

ARTICLE VIII - SANITARY SEWER SYSTEMS

Section 800: Purpose & Scope

Section 801.01 Minimum Requirements & Standards

The purpose of this Article is to address the minimum requirements for design and construction and describe the products to be incorporated into public sanitary sewerage systems with gravity sewer mains, pump stations and sewer force mains. All products shall be supplied and all work performed in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI) or other reorganized standards. Latest revisions of all standards are applicable. When the standards set forth in these Articles are more restrictive than those required by any statute, ordinance or regulation applicable within the City of Cornelia, the requirements of this Article shall govern. When the provisions of any other statute, ordinances, or regulation require more restrictive standards than required by this Article, the more restrictive standards shall apply.

Section 801.02 Authority

The authority for discretionary provisions for design and construction of public sewer systems shall vest with the Administrative Officer or his/her designee.

Section 801.03 On-site Sewage Disposal Systems

On-site sewage disposal systems for more than one individual residence or one stand-alone business will not be allowed.

Section 801.04 Periodic Revisions

This Article is subject to periodic revision to meet changing requirements for materials, environmental regulations, etc. At the beginning of a project the Developer should verify that he has the latest edition.

Section 801.05 General Design and Construction Requirements

This document is intended to convey the general design and construction requirements for a typical project. It also lists specific requirements relating to inspection, testing and acceptance of facilities. It is not intended as a substitute for site-specific engineering and construction techniques. Individual project conditions may require waivers from the provisions in this document.

Section 801.06. Sewer Extensions into Unincorporated Habersham Co.

Sanitary Sewer extensions into unincorporated Habersham County require approval by the Board of City Commissioners. Prior to requesting approval, the developer or his representative will work with the City of Cornelia and Habersham County to ensure that the proposed sewer extension is consistent with the Service Delivery Strategy for the area. If approved, these extensions must meet all regulations and specifications set forth in the City of Cornelia Minimum Development Standards Ordinance.

Section 802: General Policy and Requirements

Section 802.01. Sewer System Design

Sewerage systems shall be designed in accordance with the densities and intensities reflected in the Long Range Future Land Use Map of the Adopted City of Cornelia Comprehensive Plan and the City's Wastewater Management Plan.

Section 802.02. Coordination of Location of Existing and Proposed Sewers

The approximate location and character of proposed public sewer facilities shall correspond with the Existing and Proposed Sewer System Map, as amended.

Section 802.03. Designed for Future Population

Sewer systems shall be designed for the estimated future population from all contributing points under consideration. The estimated future population shall be based on the adopted Comprehensive Plan and/or the existing zoning of the land for the watershed to be served, whichever is greater.

Section 802.04. Buildings for Human Occupancy

Except as provided below, all future buildings within the City's corporate limits that are to be utilized for human occupancy or any other use such as commercial or industrial purposes that requires sanitary sewerage facilities shall be connected to the public sanitary sewer system.

Waiver of the requirement to connect to public sanitary sewers will be considered on a case-by-case basis for non-subdivided, single-lot buildings when the nearest connection point to a public sanitary sewer is more than 200 feet from the property line, when such buildings are to be used for single-family dwelling or some other use where the wastewater loading is no more than that of a single-family dwelling. Requests for waiver must be accompanied by appropriate documentation as may be required by local public health officials.

Section 802.05. Sewer Connections

Sewer Connections - All sewers and service laterals located outside of dedicated rights-of-way or public easements are regulated by the International Plumbing Code (IPC), and shall be privately owned and maintained.

Section 802.06. Water Supply Interconnections

There shall be no physical connections between a drinking water supply and a sewer, or appurtenance thereof.

Section 802.07. Pre-treatment Requirements for Industrial Wastewater

Some industrial and other developments may be required to pre-treat sewage prior to discharge into the City's collection system. Requirements for pretreatment will be determined in accordance with the City's Industrial Pretreatment Permit requirements.

Section 802.08. Erosion and Sediment Control

All installation and maintenance activities for sewerage systems must comply with all Federal, State and local erosion and sediment control regulations. A detailed erosion and sediment control plan is required to be submitted and approved prior to initiating any construction activities.

Section 802.09. Other Requirements

- A. Bypassing of raw wastewater onto the ground or a receiving stream is prohibited at all times.
- B. No part of these specifications is intended to relieve the Developer of his responsibility to comply with requirements of the Georgia DOT, the Georgia EPD or other appropriate regulatory agency.
- C. Photographs of the area should be taken and submitted to the City prior to initiation of any land disturbance or construction activities to show that final site conditions will be the same or better than original conditions as a result of restoration activities.
- D. All unsuitable excavated material must be properly disposed of in a manner acceptable to the City and in a manner that will not adversely impact the environment.

Section 803: Plans and Submittals

Section 803.01. General

All projects which involve construction of lateral sewers, main sewers, trunk sewers, interceptor sewers or pumping facilities shall have detailed construction plans and specifications prepared by a Registered Professional Engineer licensed in the State of Georgia. Developments that only involve gravity sanitary sewers and small connections connecting sewers less than 1,000 linear feet may have plans and specifications prepared and stamped by a Registered Land Surveyor licensed in the State of Georgia.

Section 803.02. Plan Submission

All development plans proposing a sewer system shall be submitted to the City of Cornelia's Development Department. The Development Department shall coordinate the review and approval of all elements of the plan in accordance with these Minimum Development Standards.

Section 803.03. Preliminary Plan Review

Preliminary plans will be prepared and submitted for review as described in Article 3 III of these Development Standards. Questions relating to availability of sanitary sewers and proposed location of connection should be resolved at this stage before proceeding with final planning. A submittal for preliminary plan review must include all land to be developed even though the land is to be developed in several phases or units. Availability determinations will be made for the total project.

Section 803.04. Final Plan Review

All final plans for public sanitary sewer facilities shall be prepared in accordance with the requirements described in Article 3 III and as required in regulations promulgated by the Georgia Environmental Protection Division (EPD). The Developer (not the City) shall be responsible for submitting all necessary plans and other data to EPD for required approvals and for obtaining other permits, such as DOT, railroad, wetlands, etc.

Sanitary sewer design calculations shall be submitted for all proposed mains as part of the development plans along with a sewer-shed map. Deviations from the flow rates of Table 8-1 shall be included in the submission of the development plan, with a description of the procedure used for the calculations and must be approved by the Public Works Director.

Section 803.05. Design of Cross-Country Sewers

The design of cross-country (undeveloped property) sanitary sewer lines and force mains shall be based on field-run surveys. The site plan for cross-country sanitary sewer lines and force mains need not show contour intervals, but the profiles shall be based on mean sea level elevation. Site plans for lift stations shall show existing and proposed contours.

Section 803.06. Phased Subdivision Development

In the event the subdivision is developed in phases, the final construction plans for sanitary sewers may be submitted in phases.

Section 803.07. Plan and Profiles

Profiles should have a horizontal scale of not more than 1"=100' for cross-country lines and 1"=50' for (existing and proposed) developed areas, and a vertical scale of not more than 1"=10'. The plan view should be drawn to a the 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. The vertical datum used should be the elevation above mean sea level with benchmarks shown on the plans and the horizontal datum should be tied to State Pplane coordinates. Plans and profile shall show location of streets, storm sewer, water lines and their easements.

Section 803.08. Manual for Erosion and Sediment Control in Georgia

Final plans and specifications shall include appropriate soil erosion and sediment control practices and BMP's which shall comply with the City of Cornelia ordinances, the Georgia Department of Natural Resources Environmental Protection Division regulations, the Georgia Erosion and Sedimentation Act of 1975 as amended, and the latest edition of the manual for Erosion and Sediment Control in Georgia as published by the Georgia Soil and Water Conservation Commission.

Section 803.09. Sanitary Sewer Details

Detailed engineering design drawings shall be furnished that are drawn to scale clearly show the nature of the design, and shall include the following:

1. All stream crossings and storm drain outlets with elevations of the stream bed and of

- normal and extreme high and low water levels.
2. Details of special sanitary sewer joints and cross sections.
 3. Details of special sanitary sewer appurtenances such as manholes, service connections, elevated sanitary sewers, piers, pipe bedding, special highway crossings, railroad crossings, drop manhole connections, etc.
 4. The developer's design professional shall furnish appropriate drawings for submittal by the owner to any state or federal highways, railroads, power lines, water lines, gas lines, petroleum lines or any other utility lines on which the sanitary sewer construction will encroach.
 - a. The encroachment drawings shall be 8 ½ " x 11" and shall show a plan view and profile view. The drawing shall show the same information required for easement drawings.
 - b. The encroachment drawing shall also show the right-of-way of the existing street or utility, the owner's designation of the line, the name or number of the nearest intersection or milepost or tower number and the distance to that appurtenance; clearance distance between the street surface, or the bottom of the rail, or the utility and the sanitary sewer; the type of material to be used for the sanitary sewer and the method of construction to be used; any other special information required by the owner of the facility on which the sanitary sewer is encroaching.
 - c. Two (2) copies of the utility encroachment drawing will be furnished with the plans when they are submitted for approval.
 - d. The developer's design professional shall prepare and handle the submittal. Construction permits shall not be issued until the utility encroachment permit has been obtained and until any special conditions such as insurance requirements have been complied with.

Section 803.010. As-Built Drawings

At the completion of construction (and preferably prior to the final field inspection) "As-Built" drawings of the project shall be submitted to the City to serve as a permanent record of the project. A reproducible copy of the final plan and two (2) sets of as-builts shall be submitted. A digital copy of the as-built plans shall also be submitted in a format and coordinate system compatible with the City of Cornelia's Geographic Information System (GIS). Each sheet of these drawings shall bear the words "As-Built" or "Record Drawings".

1. Guidelines for Preparation of As-Builts
 - a. As-Built drawings will be same format as the original construction plans.
 - b. Existing contour lines are not required, however the final contour lines should be shown.
 - b. Contour lines are not required.
 - c. Road names and lot numbers should be on plan.
 - d. "As-Built" or "Record Drawing" is to be stamped in large clear print on plans.

- e. Sheet should be no larger than 24" x 36".
- f. Lateral wye locations must show distance from the downstream manhole.
- g. Ends of lateral lines must show distance from downstream manhole and offset distance from the main line. Approximate depth of end of lateral should be shown.
- h. Show elevations of manhole inverts and tops.
- i. Show field-measured distance between manholes.
- j. For all sanitary sewers, show the field-measured azimuth or bearing of the line from manhole to manhole.
- k. Show actual slope of pipe.
- l. When a phase of a subdivision is completed, a location sketch of entire subdivision with said phase outlines shall appear on plans.
- m. Maximum error of as-built measurements shall be:
 - Manhole inverts measure to 0.01' with maximum vertical error of 0.050' per 1,000 feet of horizontal traverse.
 - Manhole tops measure to 0.10' with maximum vertical error of 0.050' per 1,000 feet of horizontal traverse.
 - Horizontal Locations: Measure to nearest 1.0' with allowable error of 0.1.0' per 1,000' of traverse.

Section 804: Easements

Section 804.01. General

All easements shall allow adequate room to construct and maintain the sanitary sewer and appurtenances. Permanent easements shall be provided for all sanitary sewers not located within the right-of-way or within 10 feet inside of the right-of-way shall be a minimum of 20 feet wide, ten (10) feet on each side of the line; except that when the depth of the sanitary sewer exceeds ten (10) feet the required sanitary sewer easement width shall increase such that the easement width is at least twice the depth from the ground surface to bottom of the pipe. Easements with dual utilities shall be a minimum of 35 feet in width.

Section 804.02. Easement Drawings

Easement drawings shall be furnished for work outside the development prior to approval of the sanitary sewer plans. The drawings shall be of a size suitable for legal recording and shall be prepared by a Registered Land Surveyor. The drawings shall be drawn in accordance with these Development Standards.

