvinyl chloride pipe.
3. **Gravity Sewers Larger Than 21-Inches:** Allowable gravity sewer materials for pipe larger than 21-inches in diameter, in order of preference, are ductile iron pipe, reinforced concrete pipe, and extra strength vitrified clay pipe.

4. Exceptions

- a. All aerial or exposed sewers shall be ductile iron pipe or steel pipe. Construction shall conform to details B-20 through B-24.
- b. Ductile iron pipe shall be used in the following applications:
 - under all asphalt or concrete pavement, except subdivision streets,
 - where sewers cross any existing City, County or Department of Transportation right-of-way,
 - where slope exceeds 10 percent,
 - where depth of cover is less than 4 feet,
 - where sewer crosses any stream, creek or river with running water,
 - pump station force mains,
 - where depth of cover exceeds 14 feet,
 - where sewer crosses storm or water pipe

5. Class: The class of sewer material shall be dependent upon the live and dead loads superimposed on the pipe.

D. Manhole Location: The maximum distance between manholes shall be 400 feet. A manhole shall be installed at the end-of-line of each sewer 8-inches in diameter and larger. Manholes shall be installed at the intersection of all sewers 8-inches in diameter and larger. Manholes along streams or creeks shall be installed a minimum of 15 feet from the top of bank.

E. Manhole Junctions

1. Where sewers of dissimilar sizes connect to a manhole, the crown of all influent sewers must be at or above the crown of the effluent sewer.
2. No sewers shall be connected to a manhole which requires a horizontal deflection angle greater than 90 degrees between an influent sewer and the effluent sewer.
3. No manholes shall be constructed with more than one effluent sewer.
4. Where the difference in elevation of the crowns of an influent sewer and the

effluent sewer is greater than 2 feet, an outside drop connection shall be constructed.

1.05 PIPE AND ACCESSORIES

- A. All pipe is subject to the inspection of the Authority at the pipe plant, jobsite, or other point of delivery for the purpose of rejecting pipe not conforming to these Specifications.
- B. Ductile Iron Pipe (DIP): Ductile iron pipe shall be utilized as shown on the Drawings. All pipe shall be furnished in nominal lengths of at least 18 to 20 feet.
 - 1. Pipe and Fittings: Ductile iron pipe shall conform to AWWA C151 and shall be Pressure Class 350 unless shown otherwise on the Drawings. Pipe and fittings shall be cement lined in accordance with AWWA C104. Fittings shall conform to AWWA C110 with rated working pressure of 150 psi. Pipe and fittings shall be furnished with a bituminous outside coating. Tapping saddles shall be ductile iron.
 - 2. Joints: Unless shown or specified otherwise, joints shall be push-on type for pipe and standard mechanical joints for fittings. Joints shall conform to AWWA C111. Restrained joints shall be equal to American "LOK-FAST", "FLEX-RING" or "LOK-RING", Clow "SUPER-LOCK", or U.S. "TR FLEX" or "LOK-TYTE".
 - 3. Acceptance: Acceptance will be on the basis of the Authority's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.
 - 4. Polyethylene Encasement: Ductile iron pipe shall be encased with polyethylene film where shown on the drawings. Polyethylene film shall have a minimum thickness of 8 mils. Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired.
 - 5. Service: Furnish the services of a competent factory representative of the pipe manufacturer for purposes of supervising and/or inspecting the installation of the pipe.
- C. Polyvinyl Chloride (PVC) Gravity Sewer Pipe: PVC gravity sewer pipe shall be supplied in nominal lengths of 13 to 20 feet.
 - 1. Pipe: PVC gravity sewer pipe and fittings 4 to 15-inches in diameter shall be manufactured in accordance with ASTM D 3034, SDR 26. PVC gravity sewer pipe and fittings 18 to 21-inches in diameter shall be manufactured in accordance with ASTM F 679, minimum wall thickness T-1. Fittings for pipe

8-inches and less in diameter shall be one piece with no solvent-welded joints. Fittings for pipe 10-inches and larger may be fabricated using solvent welding. No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings delivered ready for use.

2. Joints: Joints for pipe and fittings shall be of the integral bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage. Joints shall meet the requirements of ASTM D 3212; gaskets shall meet the requirements of ASTM F 477. The joint system shall be identical for pipe and fittings.
3. Detection Tape: Detectable mylar encased aluminum foil marking tape will be installed over all sewers. Tape will be green in color, at least 1-1/2-inches wide, and shall bear the printed identification "Caution: Buried Sewer Line Below" (reverse printed), so as to be readable through the mylar. Surface printing on the tape shall be equal to Lineguard Type II Detectable.
4. Acceptance: Acceptance will be on the basis of the Authority's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.
5. Service: Furnish the services of a competent factory representative of the pipe manufacturer for purposes of supervising and/or inspecting the installation of the pipe.

D. Steel Pipe: Steel pipe shall be used only in aerial crossings and only where specifically approved by the Authority. Steel pipe shall be fabricated electrically welded steel water pipe manufactured in accordance with AWWA C200. Steel plate used in fabrication shall be ASTM A 283 Grade C. Pipe wall thickness shall be approved by the Authority.

1. Pipe shall be furnished in 40-foot nominal lengths. Pipe shall be lined and coated. The pipe shall be coated with coal tar epoxy having a minimum dry film thickness of 16 mils. Surface preparation shall be SSPC-SP 10. Epoxy shall have a minimum solids content of 65 percent by volume and shall be air or airless spray applied; minimum drying time shall be seven days. Brushing shall be permitted in small areas only. All coating and recoating shall be done in strict accordance with the manufacturer's recommendations. Epoxy shall be Koppers, Tnemec, Indurall or Valspar.
2. Pipe shall be furnished with ANSI 125 pound flanges. Flanges shall be welded onto the pipe.
3. Gaskets for flanged piping shall be 1/8-inch thick ring type of red sheet rubber. Bolts for flange piping shall be hex head machine bolts with hex nuts. Bolts shall conform to ASTM A 307, Grade 2. Threads shall be ANSI B 1.1 Coarse thread series, Class 2A external and Class 2B internal.

