

SECTION 300
SANITARY SEWER SYSTEM SPECIFICATIONS

301. PRECONSTRUCTION REQUIREMENTS

301.01 Sanitary Sewer Capacity Study

The BLW may require a developer to provide a study to determine the available capacity of the existing sanitary sewers for developments where available capacity is questionable. The study must be prepared by a Georgia Registered Professional Engineer and must be approved by the BLW.

301.02 Plan Requirements

- 1) Construction Plans: All plans for public sanitary sewer facilities shall be prepared in accordance with the requirements outlined herein and as required in regulations promulgated by the Georgia Environmental Protection Division. The developer shall be responsible for submitting plans and other data to the EPD and all other regulatory agencies for required approvals and permits.

Construction plans for proposed sanitary sewer construction shall consist of the following:

- A. Site Plan with the project name, land lots, district and north arrow, lot layout (if subdivision) or building location (multi-family, commercial, or industrial). Also show all existing and proposed streets and their names, all streams, water courses and storm drains and the discharge points for all drainage structures. The site plan shall show the topography with contour lines at two foot intervals as well as the sewer layout with existing and proposed lines, manhole numbers, line designation and direction of flow. Also, show the size of all lines, the location of proposed service laterals, and proposed and existing easements. The location and sizes of all sewer lines adjacent to the project including the point(s) of connection(s). Note if any other utilities are existing. Drawings shall be to no smaller scale than 1" = 50'. Sheet size shall be 22" x 34".
- B. The design of cross-country (undeveloped property) sanitary sewer lines shall be based on field-run surveys. The site plan for cross-country sanitary sewer lines need not show contour intervals, but the profiles shall be based on mean sea level elevation. In the event the subdivision is developed in phases, the final construction plans for sanitary sewers may be submitted in phases or units. However, at the time the first phase is submitted, the design professional will

submit one copy of the preliminary layout of the entire sanitary sewer system. This layout will show all lines required to serve any lots to be developed and any surrounding property that may be served through the property. The site plans for each phase or unit shall contain a location drawing showing the relationship of the phase or unit to the total project and to the surrounding streets and sanitary sewer outfalls.

- C. All sewer lines parallelling streams, creeks or rivers shall detail the actual stream centerline, the top of the bank, and the required undisturbed stream buffer in accordance with the DNR regulations.
- D. Profiles should have a horizontal scale of 1" = 50' and a vertical scale of 1" = 10'. The plan view should be drawn to a corresponding horizontal scale. The plan view should normally be shown on the same sheet as the profile. In any case both the plan and profile view should have line designations, station numbers, manhole numbers and any other indexing necessary to easily correlate the plan and profile view.

Plans and profiles shall show:

1. Location of streets, sanitary and storm sewers, and related easements.
2. Profile of ground surface, the grade of the sanitary sewer between each two adjacent manholes, size and material of pipe, length between manholes, invert of sanitary sewer in and out of each manhole, and ground surface elevation at each manhole. All manholes shall be numbered on the plan and correspondingly numbered on the profile and station numbers will be shown for each manhole. The profile of adjacent parallel stream beds and of adjacent lake surfaces, low buildings, and lots shall be shown on the profile.
3. Locations of all special features such as connections to existing sanitary sewers, service laterals, concrete encasements, collar walls, ductile iron pipe sections, elevated sanitary sewers, piers, special manhole covers such as vented outfall covers or sealed covers, stream crossings, casings under roadways, drop manhole connections, etc.
4. All known existing structures both above and below ground which might interfere with the proposed construction, particularly water mains, gas mains, storm drains, utility conduits, etc.
5. The vertical datum used should be the elevation above mean sea level with benchmarks shown on the plans. Maximum spacing between benchmarks shall be 1000'.

6. Sanitary sewer system materials.
7. Detail of connections to existing lines or manholes.
8. Any other items incidental to the proposed system.
9. The General Notes for Sanitary Sewer System Construction shown on the following page shall be included in each set of plans.
10. Each set of construction plans shall include a reproduction of the standard Utilities Protection Center "Call Before You Dig" symbol.
11. Stream centerline, top of bank and undisturbed buffer.
12. Soil and erosion control plan.
13. Wetland boundaries as defined by the Corps of Engineers.