Sewer easements off the street right-of-way shall be clearly defined on the plat of the individual property owner and said property owner will be required to keep the easement free of all obstacles.

All easements shall be cleared of debris, excess dirt and other materials. The ground shall

be smoothed down and grassed within 10 days of completing construction work. The use of sediment control measures will be required to protect the area until a vegetative cover is obtained.

Where the developer does not contemplate installation of sewers to the most upstream property line of drainage basins running through the development, a 20 foot wide permanent easement and 60 foot wide construction easement will be required for future use of the City. These easements must be shown and recorded on the final development plat.

The title block for these easement plats shall read as follows:

<p style="text-align:center">CITY OF CORNELIA <i>NAME OF OUTFALL OR SUBDIVISION</i> EASEMENT FOR PROPOSED SANITARY SEWER CROSSING PROPERTY OF John Doe Tax Map, Block & Lot No./Zoning District//Date and/or Revised Date:</p>

Section 804.03. Adjacent Property Access

To provide for maximum utilization of public sewer systems, appropriate easements shall be provided to adjacent properties for access to, or extension of, said utilities. Such easements shall be dedicated to the City of Cornelia.

Section 804.04. Offsite Easements

It shall be the responsibility of the Developer to obtain any off-site easements required to connect the project to existing public sanitary sewers. Easements will be conveyed to the City of Cornelia for all facilities that are to be conveyed to the City. Final plans cannot be approved until all necessary on-site and off-site sanitary sewer easements have been submitted, approved and recorded (see Appendix B for a sample easement form).

Section 805: Sewers in Relation to Streams, Lakes and Other Water Bodies

Section 805.01. Crossing Streams and Standing Bodies of Water

Sewer lines crossing streams or standing bodies of water, both above and under water, present special problems, and should be discussed with the City's Development Department before final plans are prepared.

Section 805.02. Sanitary Sewers Adjacent to State Waters

Cross-country sanitary sewers adjacent to state waters shall be designed and constructed to comply with the buffer requirements, including Georgia DNR Rules 391-3-7, the Georgia Erosion and Sediment Control Act OCGA 12-7-1, and any other ordinances the City of Cornelia may have enacted. In cases where these regulations differ, the most protective (greatest distance from the edge of the stream) will serve as the standard. Sanitary sewers crossing streams shall be kept to a practicable minimum. Where sewers parallel state

waters, the sewers and their respective easements shall be located outside the buffer area. Reasons for requesting sewer lines to be located within stream buffers shall be provided in the preliminary plan application and a Stream Buffer Variance application must be made by the Developer to Georgia EPD.

Section 805.03. Sewers on Piers

Sewers laid on piers across ravines or streams shall be allowed only when it can be demonstrated that no other practical alternative exists.

Section 806: Sewer Systems in Relation to Waterworks Structures

Section 806.01. EPD and Local Health Department Requirements

Sewer systems shall meet the requirements of the EPD and the local health department with respect to minimum distances from water supply wells or water supply sources and structures.

Section 806.02. Water Supply Structure or Source

No sewer line shall pass within fifty (50) feet of a water supply source or structure unless special construction and / or pipe materials are used to obtain adequate protection.

Section 806.03. Protection of Water Structures

The proposed design shall identify and adequately address the protection of all water supply structures within 100 feet of the proposed project.

Section 807: Design Calculations

Section 807.01. Peak Flows Based on Future Flows

Sewer systems shall be designed to carry the peak flows generated by the estimated future population from all contributing points under consideration. The estimated average daily flow will be computed using the unit flows from Table 8-1. In the absence of actual data, sewer peak flows should be determined by consulting the latest edition of the Recommended Standards for Sewage Works (Ten State Standards) .

Section 807.02. Determining Peak Flows

Peak flows will be determined using Table 8-2.

Section 807.03. Determining Sewer Capacity

Considerations will be given to domestic, commercial, institutional and industrial wastes plus groundwater infiltration in determining the necessary capacity of the sewer system.

**TABLE 8-1
AVERAGE DAILY WASTEWATER FLOWS
BY FUTURE LAND USE CATEGORY**

Land Use Category	Density SU/Ac.	Unit*	Flow/Unit (gpd/unit)
Residential: Low Density	2	DU	400
Residential: Medium Density	5	DU	375
Residential: High Density	9	DU	350
Neighborhood: Commercial	--	ACRE	2,000
Office/Professional	--	Acre	2,000
Commercial	--	Acre	2,000
Light Industrial	--	Acre	1,500
Office/Distribution/Technology	--	Acre	1,750
Heavy Industrial	--	Acre	2,000
Quasi-Public/Institutional/Churches	--	Acre	2,000
Public Land	--	Acre	**

- * Acres refer to gross acreage minus the floodplain area as established.
- ** Design of sewer facilities to serve these land uses shall be on a case-by-case basis depending on specific uses.

Section 808: Sanitary Sewer Design Criteria

Section 808.01. General

The criteria listed herein is not intended to cover all aspects of design, but rather to mention the basic guidelines and those particulars that are required by the City of Cornelia. For more detailed criteria, the design should refer to standard references such as "Ten States Standards", Georgia EPD Rules and Regulations, Water Pollution Control Federation Manual of Practice No. FD-5, and other available literature.

All sanitary sewers for the conveyance of wastewater shall be designed as separate sanitary sewers in which groundwater, stormwater or other runoff from roofs, streets, parking lots, foundation drains and any source other than wastewater are excluded. Overflows from sanitary sewers shall not be permitted.

Section 808.02. Design Period

Gravity sanitary sewer pipelines should be designed in accordance with the City's wastewater management plan and should, as a minimum, be designed with capacity sufficient to handle the estimated tributary population twenty to forty years into the future. Tributary population is considered to be all areas upstream of the discharge point of the system being designed as well as any anticipated pumped flow from other basins, sanitary sewers shall 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.,

Section 808.03. Capacity and Size Determinations

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. Groundwater infiltration;
4. Topography of the area;
5. Depth of excavation.

Section 808.04. Design Features

1. No sewer main shall be less than 8"; No service lateral shall be less than 6".
2. Wet Well Volume - The wet well volume shall be sized to limit pump cycles to no more than six (6) cycles per hour under worst conditions.
3. Ventilation - The minimum requirement for wet wells shall be one (1) gravity vent pipes designed for natural ventilation. Vents shall be elevated to a minimum of two (2) feet above the 100-year flood elevation. Where conditions are conducive to formation of hazardous conditions (in the design engineer's opinion), mechanical ventilation shall be provided. Mechanical ventilation shall be required for dry wells.
4. Structures - Submersible lift stations shall have a wet well structure and a separate valve pit. Both structures shall be pre-cast concrete with a monolithic base, however, cast-in-place will be considered on a case-by-case basis.. The valve pit shall be a minimum of 4' x 4' x 5' deep with manhole steps, floor drain pipe with a "p" trap and backflow preventer, and a minimum 3' x 3' lockable aluminum access hatch. Wet wells may be either round or rectangular and shall have a diameter or width of at least five feet (5'). Wet wells shall be sized to meet cycle time requirements with a draw down (i.e. the distance between high water level and low water level) of not more than three (3) feet. The wet well shall have a lockable aluminum hatch large enough for easy removal of pumps.
 - a. Riser sections in pre-cast units shall be sealed watertight using butyl rubber sealant or other approved sealant. Mastic shall not be used. Structures shall be adequately reinforced for all loading conditions normally encountered during shipping, construction and service. All openings (for pipes, hatch, conduits, etc.)

shall be either cast-in-place or cored. Sanitary sewer pipe connections shall utilize rubber boot connectors and be watertight. The wet well will be equipped with either manhole steps or an aluminum ladder, whichever is the City's preference.

5. Accessories - All materials inside the wet well and valve pit shall be corrosion resistant. Mechanical equipment requiring ferrous metals shall have a coal tar epoxy coating. Guide rails for pumps shall be stainless steel. Miscellaneous metals including fasteners shall be aluminum or stainless steel; hatches shall be aluminum; anchor bolts shall be stainless steel. All stainless steel must be Grade 316.
6. Pressure Gauge - Pressure gauges shall be installed on the force main inside the valve pit and visible from ground level as follows: between each pump and its check valve and one (1) downstream of the plug valves. A corporation stop shall be installed on each tap to allow removal of the gauge.
7. Valves - The discharge pipe of each pump shall have a check valve followed by a plug valve before the two pipes join into a common force main.
8. Surge Control Valves - The pumping system shall be checked to determine if a surge control valve is required. If a valve is required, it shall be located within the valve pit on the common force main and a drain line installed to drain to the wet well.
- 8.9. By-pass Pump Connection – Each pump station shall be equipped with a bypass pump connection constructed of flanged and/or restrained joint ductile iron pipe, plug valve and a camlock fitting. The bypass pump connection shall be installed downstream of the valve vault and allow for the connection of a temporary pump.

Section 808.05. Pump Features

1. Pumps shall have the following features:
 - a. Non-clog impeller
 - b. Be capable of passing a three (3) inch sphere (except grinder pumps)
 - c. Be capable of dry operation without overheating
 - d. Have dual mechanical seals with seal leak indicator light in the control panel
 - e. Pump and motor casing shall be cast iron and all fasteners shall be stainless steel (Grade 316)
 - f. Motor shall be selected to be non-overloading under all operating conditions.
 - g. Motor winding shall have a heat sensor with auto reset to prevent overheating; three-phase motors shall have two sensors
 - h. The operating speed of the pump shall not exceed 1800 rpm without special approval. The motor shall have upper and lower roller bearings. The pump shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection or service. There shall be no need for personnel to enter pump well. A simple linear downward motion of the pump shall accomplish sealing of the pumping unit to the discharge connection elbow. Each pump shall be equipped with a stainless steel

chain or cable for easy removal. and a hoist shall be provided for easy removal.

Section 808.06. Depth Requirements

Any sewers installed in the street shall be sufficiently deep to provide 5 feet of cover at the inlet end of all service laterals at the street right-of-way and over any part of the main or service within the street right-of-way. Any sewers on off-street easements shall have a minimum of four feet of cover. In extraordinary circumstances where there is no other alternative, ductile iron pipe shall be used where there is less than four feet of cover and it shall have a protective coating on the pipe interior as required herein.. Filling over the pipe to obtain minimum cover is not allowed if the fill will impede the natural flow of surface water or will cause an erosion problem.

Section 808.07. Design on Average Daily Flow (ADF)

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 for a peak flow of not less than 2.5 1/2 times the average flow; this peak factor will be higher for smaller basins. Sanitary sewers should be designed to carry the peak flow when flowing at a depth of 2/3 the pipe diameter.

Section 808.08. Flow Velocities

All sanitary sewers shall be so designed and constructed to give mean velocities, when flowing full of not less than two (2) feet per second based on Manning's formula using an "n" value of 0.013. Table 8-2 below indicates the minimum slopes that should be provided; however, slopes greater than these are desirable: Where velocities greater than 15 feet per second are attained, special provision should be made to protect against displacement by erosion and impact.

**TABLE 78-2
MINIMUM REQUIRED SEWER PIPE SLOPES**

Minimum Sewer Size (inches)	Minimum Slope (ft/100ft.)
8	0.40
10	0.29
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06
36	0.05

These minimum slopes shall be used only when sufficient flows are expected to maintain a velocity of two (2) feet per second and maintain a cleaning action in the line. Sanitary sewers shall be laid with uniform slope between manholes. Sanitary sewers on 20% slopes

or greater shall be ductile iron pipe and shall be anchored securely with concrete anchors (See Standard Details) to prevent displacement by erosion or shock. The maximum slopes of sanitary sewers shall be 30% and sanitary sewers shall be designed at less than 20% whenever possible.

Section 808.09. Increasing Size

When a small sanitary sewer is connected to a larger sewer, the connection shall not be lower than matching the top of both sewers to the same elevation.