4. Acceptance: Acceptance will be on the basis of the Authority's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.
 5. Service: Furnish the services of a competent factory representative of the pipe manufacturer for purposes of supervising and/or inspecting the installation of pipe. Furnish these services for a minimum of two days during the initial pipe installation.
- E. Materials for Manholes: Provide materials for construction of manholes in accordance with the following:
1. Precast Concrete Sections: Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi. The minimum wall thickness shall be one twelfth of the inside diameter of the riser of the largest cone diameter plus 1-inch or wall thickness suitable for use of rubber boot. Transition slabs which convert bases larger than 4 feet in diameter to 4 foot diameter risers shall be designed by the manhole manufacturer to carry the live and dead loads exerted on the slab. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS 202.
 2. Brick and Mortar: Brick shall be whole and hardburned, conforming to ASTM C 32 Grade MS. Mortar shall be made of 1 part Portland cement and 2 parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150. Sand shall meet ASTM C 53.
 3. Pipe Tee Manholes: Concrete pipe tees shall meet the requirements of the pipe in which it is used. Steel reinforcement in the riser shall be securely welded to steel in line pipe before concrete fill is begun. The remainder of the manhole shall be as specified for precast concrete sections.
 4. Iron Castings: Cast iron manhole frames, covers and steps shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections. No casting will be accepted which weighs less than 95 percent of the design weight. Shop drawings must 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.
 - a. Manhole frames and covers shall be equal to the following:

TYPE	DESIGN WEIGHT	MANUFACTURER'S REFERENCE	
Standard	270#	Neenah R-1695	Vulcan V-1349
Traffic	400#	Neenah R-1642	Vulcan V-1349
Watertight	400#	Neenah R-1916-F1	Vulcan V-2358
Watertight Traffic	400#	Neenah R-1916-F1	Vulcan V-2358

b. All frames and covers shall have machined horizontal bearing surfaces. The manhole frame and cover type shall be provided on the following basis:

- (1) Watertight Traffic: Watertight traffic type shall be provided for pavement installations subject to flooding.
- (2) Watertight: Watertight type shall be provided for all other installations subject to flooding.
- (3) Traffic: Traffic type shall be provided for pavement installations not subject to flooding.
- (4) Standard: Standard type shall be provided for all other installations.
- (5) All manholes shall have standard frames and covers except where specifically shown otherwise on the Drawings.

Covers shall have the legend "Sanitary Sewer" cast into the face.

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. Bolt holes shall have the full 360 degree circle within the cover's radius when bored through the cover.

5. Plastic Steps: Manhole steps of polypropylene molded around a steel rod equal to products of M.A. Industries may be used.
6. Rubber Boots: Provide preformed rubber boots and fasteners equal to those manufactured by Kor-N-Seal or Press Seal Gasket Corporation.

1.06 LOCATION AND GRADE

- A. The Drawings shall show the alignment and slope of the sewer and the location of manholes and other appurtenances. The slope shown on the drawings is the slope of

the invert of the pipe.

- B. After the centerline or baseline of the sewer is located, clear the easement. The Contractor shall take all precautions necessary, which shall include but not necessarily be limited to installing reference points, to protect and preserve the centerline or baseline.
- C. A temporary bench mark shall be provided at intervals along the sewer route and a hub at the center line of each manhole and at all other locations where the alignment of the sewer changes for verification of sewer grade.
- D. Construction shall begin at the low end of the sewer and proceed upstream without interruption. Multiple construction sites shall not be permitted without written authorization from the Authority for each site.
- E. Prior to beginning installation of any section of the sewer line, prepare cut sheets and submit them to the Owner for approval. No installation of the sewer shall commence prior to approval of the cut sheets. Payment shall be made on the basis of these cut sheets.
- F. During clearing and construction, protect bench marks and verify their location and elevation. Preserve the location of the reference points and centerline of manholes, and provide all other control required to construct the line.

The Contractor shall be responsible for any damage done to reference points, base lines, center lines, and temporary bench marks, and shall be responsible for the cost of re-establishment of same.

1.07 EXISTING UNDERGROUND UTILITIES AND OBSTRUCTIONS

- A. The Drawings shall indicate underground utilities or obstructions that are known to exist according to the best information available. The Contractor, as required by Georgia law, shall call the Utilities Protection Center (UPC) (404-325-5000 or 1-800-282-7411) and those utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site to verify the location of, and possible interference with, the existing utilities, arrange for necessary suspension of service and make arrangements to locate and avoid interference with said utilities. Where these or unforeseen underground utilities are encountered, the location and alignment may be changed, upon written approval of the Engineer, to avoid interference.

1.08 TEMPORARY EROSION AND SEDIMENTATION CONTROLS

- A. The Developer shall submit a description, working drawing and schedule for proposed temporary erosion and sedimentation controls to the local authority. The description and working drawings shall meet the requirements of the Georgia Erosion and Sedimentation Act of 1975 (as amended) and local soil erosion and sedimentation

control ordinances. The Developer shall acquire land disturbance permits from the local authority and shall pay any fees for said permits. The Developer shall be responsible for submitting to the local authority sufficient documents such that the local authority can acquire approval from the Newton County Soil and Water Conservation District. All fines imposed for improper erosion and sedimentation control shall be paid by the Developer. A copy of the local soil erosion and sedimentation control ordinances is available from the County.

- B. Sewer main construction activity shall not commence until the Land Disturbance Permit is issued.
- C. Description and working drawings shall indicate controls which will ensure that drainage from jobsite areas which will be denuded, stripped or modified of its natural existing or artificially established stabilization or protection against erosion shall pass through some type of filter system before being discharged. These areas shall be kept sufficiently moist to control dust.
- D. Specified grassing shall be performed as soon as practical.
- E. Silt dams, traps, barriers, and appurtenances shall be installed as indicated on the approved plans and working drawings, and shall be maintained in-place until no longer needed, and then removed. Hay bales which deteriorate, and filter stone which becomes dislodged shall be replaced with new materials. Detention ponds, if constructed, shall be maintained in a condition which will ensure that unfiltered water will not leave the pond.
- F. Materials used in temporary erosion and sedimentation control shall meet the following requirements:
 - 1. Silt fence shall be nylon reinforced polyester netting with a fabric weight in excess of 4.0 ounces per yard and having a built-in cord running throughout the top edge of the fabric. Posts shall be either steel or pressure treated fir, southern pine or hemlock and shall be spaced not more than 6 feet on center. Silt fence fabric shall be equal to Mirafi 100X.
 - 2. Hay bales shall be clean, seedfree cereal hay type.
 - 3. Netting shall be ½-inch, galvanized steel, chicken wire mesh. Netting stakes shall be either steel rods not smaller than ½-inch diameter or shall be either fir, southern pine or hemlock.
 - 4. Filter stone shall be crushed stone conforming to Georgia Department of Transportation Table 800.01H, Size Number 3.

1.09 CLEARING AND GRUBBING

- A. Clear and grub the permanent easement 10 feet on each side of the pipeline before excavating. Remove all trees, growth, debris, stumps and other objectionable matter. Clear the construction easement or road right-of-way only if necessary.

B. Clearing

1. All growth such as trees, shrubs, brush, logs, upturned stumps and roots of down trees, and other similar items shall be removed and disposed of properly. Cultivated growth shall be removed and trees felled as necessary and in accordance with the requirements of paragraph 1.23, PROTECTION AND RESTORATION OF WORK AREA.
2. Where the tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility.
3. All buildings, fences, lumber piles, trash, and obstructions, except utility poles, shall be removed and disposed of by the Developer. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.
4. All fences adjoining any excavation or embankment that may be damaged or buried shall be carefully removed, stored, and replaced.

C. Grubbing: All stumps, roots, foundations and planking embedded in the ground shall be removed and disposed of. Piling and butts of utility poles shall be removed to a minimum depth of 2 feet below the limits of excavation for structures, trenches, and roadways or 2 feet below finish grade, whichever is lower.

D. Disposal of Refuse: The refuse resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Developer and shall be disposed of in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. No debris shall be deposited upon any private property except by written consent of the property owner. In no case shall any material be left on the project, shoved onto abutting private properties, or be buried on the project. When approved in writing by the Authority and when authorized by the proper authorities, the Developer may dispose of such refuse by burning on the site of the project provided all requirements set forth by the governing authorities are met. The authorization to burn shall not relieve the Developer in any way from damages which may result from his operations. On easements through private property, the Developer shall not burn on the site unless written permission is secured from the property owner.

E. Scheduling of Clearing: The Developer shall clear at each construction site only that length of the permanent or construction easement which would be the equivalent of one month's pipe laying. The Authority may permit clearing for additional lengths of the sewer provided that erosion and sedimentation controls are in place and a satisfactory stand of grass is established. Should a satisfactory stand of grass not be possible, no additional clearing shall be permitted beyond that specified above. A satisfactory stand of grass shall have no bare spots larger than 1 square yard. Bare spots shall be scattered and the bare area shall not comprise more than 1 percent of

any given area. The Developer shall be responsible for all damages to existing improvements resulting from his operations.

1.10 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS

- A. Install sewer lines and appurtenances along highways, streets and roadways in accordance with the applicable regulations of and permits issued by the Georgia Department of Transportation, Newton County, and applicable municipalities with reference to construction operations, safety, traffic control, road maintenance and repair.
- B. Traffic Control
1. The Developer shall provide, erect and maintain all necessary barricades, suitable and sufficient lights and other traffic control devices; shall provide qualified flagmen where necessary to direct traffic; shall take all necessary precautions for the protection of the work and the safety of the public. Effective July 1, 1988, all flagmen shall be certified by a DOT approved flagman training program.
 2. Construction traffic control devices and their installation shall be in accordance with the current Georgia Manual On Uniform Traffic Control Devices for Streets and Highways.
 3. Placement and removal of construction traffic control devices shall be coordinated with the Department of Transportation, Newton County, and applicable municipalities a minimum of 48 hours in advance.
 4. Placement of construction traffic control devices shall be scheduled ahead of associated construction activities. Construction time in street right-of-way shall be conducted to minimize the length of time traffic is disrupted. Construction traffic control devices shall be removed immediately following their useful purpose. Traffic control devices used intermittently, such as "Flagmen Ahead", shall be removed and replaced when needed.
 5. Existing permanent traffic control devices within the construction work zone shall be protected from damage due to construction operations. All damaged traffic control devices requiring temporary relocation due to construction shall be located as near as possible to their original position. Their original position shall be measured from permanent reference points and recorded in a permanent log prior to relocation. Temporary locations shall provide the same visibility to affected traffic as the original position. Relocated permanent traffic control devices shall be reinstalled in their original positions as soon as practical following construction in the affected location.
 6. Construction traffic control devices shall be maintained in good repair, clean

and visible to affected traffic for daytime and night time operation. Traffic control devices affected by the construction work zone shall be inspected daily.

7. Construction warning signs shall be black legend on an orange background. Regulatory signs shall be black legend on a white background. Construction sign panels shall meet the minimum reflective requirements of the Department of Transportation, Newton County and the appropriate cities. Sign panels shall be of durable materials capable of maintaining their color, reflective character and legibility during the period of construction.
8. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the current Georgia Manual On Uniform Traffic Control Devices for Streets and Highways, appropriate for the speed limit at that location. Channelization devices shall be patrolled to insure that they are maintained in the proper position throughout their period of use.

C. Construction Operations

1. Perform all work along highways, streets and roadways to minimize interference with traffic.
2. Stripping: Where the pipe line is laid along road right-of-way, strip and stockpile all sod, topsoil and other material suitable for right-of-way restoration.
3. Trenching, Laying and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.
4. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod and any other materials removed from shoulders.

D. Excavated Materials: Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off the pavement in a timely manner.

E. Drainage Structures: Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

F. Maintaining Highways, Streets, Roadways and Driveways

1. Maintain streets, highways, roadways and driveways in suitable condition for

movement of traffic until completion and final acceptance of the work.

2. During the time period between pavement removal and completing permanent pavement replacement, maintain highways, streets and roadways by the use of steel running plates. The edges of running plates shall have asphalt placed around their periphery to minimize vehicular impact. The backfill above the pipe shall be compacted, as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.
3. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways. Make the grader or front-end loader available at all times.
4. Immediately repair all driveways that are cut or damaged. Maintain them in a suitable condition for use until completion and final acceptance of the work.

1.11 HANDLING MATERIALS

- A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.
- B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift or other front loader. Do not use materials damaged in handling.
- C. Distribution: Distribute and place pipe and materials to not interfere with traffic. Do not string pipe more than 1,000 feet beyond the area where pipe is being laid. Do not obstruct drainage ditches.
- D. Storage: Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.

1.12 EXCAVATION OF TRENCHES

- A. Excavate trenches by open cut. Pavement removal and replacement required by the excavation of trenches shall be done in accordance with the requirements of Article 1.18 of this Section. Perform all excavation in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596) as amended. The Developer shall pay particular attention to Safety & Health Regulations Part 1926, sub-part P "Excavations, Trenching & Shoring" as described in OSHA Publication 2226.
- B. Dimensions
 1. Excavate trenches to the depths shown on the Standard Details for each class of bedding and for manholes and other structures.