Section 808.010. Ductile Iron Pipe

Ductile iron pipe shall be required for sanitary sewer mains:

- a. Over or under all storm sewers
- b. Crossing water mains
- c. Tunder At all stream crossings
- d. With less than 4' of cover or over 14' of cover
- e. With 20% or greater slope
- f. Inside casings
- g. At all other locations specified by the City

Section 808.011. Section 808.010. Gravity Sewer Pipe

The City reserves the right to disallow any manufacturer that does not have a consistent, long-term record of quality control and successful product performance. Gravity sewer pipe up through 15-inch diameter will normally be polyvinyl chloride (PVC). Ductile iron pipe (DIP) shall be used where certain conditions exist (see previous discussion of DIP Section 809). For 18-inch diameter pipe and larger, the contractor may have the option of using either PVC, reinforced concrete pipe (RCP), or DIP. The City may approve the other types of pipe on a case-by-case basis and may limit the options of type of pipe depending on site conditions. All buried PVC pipe shall be marked continuously with metalized locator wire. This should be addressed at the preliminary plan review stage.

Section 808.012. Section 808.011. Detection Tape/Wire Wyes and Bends

All nonferrous pipe, not just PVC, must be marked with detection tape/wire. Wyes and bends shall be equal in quality to the materials of the pipeline being installed.

Section 808.013. Sanitary Sewer Pipe Bedding

Bedding for sanitary sewer pipe shall be in accordance with ASTM D 2321, as amended to date, the pipe manufacturer's recommendations, and as follows (see also Standard Details):

1. For PVC, HDPE and any other pipe made of plastics or resins the minimum bedding shall be "Type 5".
2. For RCP and DIP pipe the minimum bedding shall be "Type 4".
3. In certain areas, the minimum bedding requirements will be increased as needed to ensure a stable support under, and on the sides of the pipe.

Section 808.014. Wyes and Bends

Wyes and bends shall be equal in quality to the materials of the pipeline being installed.

Section 808.015. Section 808.012. Pre-Cast Concrete Manholes

1. Manholes - Sanitary sewer manholes shall consist of Portland Cement concrete with a compressive strength of not less than 4,000 pounds per square inch at an age of 28 days. The minimum inside diameter of the manhole shall be as required by the Standard Details. The wall thickness shall be not less than 5 inches. Manholes over 12' deep shall be placed on a reinforced slab as shown on the detail. Joints in the wall shall be tongue and groove type. Sections shall be joined using O-ring rubber gaskets, flexible plastic gaskets conforming to the applicable provisions of ASTM Standard Specification, Serial Designation C43, or an approved bitumastic joint material. Precast concrete manholes shall consist of precast reinforced concrete sections with eccentric, (or flat slab for shallow manholes) top section and a base section conforming with the typical manhole details as shown on the Standard Detail. Flat top manholes will be approved only if a need for such can be demonstrated by the design professional.
2. Manhole Sections - Each section of the pre-cast manhole shall have not more than two holes for the purpose of handling and laying. These holes shall be sealed with cement mortar using on part Portland Cement to two parts clean sand, meeting ASTM Standard Specification, Serial Designation C144.
3. Rubber Boots - Pre-molded rubber boots with stainless steel bands shall be used for connecting sewer pipe to manholes. These may be either the lock-in "Kor-N-Seal" type as manufactured by National Pollution Control Systems, Inc. or the cast-in type as manufactured by Interpace Division of Ball Rubber, Inc. or approved equal. In all cases, the boot shall be sized to suit the outside diameter of the type pipe being used.
- 4.3. Lift Holes - Holes in precast bases to receive sewer pipe shall be precast at the factory at the required locations and heights. Knocking out of holes in the field will not be permitted; however, holes can be cored in the field with a coring machine. The design, the materials used in, the manufacturing process and the transportation of precast manhole shall be subject to inspection at any time by the City. Materials found defective by the City will not be delivered to the jobsite. Material on the jobsite that is found defective shall be removed immediately after being notified that such materials are unacceptable. Precast manhole shall conform to ASTM C478.
4. Pipe Holes - Holes in pre-cast bases to receive sanitary sewer pipe shall be pre-cast at the factory at the required locations and heights. Knocking out of holes in the field shall not be permitted on new construction. However, holes can be cored in the field with a coring machine. All manholes shall have Kor-N-Seal (or equal) rubber boots for all pipe entries/exits.
5. Rubber Boots - Pre-molded rubber boots with stainless steel bands shall be used for connecting sewer pipe to manholes. These may be either the lock-in "Kor-N-Seal"

type as manufactured by National Pollution Control Systems, Inc. or the cast-in type as manufactured by Interpace Division of Ball Rubber, Inc. or approved equal. In all cases, the boot shall be sized to suit the outside diameter of the type pipe being used.

- 5.6. Manhole Steps - Manhole steps shall be of #4 steel reinforcing bars covered with Polypropylene Plastic or rubber and shall be supplied with depth rings and other necessary appurtenances. The manhole steps shall conform to the applicable provisions of ASTM Specification C478 and shall be similar to and of equal quality to the "Sure Foot" by Oliver Tire and Rubber Company of Oakland, California or "PSI-PF" by M.A. Industries, Inc. of Peachtree City, Georgia. The step shall be factory built into the precast sections.
6. Pipe Holes - Holes in pre-cast bases to receive sanitary sewer pipe shall be pre-cast at the factory at the required locations and heights. Knocking out of holes in the field shall not be permitted on new construction. However, holes can be cored in the field with a coring machine. All manholes shall have Kor-N-Seal (or equal) rubber boots for all pipe entries/exits.
7. Inverts - The invert of manholes shall be constructed of concrete or brick in accordance with the Standard Details and shall have a cross-section of the exact shape of the invert of the sewer which it connects, changes in size and grade being made gradually and evenly. Changes in direction of the sewer and entering branch or branches shall have a true curve of as large a radius as the size of the manhole will permit. Inverts shall have a "smooth trowel" finish. The manhole bench shall be sloped 30 degrees from the manhole wall toward the invert. Manholes shall be provided with steps built into the wall as shown on the detailed drawings. Drop manholes will be required where the invert of any incoming line will be higher than two (2) feet from the invert of the outlet pipe. All manholes shall be watertight when completely built.
8. Manhole Foundation - The manhole base shall be set on a compacted mat of #57 size crushed stone. The mat shall be a minimum of 6-inch thick and graded level. In wet areas the crushed stone mat shall be thickened as needed to provide a non-yielding foundation.
9. Brickwork - Any brickwork required to complete the pre-cast concrete manhole shall be constructed using one (1) part Portland cement to two (2) parts clean sand, meeting ASTM C144 Specifications as amended, thoroughly mixed to a workable plastic mixture. All brickwork shall be constructed in a neat and workmanlike manner. Cement mortar shall be used to grout interior exposed brick joints and faces. No more than three (3) courses of brick with nine (9)-inch maximum total depth of bricks may be used to adjust manhole covers. In cross country areas, the elevation of the top shall be 18 inches above the finished grade. Manholes in other areas shall be at the elevation shown on the approved plans.
10. Frame and Cover - Manhole covers shall be cast iron with a coat of asphaltic paint applied at the foundry. The frame and cover shall be as shown on the detail drawings.

All covers shall have "Sewer" printed on them. Manhole frame and covers shall be as manufactured by Neenah R-1765 (365 lbs.) in paved roads, parking lots and driveways; and Neenah R-1779 (300 lbs.) for non-traffic areas, or approved equal. Manhole frames shall be cast in the cone if located in non-traffic areas. Waterproof manhole covers shall be cast iron with a coat of asphaltic paint applied at the foundry as shown on the drawings with a "bolted-down" lid. All covers shall have "Sewer" printed on them. Manhole frame and covers shall be as manufactured by Neenah Foundry Company R-1915-F2 (435 lbs.) or approved equal. Manhole frames shall be cast in the cone if located in non-traffic areas.

11. Masonry Work - Masonry work shall be allowed to set for a period of not less than 24 hours before being placed under traffic or in operation. All loose or waste material shall be removed from the interior of the manhole.
12. Location - Manholes shall be installed at the end of each line; all changes in grade, size or alignment; at all intersections; and at horizontal distances normally not greater than 400 feet. Cleanouts may only be used for special conditions and shall not be substituted for manholes nor installed at the ends of laterals greater than 150 feet in length. Manholes in cross-country areas shall be elevated so that the top is 18 inches above ground and/or two (2) feet above the 100-year flood plain.
13. Drop in Manholes - Drop across manholes shall be minimum 0.1 feet unless approved by the City.
14. Both the wet well wells and manholes receiving forced main effluent must be coated with a factory applied coal tar epoxy to prevent corrosion. The coating shall be 300 M as manufactured by Kopper Company, Inc. or acceptable equivalent. The coating shall be applied in two coats to achieve a dry film-thickness of at least 10 mils per coat in accordance with the manufacture's recommendations. Surfaces shall be cleaned of dust, form oil, curing compounds or other foreign material prior to coating. If the City believes that coatings will not provide adequate protection, more stringent requirements like PVC liners may be required on a case-by-case basis. If the City believes that coatings will not provide adequate protection, more stringent requirements, like PVC liners, may be required on a case-by-case basis.

Section 808.016. Section 808.013. Concrete and Mortar

1. Concrete shall consist of Portland Cement, a fine aggregate, a coarse aggregate and water. Portland Cement shall conform to Fed. Spec. SS-C-19 lb. Fine aggregate shall be clean, sharp, well-graded sand conforming to Fed. Spec. SS-S-51. Coarse aggregate shall be uniformly graded broken stone or gravel, which will pass a 1 ½" screen and be retained on 9¼" screen. Aggregate shall be free of clay, loam silt or organic matter. Water used for concrete shall be clean and free from vegetable, sewage or organic matter and the total amount used shall not exceed six (6) gallons per sack of cement. Forms may be of wood or metal properly braced to prevent bulging. Concrete shall be thoroughly mixed and well vibrated into forms and around fittings. Exposed surfaces of concrete shall be protected from premature drying by being kept covered and moist for a period of seven days. After the forms have been removed, the voids in

the interior surface, if any, shall be properly filled with cement mortar and the whole surfaced rubbed uniformly with neat cement.

2. All mortar shall be composed of one part Portland Cement to three parts sand, conforming to these specifications.
3. All concrete shall have a compressive strength of not less than 3,000 psi at an age of 28 days.

Section 808.017.Section 808.014. Reinforcing Steel

Bars for concrete reinforcement shall be of the sizes, lengths and bent as shown on plans. Bars shall be ASTM Specifications A-615 Grade 60. All Steel shall be free from rust, scale or any foreign coating.

Section 808.018.Section 808.015. Brick

All brick shall be best grade, hard-burned, common, giving a ringing sound when struck and acceptable to the City. Only bricks presenting a regular and smooth face shall be used. When submerged in water for 24 hours, they shall not absorb more than 10% of their weight in water. Brick shall be culled when delivered on the ground, and all imperfect brick are to be immediately removed from the work. All salmon, soft or arch brick or brick made of alluvial soil will be rejected. All brick used in the work shall be of uniform size.

Section 808.019.Section 808.016. Subgrade Stabilizer Stone

Stabilizer for subgrade shall be either approved crushed stone or gravel, uniformly graded from ¼" to ½" in size.

Section 808.020.Section 808.017. Casing Spacers

Approved casing spacers shall be used to secure the sewer line on grade throughout the length of the casing. The spacers shall be sufficient to secure the pipe on grade during the grouting operation.

Section 808.021.Section 808.018. Concrete for Thrust Blocks and Thrust Collars

Concrete for thrust blocks and thrust collars shall have a minimum compressive strength of 3,000 psi at 28 days.

Section 808.022.Section 808.019. Steel Casing Pipe

Steel casing pipe shall be used where boring and jacking of more than 20 feet in length is required for installation.

Steel casing pipe shall be schedule 40 thickness with minimum yield strength of 35,000 psi and shall conform to the requirements of ASTM A139. It shall be fully coated on the exterior and interior with a coal tar coating. The casing pipe diameter shall be 6 to 8 inches greater than the "bell" diameter of the carrier pipe.

Wherever steel casing is required, the carrier pipe shall be ductile iron pipe with push-on joints. Approved spacers made of stainless steel straps with nylon skids shall be used to center the carrier pipe; two spacers per section of pipe shall be used. A manhole shall be

placed at each end of the cased section at a distance of five to 10 feet beyond the end of the casing. Ductile iron pipe shall be continuous from manhole to manhole.

Section 808.023. Section 808.020. 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.

1. 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).
2. 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.
3. 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 7 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 City.

Section 808.024. Section 808.021. Service Laterals

1. A sewer service shall be provided for every existing or proposed lot or building. All services shall be shown on the construction drawings. All service laterals shall be a minimum of 6" in diameter. A common service shall not be allowed for two or more multiple buildings. The service shall extend to 5 feet inside the property line of the lot being served and normally be within 10 feet of the lower corner of the lot. The Contractor shall install a clean out at the right-of-way and extend the PVC cleanout to a height of 3' above the finished grade. The Contractor shall also place a 4"x4" pre-treated wood post painted green above the end of the service lateral to enable the builder to locate the service. All service laterals shall have minimum of 5 feet of cover at the right-of-way. Where 5 feet of cover cannot be achieved, services shall be ductile iron.
- 1.
2. Six inch (6") services shall be laid at a minimum grade of 1%. Service laterals tied directly to manholes shall enter the manholes through cored holes and shall be provided with a pre-molded rubber boot as described herein. Laterals shall enter the manhole no higher than 6" above the table and shall be provided with a concrete flume to slope the flow into the manhole invert.

3. The developer shall be responsible for serving all lots developed. On any lot where the service cannot be found, the developer shall be responsible for payment of the cost of installation of another service lateral. Also, unless noted on the final plat, the service shall be low enough to serve the first floor elevation at the building line. The builder shall be responsible for the location of the services prior to the pouring of the foundation, driveway or other appurtenance. The City will not be responsible for any house built too low to be served or for any service covered by construction.
- 2.
- 4.3. No plumber or contractor will be allowed to connect to the sewerage system except to the end of the service provided for this connection, when proper permit is issued. After the service is run from the end of the lateral provided by the sewer line contractor to the house plumbing, the cleanout at the right-of-way may be cut down to a level six inches below the finished grade. The cCleanouts s shall be provided with a cast iron ferrule with a brass screw plug to enable the cleanout to be located with a metal detector. Plastic plugs are not allowed.

Section 808.025.Section 808.022. Sanitary Sewer Line Extension Requirements

1. If an existing trunk line must be extended to serve the property, the developer may be required to pay all of the initial costs. If the line extension would serve other developments within a one-year period, the City may negotiate with the initial developer for a pro- rata share participation from future developers who wish to connect to the extension during the one-year period. This one-year period would begin upon final acceptance of the line by the City at the end of the two-year developer maintenance period.
2. Sewer line extensions shall be sized in accordance with the requirements of this Section. If the size of the trunk main extension required is larger than the minimum size required to serve the development, the Developer may be able to recapture some of the initial costs through negotiations with the City for the cost of the betterment in accordance with the Section above.

Section 808.026.Section 808.023. Polyethylene Encasement

Ductile iron pipe shall be provided with polyethylene encasement whenever the sewer line either crosses or is in close proximity to a steel gas main. Polyethylene wrap shall be manufactured of virgin polyethylene material conforming to ASTM Standard Specification D-1248, latest revision, Type I, Class A or C, Grade E-1. The polyethylene film shall have a minimum thickness of 8 mm.

Section 808.027.Section 808.024. Wastewater Lift Stations

A registered professional engineer licensed in the State of Georgia shall do lift station design. The following minimum requirements apply to wastewater lift stations:

1. Lift stations having less than 500 gpm capacity (per pump) shall utilize two submersible centrifugal pumps each having a capacity equal to the design flow. Lift

stations having a capacity of 500 gpm or more shall be reviewed on an individual basis and may have requirements differing from those outlined herein,

2. Grinder type centrifugal pumps shall be used for pumps having a capacity of less than 100 gpm. Force mains shall be sized to provide a velocity of at least two (2) feet per second.
3. The design shall allow for each removal of any pump or equipment item without the need to shutdown the entire lift station. Lift assembly shall be provided for pump or equipment removal.
4. The design engineer shall consult with the Administrative Officer or his/her designee after preliminary design data has been developed for information on approved pump manufacturers. The City reserves the right to review each application on an individual basis and to reject the use of non-approved manufacturers.

Section 808.028. Section 808.025. Plan & Design Submission

1. In addition to the information requested in Article 300, construction plans shall also include the following lift station information:
 - a. System head calculations; tabulated and plotted on the pump curve, along with a plot of force main velocity.
 - b. Standard drawings, details and specifications sufficient to ascertain compliance with these regulations.
 - c. Calculations showing determination of wet well volume and cycle time at design conditions. Wet well volume should be sufficient to provide a cycle time of no less than five (5) minutes from a pump "on" to the next pump "on" time. In addition to short cycles, the design engineer should ensure that cycles times will not be too long and create a nuisance condition.
 - d. Backup power must be provided for pump stations in the event of a power outage.
 - e. Construction drawings and specifications in sufficient detail to ascertain compliance with these regulations.
 - f. Buoyancy computations showing that structures are protected against flotation.
 - g. All pump stations must have separate valve boxes with drains. The drains shall be tied back to the wet well and include a p-trap, flap valve or similar device to prevent sewer gases from entering the valve pit and water from backing up into the valve pit.
2. Shop Drawings - After construction plan approval, but before purchasing any lift station equipment, shop drawings shall be submitted to the City including the following information:
 - a. Manufacturer's catalog sheets, performance curves, installation drawings, specifications and list of options for the specific pump that is offered for approval.

- b. Similar catalog data for controls, valves, hatches, yard hydrants, pre-cast wet well and other manufactured items.
3. Certification - After installation and before placing the system into full operation, the work must be inspected by the Developer's Engineer who must then issue a certification to the City verifying that all work has been complete in accordance with approved plans. This certification shall include all construction of the lift stations and force mains. After acceptance of the work by the engineer, a factory representative shall inspect and start up the system certifying rotation, capacity, amperage draw, lack of vibration and other standard checks. This certification shall state the beginning date of the warranty and include a copy of the warranty. The pump shall have a minimum manufacturer's warranty of five (5) years with no prorating.
4. Operation & Maintenance Manuals - On or before the date of start-up, five (5) sets of factory O & M Manuals shall be delivered to the Public Work Director. These manuals shall include the name of the purchaser, the serial numbers of pumps, detailed wiring schematics, telephone number and address for purchase of parts.
5. After construction is complete, as-built drawings shall be furnished including three (3) hard copies plus a copy in Adobe PDF formats.
 - a. Spare Parts shall be provided per Manufacturer's Recommendations for all pumps. Lift stations with pumps of five (5) HP or smaller shall be supplied with a spare complete pump. Lift stations with pumps above five (5) HP shall be supplied with an extra impeller and set of bearings.
 - b. Each lift station shall be provided with a permanent in-place emergency generator for standby power. The only exception to this requirement is if the power supply in the project area of the City has a dual feed. Generators shall not be required where there is a dual feed. Where generators are required, the generator shall be diesel powered with an automatic transfer switch and provisions for an automatic exercise cycle. Specifications for the generator shall be submitted to the City for review and approval.

Section 808.029. Section 808.026. Site Requirements

1. Flooding - Lift stations shall be designed to remain fully operational and accessible during the 25-year flood event. All electrical controls shall be designed to be above the 100-year flood elevation. All motors and mechanical equipment shall be protected against physical damage from the 100-year flood.
2. Access Road - Access roads shall be paved with a 12-foot wide surface of either concrete (4-inch thick with wire mesh) or asphalt (6-inch graded aggregated base plus 2-inch Type E asphalt),
3. Ownership - Lift station sites and the access roads shall be dedicated to the City. The land dedicated for lift stations shall include sufficient space for parking of two trucks, plus turn-around and slope maintenance. The dedicated width for access roads shall be a minimum of 30 feet.

4. Fencing - Lift station sites shall be fenced with a minimum of 6-foot high chain link fencing topped with three (3) strands of barbed wire. Access gates shall be a minimum of 15 feet in width. The fence shall be coated with black vinyl with a sign that provides the City's Contact information. The area inside the fencing shall be large enough to facilitate service vehicle access to the pumping station, wet well, and other facilities. A paved turn-around area shall be provided whenever the access road length exceeds 200 feet or when the access road grade exceeds 10%.
5. Water Supply - A metered water supply line (1" minimum size) shall be installed to the site with a freeze-proof yard hydrant located near the wet well. The hydrant shall be equipped with a suitable backflow preventer (Watts No. NF8 or approved equal). If City potable water is unavailable to the location of the lift station, a well may be supplied.
6. Lighting – One (1) pole-mounted, 150-watt mercury vapor security light shall be installed. It shall be photocell controlled and equipped with a manual on/off switch located in the main control panel to override the photocell control.
7. Submersible pumping stations shall include a hoist capable of lifting the pump from the wet-well and placing it on the bed of a truck.

Section 808.030.Section 808.027. Force Main

1. The force main shall be sized for a minimum velocity of two (2) feet per second with one pump operation.
2. Force mains shall be PVC pipe conforming to AWWA C900 DR 25 (Class 165) or DR 18 (Class 235) based on the design pressure. Color shall be green. PVC pipe shall not be exposed to sunlight or freezing temperatures. Buried PVC pipe shall be marked continuously with metallized locator wire. Ductile iron pipe shall be used in force main for stream crossing, highway and railroad crossings, and at other applications required by the City. All ductile iron pipe shall be furnished in nominal lengths of 18 to 20 feet and coated with an approved coating to prevent corrosion.
3. The force main profile shall slope continuously upward where practical. If high points occur where air could be trapped in the pipe, an air release valve of the type made for sewage applications shall be installed in a manhole at the high points.
4. The minimum depth of cover over force mains shall be four (4) feet.

Section 808.031.Section 808.028. Electrical

1. Lift station controls and electrical components shall be factory-wired in weatherproof NEMA 4X stainless steel metal cabinets. The cabinet shall be provided with condensate heaters. Spare fuses of each type used in the electrical/control system shall be furnished.
2. A main circuit breaker shall be installed that is designed to disconnect power to the entire station.
3. Three-phase power shall be provided for all motors exceeding five (5) horsepower. Phase converters will not be allowed, however, the City may consider variable frequency drives (VFD).

4. Protection against voltage surge and loss of a phase shall be provided.
5. The panel shall be equipped with a ground bus and neutral bus. The terminal shall be suitable for either aluminum or copper wire. All internal panel wiring shall be copper.
6. Motors shall be suitable for either 230 or 460-volt operation, The design engineer shall consult with the local power company to verify specifics pertaining to electrical power availability.
7. Four sealed float switches shall control the wet well level. All floats shall be provided with 25-feet of Type KO flexible cord and shall be attached to a bracket mounted at the top of the wet well. Float functions shall be as follows:
 - a. Float no. 1 Low level (Pumps Off)
 - b. Float no. 2 High Level (Lead Pump On)
 - c. Float no. 3 Extra High Level (Lag Pump On)
 - d. Float no. 4 Surge level (Alarm Activated)
8. The pump control system shall include the following features:
 - a. Level transducer or ultrasonic level indicator;
 - b. Lead pump/lag pump alternator;
 - c. Alarm light and horn to indicate high water level;
 - d. Seal failure indicating light;
 - e. Pump failure indicating light;
 - f. Condensate heater;
 - g. Lead pump selector switch;
 - h. H-O-A switch and run light for each pump;
 - i. Control voltage shall be 120V;
 - j. The wiring shall be neatly tied and number coded to facilitate maintenance and a schematic diagram furnished with the panel;
 - k. A 120V GFCI type electrical receptacle shall be located at the control panel;
 - l. Pump stations shall be equipped with a remote transmitting unit and telemeter circuitry connected to the City's SCADA system; and
 - m. Manufacturer's warranties to be supplied with a minimum of 100% coverage for five (5) years with no pro-rating,
9. All conduit entering the pump station should be sealed air tight at the wet well and at the control panel or the motor control center.
- 9.10. Warranty - Regardless of the manufacturer's warranty terms, the developer will be responsible for all repairs necessary within two (2) years from the date the station is completed and approved by the City. The Developer will be required to furnish such assurances to the City as deemed appropriate by the City to ensure prompt action.