2. Excavate the top portion of the trench to any width within the construction easement or right-of-way which will not cause unnecessary damage to adjoining structures, roadways, pavements, utilities, trees or private property.
 3. Excavate the lower portion of the trench to a width no greater than the outside diameter of the pipe plus 18-inches. Maintain this width up to two feet above the pipe.
 4. If trenches are excavated to excessive dimensions or collapse because of inadequate or improperly placed bracing and sheeting, lay the pipe with the next better class of bedding. If excavation for manholes and other structures is made to excessive depth, backfill with compacted bedding material to the required grade.
- C. Bracing and Sheeting: When required by regulations or to prevent damage to adjoining structures, roadways, pavements, utilities, trees or private property which are specifically required to remain, provide bracing and sheeting.
1. Timber: Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the Authority it cannot be safely removed. Cut off sheeting left in place at least two feet below the surface.
 2. Steel Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. Sheet piling within three feet of an existing structure or pipeline shall remain in place.
 3. Trench Shield: A trench shield (or box) may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the bedding of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be "dragged" with the bottom of the shield extending below the top of the pipe.
- D. Dewatering Trenches: Dewater excavation continuously to maintain a water level below the bottom of the trench. Dewater running sand by well pointing. Where soil conditions do not permit use of well point, construct French drains of crushed stone

or gravel to conduct water to sumps.

- E. Trench Stabilization: Wherever the material at the bottom of the trench is unsuitable for the proper installation of the pipe, the Authority will direct the removal and replacement of the unsuitable material. When so directed, undercut the trench and backfill with bedding material. Place and compact this material to bring the trench to the required grade.
- F. Rock Excavation
 - 1. Definition of Rock: Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 18,300 pounds (comparable to Caterpillar Model 215), and occupying an original volume of at least one-half cubic yard.
 - 2. Excavation: Where rock is encountered in trenches, excavate to the minimum depth which will provide clearance below the pipe barrel of 8-inches for pipe 21-inches in diameter and smaller and 12-inches for larger pipe and manholes. Remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe or manhole. The minimum width of trench in rock shall be 36-inches.
 - 3. Blasting
 - a. Provide experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all structures from the effects of the blast. Repair any resulting damage.
 - b. If the Developer persistently uses excessive blasting charges or blasts in an unsafe or improper manner, the Authority may direct the Developer to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.
 - c. No blasting shall be permitted within the Gas Pipeline easement. If rock is to be removed from the easement, the rock shall be broken by jack hammer or similar method approved by the Authority and Pipeline Company.
 - 4. Removal of Rock: Dispose of rock which is surplus or not suitable for use as rip rap or backfill.

1.13 BEDDING

- A. Bed pipelines in accordance with the Standard Details and the following Specifications.

1. **Materials:** Bedding materials shall be crushed stone unless shown or specified otherwise. Crushed stone bedding material shall meet the requirements of Georgia Department of Transportation Specification 800.01 for No. 57 stone, Group II (quartzite granite). Earth bedding material shall be suitable materials selected from materials excavated from the trench. Materials shall be clean and free of rock, organics, and other unsuitable material.
2. **General:** Compact stone bedding material by tamping or slicing with a flatblade shovel. Prepare the trench bottom to support the pipe uniformly throughout its length. Provide bell holes to relieve pipe bells of all load. If the trench is excavated to excessive width or depth, provide the next better class of bedding.
3. **Gravity Sewers:** Lay PVC pipe with minimum Class "B" bedding. PVC pipe installation shall conform to the requirements of ASTM D 2321. Lay all other pipe with Class "C" bedding unless shown or specified otherwise.
 - a. **Class "A":** Excavate the trench to a depth of one-fourth the nominal diameter of the pipe below grade and lay the pipe to line and grade on concrete block. Place concrete as specified in paragraph 1.17, **CONCRETE ENCASUREMENT COLLARS AND BLOCKING**, to the full width of the trench and to a height of one-fourth the outside diameter of the pipe above the invert.
 - b. **Class "B":** Excavate the bottom of the trench flat at a minimum depth shown on the Standard Details below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Bedding shall then be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.
 - c. **Class "C":** Excavate the bottom of the trench flat at a minimum depth shown on the Standard Details below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Bedding shall then be carefully placed by hand and compacted to provide full support under and up to a height of one-fourth the outside diameter of the pipe above the invert.
4. **Manholes:** Excavate to a minimum of 12-inches below the planned elevation of the base of the manhole. Place and compact crushed stone bedding material to the required grade before constructing the manhole.
5. **Compaction:** Bedding under pipe and manholes shall be compacted to a minimum of 85 percent of the maximum Standard Proctor density, unless shown or specified otherwise.
6. **Bell Holes:** At each joint, excavate bell holes of ample depth and width to permit the joint to be made properly and to relieve pipe bell of any load.

7. Force Mains: Unless specified or shown otherwise, bed force mains in suitable earth materials. For ductile iron pipe, bedding shall meet all requirements of Standard Laying Condition Type 2 in accordance with AWWA C151 and as detailed on the Standard Details. Where Type 4 bedding is called for on the Drawings, this bedding shall meet all requirements of Standard Laying Condition Type 4 in accordance with AWWA C151 and as detailed on the Standard Details, utilizing crushed stone as specified above.
If the trench is excavated to excessive width or depth, provide crushed stone to achieve Standard Laying Condition Type 4 in accordance with AWWA C151 and as detailed on the Standard Details. For restrained joint pipe, bedding shall meet all requirements of Standard Laying Condition Type 3 in accordance with AWWA C151 and as detailed on the Standard Details.

1.14 INSTALLING PIPE

- A. Install the pipe to conform accurately to the alignment and grade shown on the Standard Details.
- B. Handling: Use suitable tools and equipment to handle and lay pipe. Prevent damage to the pipe. Examine all pipe for cracks and other defects as it is laid. Do not lay pipe or other materials which are known to be defective. If any pipe or other material is discovered to be defective or damaged after being laid, remove and replace it.
- C. Sequence: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave un-jointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe, close the end with a plug.
- D. Placing and Jointing: Clean pipe and fittings thoroughly before laying. Before making the joint, clean the sealing surfaces of dust, dirt, gravel and other foreign substances. Apply joint lubricant recommended by the pipe manufacturer. Center the spigot end in the bell of the preceding pipe and shove home, following all manufacturer's recommendations. Apply moderate force to ensure proper seating. Complete jointing no later than five minutes after application of the lubricant. Immediately after jointing bring the pipe to final alignment and grade.
- E. Pressure Piping: Comply with A, B and C when laying pressure piping. In addition, the following requirements apply:
 1. Make all joints in accordance with the manufacturer's recommendations.
 2. Take special precautions to prevent damage to the cement lining of ductile iron pipe.
 3. Ensure that force mains are laid on a continuous grade as shown on the

Drawings. Remove and relay pipe laid at incorrect grade.