Section 809: Sanitary Sewer Pipe Design Criteria

Section 809.01. Ductile Iron Pipe (DIP)

1. Ductile iron pipe shall be required for all sanitary sewer mains:
 - a. Over or under all storm sewers
 - b. Crossing water mains
 - c. At all stream crossings
 - d. At all utility crossings with less than two (2) feet of clearance (above or below)
 - e. At locations where cover is less than four (4) feet
 - f. Where slopes exceed 20%
 - g. Under road and railroad crossings and inside casings
 - h. Where PVC sanitary sewer pipe has more than 14 feet of cover
 - i. At all other locations specified by the City

1. Ductile iron pipe shall be required at all utility crossings with less than two (2) feet of clearance (above or below), in locations where cover is less than four (4) feet, at stream crossings, where slopes exceed 20%, under road and railroad crossings and where PVC sanitary sewer pipe has more than 14 feet of cover.
2. Ductile iron pipe shall be designed and manufactured in accordance with AWWA C150. Minimum wall thickness for 4" — 12" diameter pipe shall be Pressure Class 350; Minimum wall thickness for 14" — 20" diameter pipe shall be Pressure Class 250; Minimum wall thickness for 24" diameter pipe shall be pressure Class 200; Minimum wall thickness for pipe larger than 24" in diameter shall be Pressure Class 150. Pipe shall be manufactured in accordance with AWWA C151. Wall thicknesses greater than the minimums called for above may be required due to greater depths or varying bedding requirements.
3. All D.I.P shall be subject to inspection and approval by the City after delivery. No broken, cracked, imperfectly coated or otherwise damaged or unsatisfactory pipe or fittings shall be used. The pipe interior shall be Polybond, Polyline, polyurethane or Protecto 401 ceramic epoxy lined with a minimum thickness of 40 mils. The exterior shall be seal coated with an approved bituminous seal coat in accordance with AWWA C151.
- 4.3.
- 5.4. Pipe joints shall be push-on joints conforming to AWWA C111, latest revision, unless specified otherwise on plans. Where called for, mechanical joints shall conform to AWWA C111.

Section 809.01. Section 809.02. Polyvinyl Chloride Pipe (PVC)

1. The contractor shall provide unplasticized PVC gravity sanitary sewer pipe meeting

the requirements of ASTM D3034, or latest revision, in the sizes shown unless otherwise indicated in the contract documents.

2. All PVC pipe and fittings through 15" shall meet the requirements as specified under ASTM D3034. PVC pipe 18" in diameter shall meet the requirements of ASTM F679. All pipe and fittings shall be suitable for use as a sanitary sewer conduit. Bell joints shall consist of an integral wall section with elastomeric gasket joint which provides a watertight seal. Standard laying lengths shall be 13-18 feet (\pm 1 inch). The pipe shall be capable of passing all tests which are detailed in this specification. Minimum wall thickness for pipe through 15" in diameter shall be as specified under SDR 35 in ASTM D3034. Minimum wall thickness for 18" diameter pipe shall be as specified under T-1 in ASTM F679. PVC sewers with more than 12 feet of cover may require wall thicknesses greater than SDR 35 or T-1. PVC is not allowed for sewers greater than 18" in diameter or more than 14 feet of cover.
3. Each length of pipe shall be marked with the manufacturer's name, trade name, nominal size, class, hydrostatic test pressure, manufacturer's standard symbol to signify it was tested and the date of manufacture. Each rubber ring shall be marked with the manufacturer's identification, the size, the year of manufacture and the classes of pipe with which it can be used.
4. All PVC fitting and accessories shall meet the requirements specified under ASTM D3034 or F679 and shall be manufactured and furnished by the pipe supplier. They shall have bell and/or spigot configurations compatible with that of the pipe and shall have an equivalent wall thickness. Gaskets shall meet the requirements of ASTM F477.

Section 809.02.Section 809.03. Pipe and Fittings Tests

All shipments of pipe and/or fittings shall be certified by the manufacturer that the pipe and fittings were manufactured and tested in accordance with the applicable standards.

Section 809.03.Section 809.04. Deflection

Minimum "pipe stiffness" (F/Y) at 5% deflection shall be 46 psi for all sizes, when tested in accordance with ASTM Standard Method of Test D2412 (latest edition), to determine the "External Loading Properties of Plastic Pipe by Parallel-Plate Loading". There shall be no evidence of splitting, cracking or breaking at a deflection of up to 30% of the original diameter.

Section 809.04.Section 809.05. Extrusion Quality

There shall be no evidence of flaking, swelling, or disintegration when the pipe material is tested in accordance with ASTM D2152, "Quality of Extruded Poly (vinyl chloride) pipe by Acetone Immersion".

Section 809.05.Section 809.06. Joint Tightness

Pipe and fitting joints shall comply with ASTM D3212, latest edition, for "Joints for Drain and Sanitary Sewer Plastic Pipes Using Flexible Elastomeric Seals". Joint assemblies shall not leak when subjected to both an internal and external hydrostatic test at equivalent

pressures of 10.8-psi gauge for a period of one hour. Pipes shall be tested in straight alignment, axially deflected position, and by shear load test as otherwise defined in Paragraphs 7.2, 7.3 and 7.4 of ASTM D3212. All conduit entering the pump station should be sealed air tight at the wet well and at the motor control center.

Section 809.06.Section 809.07. Impact Resistance

PVC Pipe shall comply with impact resistance test conducted in accordance with ASTM D2444, "Test for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)."

Section 809.07.Section 809.08. Installation Sanitary Sewer Pipe Bedding

PVC gravity sewer pipe will shall be installed in accordance with ASTM D2321 (latest revision). Type 5 bedding is the minimum bedding requirement for PVC pipe. In any area where the pipe is below existing ground water level, the contractor will embed PVC pipe in sand or graded gravel must extend from six (6) inches below the pipe to twelve (12) inches above the pipe, and the material must be firmly placed under the pipe haunches. Initial backfill shall be compacted to the densities outlined in ASTM D2321.

The minimum bedding for ductile iron gravity sewer pipes shall be Type 4. In certain areas, the minimum bedding requirements for all types of pipes will be increased as needed to ensure a stable support under and on the sides of the pipe.

Section 809.08.Section 809.09. Compaction Testing

The City may require up to ten (10) random compaction tests to insure compliance with ASTM D2321. If any material tested is less than the required density, the contractor shall re-compact said material and the city shall then have the right to additional compaction tests at the expense of the developer or his contractor to insure compliance with ASTM D2321.

Section 809.09.Section 809.010. Deflection Limit

Vertical deflection of installed pipe shall not exceed 5% of the undeflected diameter as defined in Table X1.1 of ASTM D3034. Upon completion of the pipe laying, and at least 30 days after installation (to allow for settling), the pipe will be tested for final acceptance. The contractor, pulling a mandrel of specified dimensions through the pipeline, shall perform the test.

Section 809.010.Section 809.011. Deflection Tape/Locator Wire

All buried PVC pipe, not just PVC, shall be marked continuously with metalized locator wire detection tape.

Section 809.011.Section 809.012. Polyethylene Pipe (HDPE)

HDPE shall be considered by the Administrative Officer in consultation with the City Engineer on a case-by-case basis.

Section 809.012.Section 809.013. Other Design Requirements

1. Distance Between Manholes - Maximum distance between manholes shall be 400 feet.
2. Depth - Any sanitary sewers installed in the street shall be sufficiently deep to provide five (5) feet of cover at the inlet end of all service laterals at the street right-of-way, and over any part of the main or service within the street right-of-way. Any sanitary sewers in off-street easements shall have a minimum of four (4) feet of cover unless cast iron or ductile iron pipe is used. Filling over the pipe to obtain minimum cover is not allowed.
3. Drop Across Manhole - For manholes where the change in pipe horizontal direction (deflection) is less than 45 degrees, the normal pipe slope can be maintained across the manhole. Where the deflection is 45 degrees or more, a vertical drop across the manhole (between in and out pipes) of 0.1 feet is required.

Section 810: Construction Methods

Section 810.01: Licensing and Safety

1. All contractors who work on sanitary sewer systems that will be owned by the City of Cornelia must be licensed as an Underground Utility Contractor in accordance with State of Georgia law and local ordinance. Compliance with applicable safety regulations is the responsibility of each company engaged in the work. The City assumes no responsibility for the actions of others on the job site. It is the responsibility of those installing sanitary sewers, lift stations and related appurtenances to conform to OSHA regulations, 29 CFR Part 1926, Subpart P, Paragraph 1926.650 through 1926.653. Publications from OSHA can be obtained by contacting OSHA Publications Distribution, Washington, D.C.
2. Contractors performing sanitary sewer system installations must be approved by the City and shall be required to be completely familiar with the procedures and contract requirements associated with this type project.
3. Unsatisfactory work may result in the loss of privilege to obtain a permit for future work in the City of Cornelia.

Section 810.02: Construction Permits

1. No construction shall begin until the City of Cornelia and the Georgia Department of Natural Resources, Environmental Protection Division has issued all applicable permits. A pre-construction conference will be required prior to the commencement of construction.
2. The contractor shall submit one copy of the approved construction plans. The contractor shall furnish his name and address, telephone number, proof of his Georgia Utility Contractor License to do this type of work, name of the person in charge of the project, list of any subcontractors and the name and telephone number of a responsible person who can be contacted in case of emergencies during nonworking hours.

3. The contractor, whose name shall appear on the approved contractor's list, shall furnish his construction schedule and shall notify the City 24-hours prior to beginning any work. Once the contractor begins work, he shall proceed in a workmanlike manner and shall complete the work in a reasonable time without undue off days and period of inactivity which makes it hard for the City to keep up with his activity.

Section 810.03: Revisions to Approved Plans

1. Any revisions to approved final plans that affect the approved site or subdivision plan, shall require formal City review and approval prior acceptance of the project by the City and issuance of any Certificates of Completion or Occupancy. Revisions shall be submitted and process in accordance with these Regulations.
- 1.2. Any major changes to the approved system plans, not affecting the approved site or subdivision plans shall require the design engineer to submit revised drawings to the Development Department prior to construction of the change. Such request shall include an explanation of the reason for the change. Any deviation from City's standards will be considered a major change, as will any change that will affect capacity, longevity, operation or maintenance of the facility. Any deviation from approved materials will be considered a major change.
- 2.3. Minor field changes may be made by the design engineer only with prior approval of the City and the changes documented in writing. The written documents must be submitted to the Public Works Director for review and approval.