4. Minimum depth of cover for force mains shall be 4 feet below final grade. Within DOT right-of-way, install force mains at a minimum depth of 4 feet below the nearest pavement edge. Within DOT right-of-way all force mains to be DIP, with proper internal corrosion protection.

F. House Connections: Install wyes or tees in locations designated by the Authority for future connection of service lines. Plug the branch of the wye or tee. Record the location of fittings installed on a copy of the Approved Drawings to be submitted as Record Drawings.

1.15 BACKFILLING

A. Backfill carefully to restore the ground surface to its original condition. Dispose of surplus material.

B. Detection Tape: Detection tape shall be buried 4 to 6-inches beneath the ground surface directly over the top of the pipe. The tape will be installed according to the manufacturer's recommendations in a manner acceptable to the Authority.

C. Initial: Place initial backfill material carefully around the pipe above bedding in uniform 6-inch layers to a depth of at least 18-inches above the pipe bell. Compact each layer thoroughly with suitable hand tools. Do not disturb or damage the pipe. Backfill on both sides of the pipe simultaneously to prevent side pressures. Initial backfill material is earth material excavated from the trench which is clean and free of rock, stumps, limbs, man-made waste and other unsuitable material. Should pipe installation activities encounter saturated material during excavation, the saturated material may be used as initial backfill provided it is allowed to dry properly and is capable of meeting the specified compaction requirements. If materials excavated from the trench are not suitable for use as initial backfill material, obtain suitable materials elsewhere.

D. Final: After initial backfill material has been placed and compacted, backfill with general excavated material. Final backfill material shall not contain more than 1/3 broken rock, of which no single stone or boulder shall weigh more than 50 pounds. Place backfill material in uniform layers, compacting each layer thoroughly with heavy, power tamping tools of the "Wacker" type, a hydra-hammer or backhoe.

E. Settlement: If trenches settle, re-fill and grade the surface to conform to the adjacent surfaces.

F. Backfill Under Roads: Compact backfill underlying pavement and backfill under dirt and gravel roads to 95 percent of the maximum dry density as determined by the Standard Proctor Compaction Test (ASTM D 698). A minimum of two density tests shall be performed for each sewer lateral and at least every 100 feet when sewer is within pavement, present or proposed.

- G. Additional Material: Where final grades above the pre-existing grades are required to maintain minimum cover, additional fill material will be shown on the Standard Details. Utilize excess material excavated from the trench if the material is suitable. If excess excavated materials are not suitable, or if the quantity available is not sufficient, provide suitable additional fill material.
- H. Backfill Within DOT Right-of-Way: Backfill within the DOT right-of-way shall meet the requirements stipulated in the "Utility Accommodation Policy and Standards", published by the Georgia Department of Transportation.
- I. Backfill Along Restrained Joint Pipe: Backfill along restrained joint pipe shall be compacted to at least 80 percent of the maximum dry density as determined by the Standard Proctor Compaction Test (ASTM D 698).
- J. Select Backfill: Select backfill shall be provided if the indigenous material will not meet the compaction requirements specified elsewhere.

1.16 MANHOLES

- A. Construct manholes as shown on the Standard Details.
- B. Precast Concrete: Handle sections carefully to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent uneven loading. If preformed openings must be enlarged or altered, or if new openings must be made in the field, minimize the amount of material removed to provide closely matched surfaces for grouting. Install gaskets and joint sealants in accordance with manufacturer's recommendations to produce a watertight structure.
- C. Pipe Tee: Place, joint, and properly backfill the pipe tee prior to placing any riser sections. Meet all requirements for precast manholes.
- D. Brick: Bed the bottom and sides of every brick in mortar. Apply a smooth coat of mortar, 3/4-inches thick, on the inside and outside.
- E. Pipe Connections: Connect pipe to manhole utilizing rubber boots installed in a cored or cast hole.
- F. Inverts: Form channels as shown on the Standard Details, rounded, and troweled smooth. Maintain consistent grade through the invert.
- G. Top elevations: Build manholes outside of paved areas to 18-inches above finished grade unless otherwise shown on the Standard Details or directed by the Authority. Build manholes in paved areas to existing grades.
- H. Drop Connections: Manholes requiring drop connections shall be shown on the Drawings. Construct drop connections of the same materials as the upstream sewer and in accordance with the details shown on the Standard Details.

- I. Frames and Covers: Unless frame and cover is at grade, the frame shall be cast into the cone section.

1.17 CONCRETE ENCASEMENT COLLARS AND BLOCKING

- A. Concrete: Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the Authority. Mix and transport ready-mixed concrete in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, grade 60.
- B. Encasement: Excavate the trench to provide a minimum of 6-inches clearance from the bell of the pipe. Lay the pipe to line and grade on concrete block. Pour concrete to the full width of the trench, and to a height of not less than 6-inches above the top of the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is poured.
- C. Blocking: Block bends, tees, valves, and other points where hydraulic thrust may develop. Form and pour concrete blocking as shown on the Standard Details and as directed by the Authority. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation. Blocking is not required in locations where restrained joint pipe or restrained joint fittings are shown on the Drawings.
- D. Collars: Construct collars as shown on the Standard Details.

1.18 REMOVING AND REPLACING PAVEMENT

- A. Removing Pavement: Remove existing pavement as necessary for installing the pipe and appurtenances.
 - 1. Marking: Before removing any pavement, mark the pavement neatly paralleling pipe lines and existing street lines. Space the marks the width of the trench.
 - 2. Breaking: Break asphalt pavement along the marks using jack hammers or other suitable tools. Break concrete pavement along the marks by use of jack hammers or by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.
 - 3. Machine Pulling: Do not pull pavement with machines until completely broken and separated from pavement to remain.
 - 4. Damage to Adjacent Pavement: Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.

5. Sidewalk: Remove and replace sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.
 6. Curbs: Remove and replace or tunnel under any curb disturbed by construction to the nearest undisturbed joint.
- B. Replacing Pavement: Upon completion of backfilling and consolidation of the backfill, arrange to have the compaction tested by an independent testing laboratory approved by the Authority. After compaction testing has been satisfactorily completed, replace all pavements, sidewalks and curbs removed. Gravel roads and drive shall meet the requirements for graded aggregate sub-base.
1. Materials: Place materials for pavement replacement to dimensions shown on the Drawings.
 - a. Graded Aggregate Sub-Base: Furnish graded aggregate sub-base in two sizes of such gradation that when combined in approximately equal quantities, the resulting mixture is well graded from coarse to fine, meeting the gradation requirements of Section 815 of the Georgia Department of Transportation Standard Specifications.
 - b. Black Base: The base for all paved roadways shall conform to the requirements of the Georgia Department of Transportation Specifications for the Black Base (Hot Mix). Use a Pug Mill Rotary Drum type mixer with minimum capacity of not less than 50 tons per hour for asphalt production. Apply and compact the base in two courses by asphalt spreader equipment of design and operation approved by the Authority. After compaction, the black base shall be smooth and true to established profiles and sections.
 - c. Surface Course: The surface course for all pavement, including paint or tack coat when required by the Authority, shall conform to the requirements of the Georgia Department of Transportation Specifications for Asphaltic Concrete, Section 400, Type "F" (Modified Top). Produce surface course in an asphalt plant of the same type as noted above for Black Base. Apply and compact the surface course in a manner approved by the Authority. Immediately correct any high, low or defective areas by cutting out the course, replacing with fresh hot mix, and immediately compacting to conform and thoroughly bond to the surrounding area.
 - d. Concrete: Provide concrete and reinforcing for concrete pavement in accordance with the requirements of Georgia Department of Transportation Specifications for Portland Cement Concrete Pavement, Section 430.
 2. Supervision and Approval: Pavement restoration shall meet the requirements

of the regulatory agency responsible for the pavement. Obtain agency approval of pavement restorations before requesting final payment. Obtain the Authority's approval of restoration of pavement not the responsibility of a regulatory agency such as private roads and drives. Complete pavement restoration as soon as possible after backfilling.

3. Replacement: Prior to replacing pavement, make a final cut in concrete pavement 12-inches back from the edge of damaged pavement. Make the cut using a rotary saw. Remove asphalt pavement 9-inches back from the edge of damaged pavement using jack hammers or other suitable tools. Replace all street and roadway pavement as shown on the Standard Details. Replace driveways, sidewalks, and curbs with the same material and to the same dimensions as existing.
4. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the life of the bonded period, promptly restore or repair defects.

1.19 ROADWAY CROSSINGS

- A. Furnish and install tunnel liner or casing pipe and install the pipe line therein in accordance with the Standard Details and the following specifications:
- B. General: The Developer shall provide to the Authority, for approval, a detailed plan for the methods proposed for the construction of the tunnel or casing. These plans shall include the methods proposed for groundwater control and face protection.
 1. Groundwater Control: The Developer shall control the groundwater throughout the construction of the tunnel or casing. The groundwater shall be controlled by dewatering (well points or deep wells), grouting, compressed air, freezing or other method approved by the Authority. The Developer shall prepare a written, detailed plan for controlling the groundwater, citing similar installation conditions and results. This plan is to be submitted to the Authority for approval prior to any construction activity for the tunnel or casing.
 2. Face Protection: The face of the tunnel excavation shall be protected from the collapse of the soil. This protection is to be provided by bulkheads, shields or other means approved by the Authority.
- C. Casing: Furnish all material and equipment and perform all labor required to install steel casing pipe at locations indicated on the Standard Details and as specified. A minimum of five years of experience in steel pipe casing construction is required by the casing installer. Submit evidence of experience with shop drawings for review by the County.
 1. Materials: The casing shall be made from steel plate having a minimum yield strength of 35,000 psi. The steel plate shall also meet the chemical requirements of ASTM A 36. The outside of the casing pipe shall be coated

with coal tar epoxy having a minimum dry film thickness of 16 mils. Surface preparation shall be SSPC-SP 10. Epoxy shall have a minimum solids content of 65 percent by volume and shall be air or airless spray applied; minimum drying time shall be seven days. Brushing shall be permitted in small areas only. All coating and recoating shall be done in strict accordance with the manufacturer's recommendations. Epoxy shall be Tnemec, Indurall or Valspar.

UNDER RAILROADS

<u>Pipe Diameter</u> <u>inches</u>	<u>Casing Diameter</u> <u>inches</u>	<u>Wall Thickness</u> <u>inches</u>
6	14	0.250
8	18	0.250
10	20	0.281
12	22	0.312
16	30	0.406
18	30	0.406
20	32	0.469
24	36	0.469
30	42	0.500
36	48	0.625

UNDER HIGHWAYS

<u>Pipe Diameter</u> <u>inches</u>	<u>Casing Diameter</u> <u>inches</u>	<u>Wall Thickness</u> <u>inches</u>
6	12	0.250
8	16	0.250
10	16	0.250
12	18	0.250
16	24	0.250
18	30	0.312
20	30	0.312
24	36	0.375
30	42	0.375
36	48	0.500

2. Construction: Install the steel casing pipe by the dry boring method. Bore the hole

and install the casing through the soil simultaneously by a cutting head on a continuous auger mounted inside the casing pipe. On casing pipe for gravity sewer over 60 feet in length, the installation equipment shall include a steering head and a grade indicator. The steering head shall be controlled manually from the bore pit. The grade indicator shall consist of a water level attached to the casing which would indicate the elevation of the front end of the casing, or some other means for grade indication approved by the Authority. For casing pipe installations over 100 feet in length, the auger shall be removed and the alignment and grade checked at minimum intervals of 60 feet. Fully weld lengths of casing pipe to the preceding section in accordance with AWS recommended procedures. After the boring and installation of the casing is complete, install a cleaning plug on the rig and clean the casing.

D. Tunnel: Install the tunnel liner in strict accordance with Department of Transportation (DOT) and/or Railroad Company requirements. Provide any special insurance coverage required by the governing body. A minimum of five years of experience in construction of tunnels of the general size is required of the tunnel installer. Prior to any work involving explosives, the Developer shall make application to DOT for a special permit which will be in addition to any tunneling permit not involving explosives. The Developer shall comply with all requirements and conditions of all permits including required submittals. Schedule the work so as not to interfere with or in any way endanger traffic flow on the highway or railway. 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 meeting the chemical requirements of 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 percent

Liner plates shall be minimum 10 gage, with the nominal 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 or joints. Bolt spacing in circumferential flanges shall be 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 to meet the longitudinal seam strength requirements of Section 13 of AASHTO 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 and 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, 2 parts mortar sand. 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: Construct tunnel so that no settlement of the overpassing roadway or railway section will occur. In order to prevent such settlement, the use of poling plates, breast boards, shields, and soil solidification or a combination of these methods may be necessary. Install steel liner plates as soon as possible, but no more than 5 feet of tunnel shall remain unlined while tunneling operations are in progress. No portion of the 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. Locate liner plates with grout couplings at the top of the tunnel at intervals not to exceed 10 feet. Install additional plates with grout couplings on each side of the tunnel between the top couplings. Pressure grout all voids in the area outside the plates every 10 feet and at the end of the work shift. Pressure grout more frequently if soil conditions dictate. Before grouting any segment of tunnel liner, seal that segment sufficiently between the liner plates and the surrounding soil to retain the grouting pressure. Locate seals at the entrance of the tunnel, between grout couplings, and within 1 foot of the end of the tunnel at the end of the work shift. Provide pumping equipment 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. Repair damaged spelter coating in accordance with Georgia DOT Specifications, Section 645. Any plates having damaged spelter or bituminous coatings which, in the opinion of the Authority cannot be satisfactorily repaired, shall be replaced at no additional cost.