Section 810.04: Trench Excavation

1. Sanitary sewer lines shall normally be installed by open-cut trench excavation. Trenches shall be cut true to the lines and grades shown on the approved plans. The bottom of the trench shall be cut carefully to the required grade of the pipe except where bedding materials or cradles are shown. In such cases the excavation shall extend to the bottom of the bedding or cradles as shown on the approved plans. Minimum pipe cover shall be as shown on the approved plans.
2. Trenches shall have a minimum width of 12-inches plus the diameter of the outside of the bell of the sewer main and the maximum trench width at the centerline of the pipe shall not be more than the nominal diameter of the pipe plus two (2) feet. In unpaved areas, the trenches may have a greater width than this, beginning at one foot above the top of the pipe and extending to the ground surface, if such width is necessary or desirable; however, in paved areas, the width of the trench from top to bottom shall not exceed the nominal diameter of the pipe plus two feet.
3. No excavation shall be made under highways, streets, alleys or private property until satisfactory arrangements have been made with the State, City, County or owners of the property to be crossed. All excavated material shall be placed so as to not

interfere with public travel on the streets and highways along which the lines are laid. Not more than 100 feet of trench shall be opened on any line in advance of pipe laying.

4. When possible, all crossings of paved highways or driveways by pipeline shall be made by boring or jacking the pipe under the pavement and shall be done in such manner as not to damage the pavement or foundation, unless the casing or pipe is in solid rock, in which case the crossing shall be made by the open cut method or by tunneling.
5. Wherever streets, roads or driveways are cut, they shall be immediately backfilled and compacted after the pipe is laid and shall be maintained in first-class condition as passable at all times until repaved.
6. Backfilling, compaction, dressing and clean-up shall be kept as close to the line laying crew as is practical and negligence in this feature of the work will not be tolerated.
7. In excavation and backfilling and laying pipe, care must be taken not to remove or damage any water, sewer, gas or other pipes, conduits or other structures without an order from the Designer. When an obstruction is encountered, the Contractor shall notify the Designer, who will have the Owners of the obstruction adjust same or make necessary changes in grade and/or alignment to avoid such obstruction. Any house connection, drains or other structures damaged by the Contractor shall be repaired or replaced immediately.
8. All excavation shall be placed on one side of the trench, unless permission is given by the City to place it on both sides. Excavation materials shall be so placed as not to endanger the work and so that free access may be had at all times to all parts of the trench and to all fire hydrants or water valve boxes, etc. All shade trees, shrubs, etc. shall be protected.
9. The excavation for manholes shall extend to a firm, acceptable foundation and leave not less than 24 inches in the clear between their exterior surface and the embankment or timber that may be used to protect it,
10. The Contractor shall furnish, install and maintain such sheathing, bracing, etc., as may be required to support the sides of the excavation and to prevent any movement that might injure the pipe, or cause sloughing of the street or trench, or otherwise injure or delay the work or interfere with adjoining structures,
11. All materials shall be considered as rock which cannot be excavated except by drilling, blasting or wedging. It shall consist of undecomposed stone in solid layers or of boulders of not less than 1/2 cubic yard. Wherever rock is encountered in the excavation, it shall be removed by suitable means. If blasting is used for removal of rock, the contractor shall take all proper safety precautions. He shall comply with all rules and regulations for the protection of life and property that may be imposed by any public body having jurisdiction relative to the handling, storing and use of explosives. He is fully responsible for applying for and acquiring any blasting permits

which may be required by those agencies with such jurisdiction. Before blasting, the Contractor shall cover the excavation with heavy timbers and mats in such a manner as to prevent damage to persons or the adjacent property. Rock excavation near existing pipelines or other structures shall be conducted with the utmost care to avoid damage. The Contractor shall be wholly responsible for any damage resulting from blasting, and any injury or damage to structures or property shall be promptly repaired by the Contractor to the satisfaction of the City and property owner.

12. Rock in trenches shall be excavated over the horizontal limits of excavation and to depths as follows:

**TABLE 8-3
ROCK EXCAVATION DEPTHS**

Size of Pipe (inches)	Depth of Excavation Below Bottom of Pipe (inches)
4 and Less	4
4 to 6	6
8 to 18	8
18 to 30	10
Over 30	12

The undercut space shall then be brought up to grade by backfilling with subgrade stabilizer stone.

13. In rock excavation, the backfill from the bottom of the trench to one foot above the top of the pipe shall be finely pulverized soil, free from rocks and stones. The rest of the backfill shall not contain over 75% broken stone and the maximum sized stone placed in the trench shall not weigh over 50 pounds. Excess rock and fragments of rock weighing more than 50 pounds shall be loaded and hauled to disposal. If it is necessary, in order to comply with these specifications, selected backfill shall be borrowed and hauled to the trenches in rock excavation. Sides of the trench shall be trimmed of projecting rock that will interfere with backfilling operations. Rock excavation by blasting shall be at least 75 feet in advance of pipe laying.
14. Construction occurring around active sanitary sewerage systems shall be done in such a way so as to prevent the spillage of sewage.

Section 810.05: Installation of Sanitary Sewer Pipe

1. Construction stakeout shall be required prior to construction of sanitary sewer lines. As a minimum, the horizontal alignment will be staked at 100-foot intervals and each manhole will be located with a centerline stake and two offset hubs, "Cuts" to invert elevations will be shown for each manhole entry and exit pipe. A copy of the stakeout notes will be provided to the Public Works Director.
2. Pipe and accessories shall be handled with care at all times to avoid damage. Whether moved by hand, skidways or hoists, material shall not be dropped or bumped. The interior of all pipes shall be kept free from dirt and foreign matter at all

times. Each joint of pipe shall be unloaded opposite or near the place where it is to be laid in the trench.

3. All pipe and specials shall be of the dimensions and laid to the line and grade as shown on the plans and as established by the design professional and as approved by the City. Wyes and/or service connections and stubs from manholes shall be placed where shown on plans and as approved by the City. All such connections shall be blanked off with suitable stopper and made watertight with jute and cement mortar.
4. The preferred order of construction is to connect to existing sanitary sewers after all other construction is complete and conditionally accepted by the City. Connection to existing sanitary sewers can be done at the beginning of construction, however, the new main shall be plugged where it entered either the existing manhole or the new doghouse manhole over an existing sanitary sewer and the plug shall remain in-place until the project is conditionally accepted.
5. Sanitary sewer pipes shall be joined by "push-on" joints using elastomeric gaskets to affect the pressure seal. The ends of pipe to be joined and the gaskets shall be cleaned immediately before assembly and the assembly shall be made as recommended by the pipe manufacturer. Lubricant used must be non-toxic and supplied or approved for use by the pipe manufacturer. Sanitary sewer pipes shall be laid in the uphill direction with the bells pointing upgrade. Any variation from this procedure shall require approval from the City.
6. Bell holes shall be provided of sufficient size to allow ample room for making the pipe joints without putting any load on the bell of the pipe. The bottom of the trench between bell holes shall be carefully graded so the pipe barrel will rest on a solid foundation for its entire length as shown on the plans. Each joint shall be laid so it will form a close concentric joint with adjoining pipe and in order to avoid sudden offsets or inequalities in the flow line.
7. When pipe is not actively being laid, the open ends of installed pipe shall be plugged with a watertight plug to prevent entrance of trench water into the line.
8. All D.I.P. pipe shall have a minimum of Type 4 bedding and all PVC pipe shall have minimum Type 5 bedding as and shown in the Standard Details. Wherever water or wet soil is encountered, Type 5 bedding shall be provided for D.I.P. A description of Type 1, 2, 3, 4 and 5 bedding is as follows:
 - a. Type 1 - Flat Bottom Trench. Flat bottom trench on undisturbed earth with excavation for Bells.
 - b. Type 2 - Flat Bottom Trench. Flat Bottom Trench on undisturbed earth with excavation for Bells. Select backfill shall be placed and lightly tamped to the top of the pipe.

- c. Type 3 - Loose Soil Bedding. Pipe bedded in Select Material to a depth of $\frac{1}{4}$ outside pipe diameter or 4-inch minimum, whichever is greater, on a flat bottom trench. Select backfill shall be placed and lightly consolidated to a level of 6-inches minimum over the top of the pipe.
 - d. Type 4 - Granular Bedding. Pipe bedded in granular material to a depth of 8-inches of granular material for pipes with an inside diameter of 21-inches or less or 12-inches of granular material for pipes with an inside diameter of 24-inches or greater on a flat trench bottom. The bedding material shall be placed under the haunches of the pipe with a shovel or other suitable tool to a height of $\frac{1}{4}$ outside pipe diameter of the pipe. The initial select backfill shall be hand placed to a level of 12-inches minimum over the top of the pipe and shall consist of finely divided select materials free from debris, organic material and large rocks and stones. It shall be placed and tamped in layers not over 6-inches thick to at least 90% Standard Proctor, AASHTO T-99 (95% under road crossings).
 - e. Type 5 - Granular Bedding. Pipe bedded in to a depth of 8-inches of granular material for pipes with an inside diameter of 21-inches or less or 12-inches of granular material for pipes with an inside diameter of 24-inches or greater on a flat trench bottom. The bedding material shall be placed under the haunches of the pipe with a shovel or other suitable tool to a height of $\frac{1}{2}$ outside pipe diameter of the pipe. The initial select backfill shall be hand placed to a level of 12-inches minimum over the top of the pipe and shall consist of finely divided select materials free from debris, organic material and large rocks and stones. It shall be placed and tamped in layers not over 6-inches thick to at least 95% Standard Proctor, AASHTO T-99.
9. Pipe grades shall be obtained by use of a laser and double checked with a surveying level and rod. Completed sewers shall be tested between manholes with lanterns or reflected light and shall show at least 80% of the full circle of the pipe from manhole to manhole without obstruction.
 10. Sewers shall be laid tight and the rate of infiltration in any section of line between adjacent manholes shall not exceed 25 gpd per inch diameter of pipe per mile of line when the trenches are saturated with water.
 11. No length of pipe shall be laid until the one preceding it has a sufficient quantity of fine earth tamped around to hold it firmly in place.
 12. The Contractor shall do all necessary pumping or bailing, build all drains and do all other work necessary at his own expense to keep the trenches clear of water during the progress of the work. If pumps are used, the Contractor shall have back-up pumps available in case the primary pumps fail. No structure shall be built or pipe shall be laid in water and water shall not be allowed to flow over or rise upon any concrete, masonry or pipe until the same has been inspected and the concrete or joint material has thoroughly set. The installed pipe shall not be used for draining water from the ditch. All water pumped, bailed or otherwise removed from the

trench or other excavation shall be conveyed in a proper manner to a suitable place of discharge where it will not cause injury to the public health, or the public or private property, or to work completed or in progress, or to the surface of the streets, or cause any interference with the use of same by the public.

13. Trench Backfilling.

- a. After the pipe has been laid, backfilling shall be done in two (2) distinct operations. In general, all backfill beneath, around and to a depth of 12 inches (12") above the top of the pipe shall be placed by hand in four -inch (4") layers for the full width of the trench and thoroughly compacted by hand with vibrating equipment. The remainder of the backfill shall be placed in 6" layers and compacted to the top of the trench, either by pneumatic hand tamps, hydro-tamps or other approved methods. Care shall be taken so the pipe is not laterally displaced during backfilling operations. The backfill lifts shall be placed by an approved method in accordance with that hereinafter specified. Backfill materials shall be the excavated materials without bricks, stone, foreign matter or corrosive materials, where not otherwise specified or indicated on the plans.
- b. Backfill under permanent concrete or bituminous pavement or floors and as elsewhere specified or indicated on the plans shall be approved bank-run sand or gravel or crushed stone, free from large stones and containing no more than 10% by weight of loam or clay. This backfill shall be compacted to 100% as determined by the Modified Proctor test for the top two (2) feet^{12"} of trench and 95% by the Modified Proctor test from pipe bedding to two (2) feet^{12"} below trench top. Mechanical vibrating equipment shall be used to achieve the required compaction.
- c. Backfill under gravel or crushed stone surfaced roadways and low-type bituminous surfaced roadways shall be the approved suitable excavated material placed in 6-inch (6") layers thoroughly compacted for the full depth and width of the trench, conforming to the compacting, density compaction method and materials as specified above.
- d. Backfill in unpaved areas shall be compacted with mechanical vibrating equipment to 90% as determined by the Modified Proctor Test. Backfill material from pipe bedding to ground surface shall be excavated earth free from large stones and other debris.
- e. The contractor shall fully restore and replace all pavement, sidewalks, landscapes, surface structures, etc. removed or disturbed as part of the work to a condition equal to that before the work began to the satisfaction of the City.
- f. Where sheeting is used in connection with the work, it is in no case to be withdrawn before the trench is sufficiently filled to prevent damage to banks,

road surfaces, adjacent pipes, adjacent structures or adjacent property, public or private.