E. Installation of Pipe: After construction of the casing or tunnel is complete, and has

been accepted by the Authority, install the pipeline in accordance with the Standard Details and the Specifications. For gravity sewers, check the alignment and grade of the casing or tunnel and submit a plan to the Authority for approval to set the pipe at proper alignment, grade and elevation. The pipe shall be supported by wooden skids strapped to the pipe barrel, or similar arrangement approved by the Authority, to prevent pipe movement of flotation within the casing or tunnel. Fill the void between pipe and casing or tunnel with grout. Prior to grouting, the pipe within the casing or tunnel shall be filled with water to guard against flotation. Grout shall be pumped gradually filling the void from the lower end to the upper end. For force mains, the pipe shall be supported by wooden skids strapped to the pipe barrel, or some similar arrangement approved by the Authority, to preclude pipe movement within the casing or tunnel. Close the ends of the casing with 4-inch brick walls, tunnel with 3 course brick walls, plastered with Portland cement mortar.

- F. Safety: Provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it. Begin the tunneling or boring operation in a pit, sheeted and shored as necessary and begin at and proceed from one end. Observe all applicable requirements of DOT and Railroad regulations. Conduct the operations in such a manner that all work will be performed below the level of the roadbed. Coordinate and schedule all of the work with DOT. A temporary bulkhead against the face of the excavation shall be provided and well braced during each cessation of tunneling work while the heading is within 20 feet of railroad tracks or highway pavement. If, in the opinion of the Authority, the tunnel installation work is being conducted in an unsafe manner or in a manner detrimental to the overpassing roadway or to the safety of the traveling public, all operations of tunneling and boring shall cease until the necessary corrections have been made. In the event that distress occurs to the roadway due to the tunneling, the Developer shall be required to submit a plan to repair the roadway. The plan must be acceptable to DOT, the Railroad, the Authority and the County. The Authority will not be responsible and shall be saved harmless in the event of delays to the Developer's work resulting from any cause whatsoever.

1.20 STREAM AND DITCH CROSSING

- A. At all points where banks of streams or drainage ditches are disturbed by excavation or where natural vegetation is removed, carefully compact backfill and place rip rap to prevent subsequent settlement and erosion. This requirement applies equally to construction along side a stream or drainage ditch as well as crossing stream or drainage ditch. Place rip rap a distance of not less than 10 feet upstream and 10 feet downstream from any disturbed area. Extend rip rap from 1 foot below streambed to top of bank. Place to conform with the natural slope of the stream bank.

B. Stone Rip Rap

1. Use sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Specific gravity shall be 2.0 or higher.
2. Minimum weight of individual stones shall be 50 pounds. The maximum allowable dimension for an individual stone is 24-inches; the minimum allowable dimension for an individual stone is 6-inches. At least 50 percent of the stones shall have a minimum dimension of 12-inches.
3. Imbed stone rip rap by hand so as to form a compact layer at least 12-inches thick. Place rip rap in such a way that the smaller stones are not segregated but evenly distributed. Place chinking stones in the crevices between the larger stones so that a dense, well graded mass is produced.

C. Filter Fabric: The filter fabric shall be a monofilament, polypropolene woven fabric meeting the specifications as established by Task Force 25 for the Federal Highway Administration. The filter fabric shall have an equivalent opening size of 70 and shall be manufactured by Mirafi, Amoco, Exxon, or Nicolon. Filter fabric shall be provided for stream and ditch crossings. The fabric shall be overlaid with sand, or crushed stone as necessary due to stream flow, to maximize the contact area between the soil and fabric. Rip rap as specified above shall be placed on top of this fabric and its covering.

1.21 CONCRETE PIERS

A. Construct piers as shown on the Standard Details and in accordance with the following requirements:

1. Material: Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the City. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, grade 60.
2. Bearing
 - a. Earth: Where excavation reveals undisturbed earth subsurface, construct piers with spread footing foundations as shown on the Drawings.
 - b. Rock: Where excavation reveals level or benched rock having a minimum safe bearing value of 20,000 psf, construct piers with foundations bearing directly on rock. Drill a minimum of four holes into the rock under each pier and grout dowels into place to anchor the pier to the rock. Hole and dowel sizes are as follows:

Carrier Pipe Size	Grout Hole Diameter, inches	Grout Hole Depth, feet	Reinforcing Bar Dowel Size
8 - 24	2.5	8	5
27 - 54	4	8	6

Grout holes from the bottom up using a grout pump. Take extreme care to ensure that the entire hole is filled with grout prior to inserting the dowel.

3. Installation

- a. Employ experienced form work carpenters to construct forms. Build formwork sufficiently strong to resist movement and distortion during pouring and to protect the pier from caving in or lateral movement.
- b. Before placing concrete, dewater the bottom of the hole and clean out all mud, loose earth, and extraneous matter.
- c. Pour concrete as soon as possible after the forms have been approved. Do not leave the excavation open for prolonged periods of time. Protect the excavation from surface water. Do not allow water to accumulate in the excavation or in surrounding areas.
- d. Take all necessary precautions to protect the work and personnel on the site. Cover open holes when work is not in progress. Examine all surrounding excavations and embankments for possible hazards.

E. Inspection: Select and, with the approval of the Authority, employ a consulting soil and foundation engineer to perform the following:

1. Inspect the bearing material and evaluate its suitability.
2. Inspect pneumatically drilled grout holes where applicable.
3. Check dimensions and plumbness of forms to ensure conformity with the standard detail and these Specifications.
4. Evaluate material penetrated by excavation with regard to lateral stability and uplift resistance.
5. Recommend remedial measures should insufficient lateral stability or uplift resistance exist.