- g. All costs associated with the compaction tests shall be the responsibility of the developer.
14. Backfill Compaction - All backfill beneath proposed lots, roads, sidewalks or other critical areas shall be compacted to 95% Standard Proctor, except for the top 12" in roadways where the compaction requirement is 100% of standard Proctor, The compaction shall be done using mechanical tamping equipment in six-inch (6") lifts. Moisture control of the backfill material and/or hauling in of select material may be required to achieve this compaction percentage. Compaction testing and certification by an independent soil testing company will be required in these areas. The test results shall be submitted for review to the Administrative Officer or his/her designee,
15. Railroad Crossings - All railroad crossings shall conform to the requirements of the American Railway Engineering Association Manual for Railway Engineering, Part 5. The contractor Developer shall secure permission from the railroad to schedule the work so as not to interfere with the operation of the railroads. The Developer contractor shall be held responsible for any delays or damages occurring to the railroads. The Developer contractor shall furnish the railroad with such additional insurance as may be required, cost of the insurance shall be borne by the Developer contractor, together with the costs for flagmen, watchmen, temporary work of any nature, safety devices and any other items that may be required by the railroad.
16. Highway Crossings - All construction work in a State highway right-of-way shall be approved by the Georgia DOT.
17. Stream Crossings
- a. The preferred method for crossing rivers, streams, creeks, impoundments or wet weather ditches is with a minimum of six-inches (6") of cover between the lowest point in the stream and the top outside diameter of the pipe. Ductile iron pipe is required for all stream crossings and shall extend a minimum of ten (10) feet beyond the top of bank on each side. Concrete collars or encasement must be provided at all joints for ductile iron pipe with less than three (3) feet of cover.
 - b. The stream bed and sides at the crossing point shall be protected from erosion with the use of rip-rap, as defined and sized in the *Manual for Erosion and Sediment Control in Georgia*, Appendix C — Construction Materials, latest revision.
 - c. Aerial Crossings will require detailed plans and will be allowed only when, in the City's opinion, there is no reasonable alternative.

- d. Erosion control measures shall be installed prior to installing pipe across any stream. All work should be performed when stream flows are at their lowest, and as quickly and safely as possible. As soon as conditions permit, the stream bed shall be cleared of all false-work, debris, and other obstructions placed therein or caused by the construction operations.

Section 810.06: Casing for Sanitary Sewers

1. Where pipe is required to be installed under railroads, highways, streets or other facilities by jacking or boring methods, construction shall be done in a manner that will not interfere with the operation of the facility, and shall not weaken the roadbed or structure.
2. Casing pipe shall be installed at the locations shown on the plans. Unless directed otherwise, the installation procedure shall be the dry bore method. The hole is to be mechanically bored and cased through the soil by cutting head on a continuous auger mounted inside the casing pipe. The installation of the casing and boring of the hole shall be done simultaneously by jacking. The diameter of the bore shall conform to the outside diameter and circumference of the casing pipe as closely as practicable. Any voids that develop during the installation operation shall be pressure grouted. Each segment of the casing pipe shall be welded with a full circumference butt weld to the adjoining segment. The completed casing shall have no sags or crowns that cause the grade for any segment to be less than the minimum slope for the size pipe being installed.
3. Excavation material will be removed and placed at the top of the working pit. Backfill material and methods of backfilling and tamping shall be as required herein. Carrier pipe shall be D.I.P. and shall be inserted within the casing by use of approved casing spacers. Inside of casings, the sewer main joints shall be slip joint restrained by using U.S. Pipe "Field-Lok" gaskets or approved equal.
4. The annular space between the carrier pipe and the casing shall be pressure grouted after the carrier pipe is sufficiently secured on grade to prevent floating during grouting. The carrier pipe should be filled with water prior to grouting to aid in the prevention of floating. At each end of the casing pipe, the void between the carrier pipe and casing shall be sealed with brick and mortar.

Section 810.07: Replacement of Pavement

The Developer contractor shall fully restore and replace all pavement, curbs, gutters, sidewalks and other surface structures removed or disturbed by the construction, to a condition that is equal to or better than the original condition in a manner satisfactory to the City (see Sstandard dDetails).

Section 810.08: Location/Protection of Existing Underground Utilities

It shall be the responsibility of the contractor to locate and protect all underground utilities. The contractor contractor, at his own expense, shall repair utility lines or services damaged by the contractor contractor.

Section 810.09: Protection of Water Supply and Other Utilities

1. The City has an established Cross-Connection Program to prevent the entry of contaminants of pollutants into any area of the potable water supply. Therefore, it is illegal to introduce any substance into, or to have any cross connections with, the potable water supply. There shall be no physical connection between a public or private potable water supply system and a sanitary sewer that permits the passage of any sewage or polluted water into the potable water supply.
2. Whenever possible, sanitary sewers shall be laid at least ten (10) feet distance horizontally from any existing or proposed water main. Should conditions prevent this separation, the lines shall be laid in separate trenches and the sanitary sewers shall be ductile iron. In either case, the elevation of the crown of the sanitary sewer shall be at least 18 inches below the invert of the water main.
3. When sanitary sewers cross under water mains, the sanitary sewer shall be laid so the top of the sanitary sewer is at least 18 inches below the bottom of the water main. If conditions prevent this minimum vertical separation, the sanitary sewer shall be ductile iron and shall be encased in concrete.

Section 810.010: Sewer Service Laterals

A sewer service shall be provided for every existing or proposed lot or building. All services shall be shown on the construction drawings. All service laterals shall be a minimum of 6" in diameter, A common service shall not be allowed for two or more buildings. The service shall extend to 5' inside the property line of the lot being served and normally be within 10 feet of the lower corner of the lot. The Contractor shall install a clean out at the right-of-way and extend the PVC cleanout to a height of 3' above the finished grade. The Contractor shall also place a 4"x4" pre-treated wood post painted green above the end of the service lateral to enable the builder to locate the service. All service laterals shall have minimum of 5 feet of cover at the right-of-way. Where 5 feet of cover cannot be achieved, services shall be ductile iron.

- 1.
- 1.2. Six inch (6") services shall be laid at a minimum grade of 1%. Service laterals tied directly to manholes shall enter the manholes through cored holes and shall be provided with a pre-molded rubber boot as described herein. Laterals shall enter the manhole no higher than 6" above the table and shall be provided with a concrete flume to slope the flow into the manhole invert
- 2.3. The developer shall be responsible for serving all lots developed. On any lot where the service cannot be found, the developer shall be responsible for payment of the cost of installation of a new service. Also, unless noted on the final plat, the service shall be located low enough to serve the first floor elevation at the building line.
- 3.4. The builder shall be responsible for the location of the service prior to the pouring of the foundation, driveway or other appurtenance. The City will not be responsible for any house built too low to be served, nor for any service made inaccessible.

- 4.5. No plumber or contractor will be allowed to connect to the sewerage system except to the end of the service provided for this connection, when proper permit is issued. After the service is run from the end of the lateral provided by the sewer line contractor to the house plumbing, the cleanout at the right-of-way may be cut down to a level six inches below the finished grade. The cleanout shall be provided with a cast iron ferrule with a brass screw plug to enable the cleanout to be located with a metal detector. Plastic plugs are not allowed.

Section 810.011: Setting Fittings on Force Mains

1. Fittings shall be placed where shown on the plans. Fittings shall be properly braced to insure they will not be blown off or broken loose under the greatest possible working pressure. All fittings shall be mechanical joints unless specified otherwise. In situations where there is insufficient undisturbed earth to act as a bearing surface or where otherwise directed by the City, fittings shall be restrained by the use of threaded rods or other method acceptable to the City.
2. Prior to blocking any joint or fitting with concrete, the joint or fitting shall be wrapped with polyethylene film in such a manner that the concrete will not stick directly to the pipe but so the load bearing capacity of the blocking will not be affected..

Section 810.012: Bracing, Sheeting and/or Shoring

Whenever the condition of the ground is such that it is necessary to protect the work, the street, the roadway or the workmen, the sides of the trench shall be supported with suitable bracing, sheeting and/or shoring to be furnished by the contractor at his own expense.

Section 810.013: Connection to Existing City Sanitary Sewer System

1. The developer's private contractor shall make all required connections to the City's sewer system. The City's Inspector will supervise the connection and all associated work. The contractor shall give the City a minimum of 48 hours notice prior to any sewerage system work.
2. The Contractor will provide proper traffic control devices and certified personnel to direct traffic if required.
3. All connections to existing manholes shall be properly cored with a coring machine; "Knocking-out" of a hole in the manhole for a connection is not permitted.
4. The timing of the Developer's connection to the City's system shall be pre-arranged with the City.

Section 810.014: Street Cuts

1. All paved roads will be bored and cased. A bore must be attempted before consideration will be given to cutting the street.
2. Existing roadways shall not be open cut unless written permission is granted by the governing authority or owner (e.g. City of Cornelia, Habersham County, GA DOT, etc.)
3. Submittal of an authorization letter from the D.O.T. or Habersham County is required.

4. One lane of traffic shall be maintained open at all times. Lane and road closure shall be limited to time between 9 a.m. and 2 p.m., if practical
5. The Contractor shall furnish traffic control devices and person(s) to direct traffic, if required.
6. The above requirements may be altered with the written approval of the City in extenuating circumstances.
7. Assuming that a road bore has been attempted and failed, or that the Developer has received permission to open cut a road, pavement replacement shall adhere to the following guidelines:
 - a. Removing and replacing pavement shall consist of removing the type of pavement and base encountered and replacing same to its original shape, appearance and riding quality, in accordance with the detailed plans. Where possible, all pipe under existing paved driveways will be either free bored or installed in casing. Free bores under driveways will be made with D.I.P. Casing will be required where the installation is under any roadway. Carrier pipe shall be D.I.P.
 - b. Concrete pavement shall be replaced with pavement of a thickness equal to that removed, or 6" for driveways and 8" for roads, whichever is thicker. The concrete shall meet the specifications of the D.O.T. for concrete paving.
 - c. Where bitumastic paving is replaced, a base course of 3000 psi concrete shall be placed over the ditch line. The concrete shall be 6" thick for driveways and parking lots and 8" thick for public roads. The top of this base course shall be left with a rough float finish 1 1/2" below the surface of the existing paving. After the concrete has attained its strength, a tack coat of AC-15 or equal shall be applied at the rate of 0.25 gallons per square yard, and a plant mix surface course applied over this, and finished off level with existing pavement.
 - d. Unless otherwise directed in writing, all pavement will be removed to a width of the trench plus 12" on each side as shown on the detailed drawings. Under normal circumstances, the maximum allowable trench width shall be the nominal diameter of the pipe plus 24 inches.

Section 810.015: Standard Drawings

Installation of sewer mains, service laterals, manholes, casings, cleanouts, etc. shall be made in accordance with the applicable Standard Design Drawings in this Manual.

Section 810.016: Clean-up

1. Prior to requesting the "completion of sanitary sewer construction" inspection, the contractor shall remove and dispose of in an acceptable manner all shipping timbers, shipping bands, spacers, excess materials, broken material, crates, boxes and any other material brought to the job site.
2. Any work areas, within the public right-of-way or on private property outside of the development, that were damaged by the sanitary sewer construction shall be repaired

or replaced with the same kind of material as existed prior to the damage occurring. All easement areas shall be completely cleared of trees, stumps and other debris and left in a condition such that the easement can be maintained by bush-hog equipment.

3. All shoulders, ditches, culverts and other areas disturbed by the sanitary sewer construction shall be brought to the proper grades and left smooth in appearance.
4. All manhole covers shall be brought to grade.
5. A uniform stand of grass or mulch for erosion protection, as defined in the *Manual for Erosion and Sediment Control in Georgia*, is required over all construction easements and sanitary sewer easements prior to the City's acceptance of the sanitary sewer.
6. Streets, sidewalks, landscaping and other public and private property disturbed in the course of the work shall be restored as near to original condition as possible or better in a manner satisfactory to the City.
7. Trenches shall be kept free of water by pumping or well pointing, as determined by the contractor. No structure shall be built, or pipe shall be laid, in water. Water shall not be allowed to flow over or rise upon any concrete, masonry or pipe until the same has been inspected and the concrete or joint material has thoroughly set. All water pumped, bailed, or otherwise removed from the trench or other excavation shall be conveyed in a proper manner to a suitable place of discharge. Such discharge shall not cause injury to public health, property, work completed, work in progress or to any street surface, or cause any interference with the use of it by the public.

Section 810.017: Barricades

The Contractor shall provide, erect and maintain all necessary barricades, suitable and sufficient red lights, danger signals and necessary precautions for the protection of the work and the safety of the public. Streets closed to traffic shall be protected by effective barricades on which shall be placed acceptable warning signs. Barricades shall extend completely across the street which is to be closed, and shall be illuminated at night by lights not farther than five feet apart and lights shall be kept burning from sunset to sunrise.

Section 810.018: Grassing

1. All areas outside structures and along pipelines where earth is disturbed shall be grassed. After the soil has been properly prepared, the seed shall be planted. After the seeds have been planted, mulching using wheat or oat straw shall be applied and the moisture content of the soil shall be maintained at the optimum amount to ensure germination of the seed and growth of the grass.
2. Immediately after the initial watering of seeded areas, the Contractor shall apply a mat of hay or rye, wheat or oat straw over the area at a uniform rate of not less than 1 ½ ton of mat to the acre. The minimum depth of the straw shall be two inches (2") and the maximum depth of 3 inches (3"). • After the grass has shown a satisfactory growth (approximately 30 days after planting), fertilizer shall be applied at a uniform rate of 100 pounds per acre, followed by sufficient water to dissolve the fertilizer.
3. The Contractor shall do all maintenance work necessary to keep all planted areas in satisfactory condition until the work is finally accepted. This shall include mowing,

repairing washes that occur, reseeding and watering as required to produce a healthy and growing stand of grass. Mowing will be required to remove tall and obnoxious weeds before they go to seed.

4. It is the intent of these specifications to produce a stand of grass that is alive and growing, without any bare spots larger than one square foot. The Contractor shall repeat all work, including plowing, fertilizing, watering and seeding as is necessary to produce a satisfactory stand of grass.

Section 811: Inspection of Sanitary Sewers

Section 811.01: Construction Inspection

1. The developer's contractor is responsible for the quality, accuracy and workmanship of his completed work.
2. The City may employ the services of an engineer for the inspection of the project. If a consulting engineer is used, the City has the option of billing the Developer the same rate or amount that the City has been billed or invoiced by their consulting engineer.
3. City personnel or their authorized representative will visit the job site on a periodic basis and will make spot checks, as they deem appropriate. The City shall have the right to review and inspect all construction and may reject any work that does not meet quality control standards.

Section 811.02: Access to Project

Authorized representatives of the City that may include, but is not limited to, City employees, City consultants, state or Federal agencies shall have access to the site for inspection at any time.

Section 811.03: Communications During Construction

1. All written communications regarding sanitary sewer construction shall be directed to:

Administrative Officer (or his/her designee)
City of Cornelia
P. O. Box 785
Cornelia, GA 30531
Phone: (706) 778-8585
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2. The Developer, contractor(s) and the Developer's professional responsible for inspection will be required to attend a pre-construction conference with the City. At the pre-construction conference, the contractor will submit to the City, in writing, the date they propose to begin construction. The contractor shall provide notification by phone any time the work is to be vacated and will provide notice by phone prior to resuming work.

3. The City inspector may have informal verbal communications with the contractor, foreman or superintendent at any time during construction. The City inspector will not direct the actions of the contractor's workmen.

Section 811.04: Concealed Work

The City inspector may direct that the contractor notify the City and receive inspection approval prior to concealing certain work such as manhole foundations, pipe bedding, wyes, bends, service laterals or other appurtenances.

Section 811.05: Minimum Required Inspections

The following inspections shall be the minimum to be performed and certified in writing by the professional engineer employed by the developer for quality control checking of the construction work:

1. Distances - Horizontal location measuring "as-built" distances between manholes and bearings from manhole to manhole to check horizontal location of the line.
2. Elevation and Slope - Elevation of each invert and top of manhole shall be measured and recorded. Actual pipe slope shall be computed and any segment having less than minimum allowable slope shall be rejected and re-done.
3. Manhole Construction - Every manhole shall be visually inspected to check for plugging of lift holes, use of connection boots, use of joint material, leakage, proper invert construction, and the proper setting of frame and cover. In addition, vacuum testing of every manhole will be required.
4. Pipe Straightness - Every section of sanitary sewer line shall be visually checked for straightness. For a section to pass must show at least 80% of a full circle when observed from one end. Any section that fails this visual test shall have water run through it sufficient to fill any sag that may exist. It shall also have a television camera pulled through it to check for sags. Any sag holding more than 1 ½ -inches of water shall require the pipe be removed and replaced to proper grade. Following the replacement, the section shall be televised again to verify correction at which time the section is evaluated by the City or their designated representative.
5. Video - The video of the televised lines shall be furnished to the City prior to issuance of the Certificate of Occupancy. Sections of lines in the video shall be identified by manhole numbers corresponding to those on the plans. In addition, all service wyes shall be identified by station number on the video.
6. Infiltration - The allowable limit of infiltration, for any section from manhole to manhole, shall be 25 gallons per day per inch of pipe diameter per mile of pipe. If any infiltration is present at the most downstream point, then it will be measured using a specially made weir and measurements also made at each upstream manhole that has any visible flow of water. Any individual segment that exceeds the allowable infiltration shall be corrected to within allowance limits.
7. Compaction of Backfill - Compaction testing shall be required for construction in paved areas or where pavement is planned. A minimum of five (5) tests per 1,000 feet of sanitary sewer shall be conducted at varying depths. If any of these tests show

failing results, the failing backfill shall be removed, re-compacted and re-tested, and one additional area shall also be tested.

Section 811.06: Additional Testing Requirements

The contractor shall also perform the tests listed below during the presence of the developer's professional. The City must be notified at least two (2) days prior to these tests being conducted to afford the City the opportunity to be present.

1. Mandrel Test for Gravity Sanitary Sewer PVC Pipe - The procedure for testing PVC sanitary sewer pipe for maximum allowable deflection shall be generally as follows (see ASTM specs for mandrel dimensions and more detail):

Completely flush the line making sure the pipe is clean of any mud or trash that would hinder the passage of the mandrel. During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line (a nylon ski rope is recommended). After the rope is threaded through the line, connect the pull rope to the mandrel and place the mandrel in the entrance of the pipe. Connect a second rope to the back of the mandrel. This will enable the mandrel to be retrieved if excessive deflection is encountered. Draw the mandrel through the sanitary sewer line. An increasing resistance to pull is an indication of excessive deflection. If this occurs mark the rope to note the location. Televis the sanitary sewer section to identify the extent of the problem and develop a plan, subject to City approval, for correcting the problem. A retest shall then be undertaken.

2. Air Pressure Test
 - a. The contractor, to check for leaks, shall conduct a low-pressure test of each gravity sanitary sewer line section. The following general procedures will apply:

Temporarily plug the line segment between two (2) manholes using plugs with airtight fittings through which low-pressure air can be introduced into the pipe segment being tested. Introduce low-pressure air into the test pipe segment until the internal air pressure reaches 4.5 psig above ground water pressure, if any. Wait at least five (5) minutes for air temperature in the test segment to stabilize while internal air pressure remains at least 3.5 psig above ground water pressure. Bleed internal air pressure to exactly 3.5 psig above ground water pressure. Accurately determine the elapsed time for the internal pressure to drop to 2.5 psig above ground water pressure. The air test is acceptable if elapsed time is no less than shown on Table 8-4 below.
 - b. Excessive leakage shall be permanently corrected and the test repeated until the developer's professional witnesses a successful test on each line segment.
 - c. Air leakage time is based on the pipe being damp. If pipe and joints are dry, dampen line if helpful in meeting air test time requirement.
 - d. All visible leaks will be corrected regardless of test results.
 - e. Upon request, the City may allow substitution of an exfiltration test in lieu of the air pressure test. If used, the exfiltration test shall be conducted with a minimum water head of two (2) feet above the groundwater table and the

allowable exfiltration shall be limited to 50 gallons per day per inch diameter of pipe per mile of pipe.

3. Force Main Pressure Testing - Before applying the specified test pressure, all air shall be expelled from the pipe. All pipe laid in trenches shall be backfilled adequately to secure the pipe during the test.

Any observed leakage shall require corrective measures to pipe lines and/or joints as otherwise provided for in these specifications and to the satisfaction of the City. The City will furnish the necessary water for testing the force main. However, any water lost through breakage of lines or unnecessary or excessive flushing of the line shall be charged to the developer. The force main must be flushed and tested at a pressure of 200 PSI for two (2) hours. When testing at the specified pressures, the rate of leakage shall not exceed 25 gallons per 24 hours per inch diameter per mile of line (see Table 8-4 below). If the force main does not meet this test, the leaks shall be found and corrected at once and re-tested until the leakage falls within the limits specified.

**TABLE 8-4
MAXIMUM ACCEPTABLE WATER LEAKAGE**

Size of Pipe (inches)	Gallons per Hour per 100 Feet	Gallons per Day per 100 Feet
14	0.276	6.624
12	0.237	5.688
10	0.197	4.728
8	0.158	3.792
6	0.118	2.832
4	0.079	1.896

Section 811.07: Final Inspection and Conditional Acceptance

1. No buildings or plumbing fixtures shall be connected to the sanitary sewers until inspected and approved by the City.
2. The professional responsible for inspection of the construction shall provide the City with an engineering statement after he completes his inspection, testing and submittal of as-built drawings and easements. This statement must certify that all specified inspections and tests have been made and successfully passed, and that the work has been completed in substantial accordance with the approved plans and specifications. After receipt of this statement, the City will schedule a final inspection. A representative of the developer's professional and the contractor shall be present during this final inspection.
3. After any discrepancies are corrected, the City will issue a letter certifying conditional acceptance of the system. This letter shall commence the start of the twelve (12) month warranty period that is required of the contractor.
4. At the end of the warranty period, the subdivision inspection team will again inspect the entire development. When all discrepancies have been corrected, the City will issue an acceptance letter and will begin perpetual maintenance and operation of the system.

Section 811.08: Maintenance and Payment Bond

The dDeveloper shall post a maintenance bond on the facility, in accordance with Section 315Article III of this oOrdinance, for a twelve (12) month period after completion and conditional acceptance of the facility by the City. In addition, the developer shall post a payment bond on the facility for all subcontractor and material supplier work.

Section 811.09: Maintenance Until Final Acceptance

It shall be the Ddeveloper's obligation to provide all maintenance for a twelve (12) month period after conditional acceptance of the project by the City. The developer must notify the City three months prior to the end of the twelve (12) month period to schedule the final inspection. The City shall inspect the sewer system, and upon correction by the dDeveloper of all deficiencies noted by the City, the City will accept the system for operation.

END OF ARTICLE VIII