- A. Clean and test lines before requesting final acceptance. Where any obstruction is met, clean the sewers by means of rods, swabs, or other instruments. When directed by the Authority, flush out lines and manholes before final inspection.
- B. Gravity Sewers: Pipe lines shall be straight and show a uniform grade between manholes. Correct any discrepancies discovered during inspection.
 - 1. Infiltration Tests: Install suitable weirs in manholes selected by the Engineer to determine the leakage of ground water into the sewer. The maximum length of line for each infiltration test shall be 5,000 feet. Measure leakage only when all visible leaks have been repaired and the ground water is 2 feet above the top of the pipe. If leakage in any section of the sewer line exceeds 25 gpd/inch diameter/mile, locate and repair leaks. Repair methods must be approved by the Authority. After repairs are completed, re-test for leakage. Furnish, install, and remove the necessary weirs, plugs, and bulkheads required to perform the leakage tests.
 - 2. Exfiltration Tests: Choose one of the following when groundwater is not 2 feet above the top of the pipe.
 - a. Hydrostatic Test: Test pipe between manholes with a minimum of 10 feet hydrostatic pressure, measured at the center of the pipe at the upstream manhole. The ends of the pipe in the test section shall be closed with suitable watertight bulkheads. Inserted into each bulkhead at the top of the sewer pipe shall be a 2-inch pipe nipple with an elbow. At the upper end of the test section, a 12-inch riser pipe shall be connected to the 2-inch nipple. The test section of pipe shall be filled through the pipe connection in the lower bulkhead which shall be fitted with a tight valve, until all air is exhausted and until water overflows the riser pipe at the upper end. Water may be introduced into the pipe 24 hours prior to the test period to allow complete saturation. House service lines, if installed, shall also be fitted with suitable bulkheads having provisions for the release of air while the test section is being filled with water. During the test period, which shall extend over a period of 2 hours, water shall be introduced into the riser pipe from measured containers at such intervals as are necessary to maintain the water level at the top of the riser pipe. The total volume of water added during the test period shall not exceed that specified for infiltration.
 - b. Low-Pressure Air Test: Prior to air testing, the section of sewer between manholes shall be thoroughly cleaned and wetted. Immediately after cleaning or while the pipe is water soaked, the sewer shall be tested with low-pressure air. At the Developer's option, sewers may be tested in lengths between manholes or in short sections (25 feet or less) using Air-Lock balls pulled through the line from manhole to manhole. Air shall be slowly supplied to the plugged

sewer section until internal air pressure reaches approximately 4.0 psi. After this pressure is reached and the pressure allowed to stabilize (approximately 2 to 5 minutes), the pressure may be reduced to 3.5 psi before starting the test. If a 1.0 psi drop does not occur within the test time, then the line has passed the test. If the pressure drops more than 1.0 psi during the test time, the line is presumed to have failed the test, and the Developer will be required to locate the failure, make necessary repairs, and retest the line. Minimum test time for various pipe sizes, in accordance with ASTM C 828, as amended to date, is as follows:

<u>Nominal Pipe Size, inches</u>	<u>T (time) Min/100 Feet</u>
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0

- c. Required test equipment, including Air-Lock balls, braces, air hose, air source, timer, rotometer as applicable, cut-off valves, pressure reducing valve, 0-15 psi pressure gauge, 0-5 psi pressure gauge with gradations in 0.1 psi and accuracy of plus or minus 2 percent, shall be provided by the Developer.
- d. The Developer shall keep records of all tests made. Copy of such records will be given to the Authority. Such records shall show date, line number and stations, operator, and such other pertinent information as required by the Authority.
- e. The Developer is cautioned to observe proper safety precautions in performance of the air testing. It is imperative that plugs be properly secured and that care be exercised in their removal.
- f. Every precaution shall be taken to avoid the possibility of over-pressurizing the sewer line.
- g. All PVC sewer lines under pavement shall pass a standard mandrel test.

C. Force Mains

1. The Developer 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.
2. Pressure test force mains at the pump shut off head plus 50 psi measured at the lowest point. Test for a minimum of 2 hours. Leakage shall not exceed 0.12 gph/inch diameter/1000 feet.
3. If leaks are detected, locate, repair, and re-test. Repair methods must be approved by the Authority. If results are not totally satisfactory, the Authority may require testing for a longer period of time.

1.23 PROTECTION AND RESTORATION OF WORK AREA

- A. General: 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. Man-Made Improvements: Protect, or remove and replace with the Authority'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.
- C. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by the Authority. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.
- D. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3-inches in diameter, not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work site and disposed of by the Developer. No stumps, wood piles, or trash piles will be permitted on the work site.
- E. Grassing: Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Outside of residential areas, plant the entire area disturbed by the work in rye, fescue, bermuda, clover or other suitable ground cover on completion of work in any area. In all areas, promptly establish successful stands of grass. Grassing activities shall comply with the Manual for Erosion and Sediment Control in Georgia, specifically, selection of species, planting dates, and application rates for seeding, fertilizer and mulching. Where permanent vegetative cover (grassing) cannot be immediately established (due to season or other circumstances) the Contractor shall provide temporary vegetative cover. The Contractor shall submit a written plan for grassing to the Engineer for approval. This

plan shall include selection of species, dates and rate of application.

- F. Erosion Control: Plan excavation work to prevent erosion and the washing of soil into adjacent streams. Limit the amount of open excavation at any one time. Place spoil in the proper place and keep natural water routes open. All owner/developer and contractor activities should comply with Georgia's NPDES General Permit No. GAR100000 for Storm Water Discharges Associate with construction activities.
- G. Disposal of Rubbish: Dispose of all materials cleaned and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate regulatory agencies, county, state and federal.
- H. Swamps and Other Wetlands: The Developer shall not construct permanent roadbeds, berms, drainage structures or any other structures which alter the original topographic features within the easement. Temporary construction of roadbeds, berms, drainage structures, or stockpiling of excavated material and bedding will be permitted as necessary. All temporary construction or alterations to the original topography will incorporate measures to prevent erosion into the surrounding swamp or wetland. All areas within the easement shall be returned to their original topographic condition as soon as possible after work is completed in the area. All materials of construction and other non-native materials shall be disposed by the Developer. The Developer shall provide temporary culverts or other drainage structures as necessary to permit the free migration of water between portions of a swamp, wetland or stream which may be temporarily divided by construction. The Developer shall not spread, discharge or dump any fuel oil, gasoline, pesticide, or any other pollutant to adjacent swamps or wetlands.