BOARD OF LIGHTS AND WATER
SANITARY SEWER SYSTEM CONSTRUCTION
GENERAL NOTES

1. All sanitary sewer system construction must follow the current BLW sanitary sewer system specifications.
2. For D.I.P. sewer lines, the minimum wall thickness shall be Class 50. Wall thicknesses greater than the minimum called for above may be required due to greater depths or varying bedding requirements. Class C bedding is the minimum allowed.
3. All Polyvinyl Chloride (PVC) sewers 6" to 15" in diameter shall meet the requirements for minimum wall thickness as specified under SDR 35 in ASTM D3034, latest revision. PVC sewers that are 18" in diameter shall have a minimum wall thickness as specified under T-1 in ASTM F679, latest revision. 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 18 feet of cover.
4. Ductile Iron Pipe is required for sanitary sewer lines:
 - a. Over and under all storm sewers
 - b. Under all stream crossings
 - c. With 20% or greater slope
 - d. At all drop manholes (See Detail 402-01).
 - e. Crossing water mains
 - f. With less than 3' of cover or over 18' in cover
 - g. Inside casings
 - h. At all other locations specified by the BLW
5. Information regarding underground utilities on these plans is not guaranteed as to accuracy or completeness. Prior to beginning work, the Contractor shall request a field location through the utilities protection center and any utility owners thought to have facilities in the area. The Contractor shall promptly compare these field-marked locations with the project plans and then notify the designer of any anticipated problems or need for design changes. It is the Contractor's responsibility to excavate or cause the utility owner to excavate for the purpose of determining exact elevations or locations at utility crossings and other critical locations well in advance of the work under this contract. Damage to existing utilities resulting from the Contractor's negligence shall be repaired at the Contractor's expense. The Developer and/or the Developer's Contractor is responsible for verifying the exact location, size, and material of any existing water or sanitary sewer facility proposed for connection or use by this project.
6. All sewer service laterals shall have a minimum diameter of 6".
7. The Developer shall obtain a permit from the Public Works Department and notify the sewer system inspector 48 hours before beginning construction.
8. This project is located in land lots _____, _____ district of Cobb County, Georgia.
9. The existing land use is (describe current land use, such as agricultural, commercial, etc.).
10. The Developer is: (name, address, and telephone number).
11. 24-Hour local contact for erosion and sediment control is (name and 24 hour telephone numbers).
12. This project construction area is _____ acres.
13. This project consists of: (Describe sanitary sewer work to be done, including length of pipe and sizes and number of manholes.).
14. Adjacent areas include (Describe development style of area surrounding project.).
15. All fill slopes will have silt fence at the toe of the slopes.
16. The escape of sediment from the site shall be prevented by the installation of erosion control measures and practices prior to, or concurrent with, land disturbing activities and erosion control measures will be maintained at all times. If full implementation of the approved plan does not provide for effective erosion control, additional erosion and sediment control measures shall be implemented to control or treat the sediment source.
17. All erosion and sediment control measures will be checked daily and any deficiencies noted will be corrected by the end of the day.
18. This property (is / is not) located within a 100 year flood plain as shown on F.I.R.M. Community Panel Number _____, dated _____.
19. A 25' undisturbed vegetative buffer adjacent to all running streams and creeks will be left and

maintained.

20. Clearing will be kept to an absolute minimum. Vegetation and mulch will be applied to applicable areas immediately after grading is complete. Land disturbing will be scheduled to limit exposure of bare soils to erosive elements.
21. Construction activities will be performed in compliance with all applicable laws and regulations.
22. All marketable timber will be salvaged. Top soil will be salvaged, stock piled and spread on areas to be vegetated. Trees outside of the clearing line will be protected from damage by appropriate markings. Supplemental vegetation will be established.
23. Cleanout of sediment control structures will be accomplished in accordance with the sediment disposal accomplished by spreading on site. Sediment barriers will remain in place until sediment contributing areas are stabilized.
24. Contractor is responsible for staking the alignment of the proposed pipeline prior to pipe installation. If a conflict should arise the contractor shall notify the designer at that time.
25. All excavated dirt shall be placed on the high side of the trench away from any creeks.
26. Any fill dirt over the pipe shall be graded to prevent ponding.
27. The construction easement represents the limits of clearing for the complete job. The contractor shall not clear beyond this limit.
28. No rip-rap shall be placed in any wetland area or in any location or manner so as to impair surface water flow into or out of any wetland area.
29. This project is allowed construction within wetland areas under the Nationwide Permit, Corps of Engineers Regulations, dated November 22, 1991, part 330.5, Section 12 and 33. Part 330.6 shall also be followed, to the maximum extent practicable, in order to minimize the adverse effects of these discharges on the aquatic environment. Failure to comply with these practices may be cause for the District Engineer to recommend or the Division Engineer to take discretionary authority to regulate the activity on a individual or regional basis pursuant to part 330.8 of the Nationwide Permit, Corps of Engineers Regulations.
30. Discharges of material for backfill or bedding for utility lines, including outfall and intake structures, provided there is no change in preconstruction contours: A "utility line" is defined as any pipe or pipeline for the transportation of any gaseous, liquid, liquefiable, or slurry substance, for any purpose, and any cable, line or wire for the transmission for any purpose of electrical energy, telephone and telegraph messages, and radio and television communication. The term "utility line" does not include activities that drain a water of the United States, such as drainage tile; however, it does apply to pipes conveying drainage from another area. Material resulting from trench excavation may be temporarily side cast (up to three months) into waters of the United States provided that the material is not placed in such a manner that it is dispersed by currents or other forces. The district engineer may extend the period of temporary side casting up to 180 days, where appropriate. The area of waters of the United States that is disturbed must be limited to the minimum necessary to construct the utility line. In wetlands, the top 6" to 12" of the trench should generally be filled with topsoil from the trench. Excess material must be removed to upland areas immediately upon completion of construction. Any exposed slopes and stream banks must be stabilized immediately upon completion of the utility line. The utility line itself will require a Section 10 permit if in navigable waters of the United States (See 33 CFR Part 322). (Section 404)
31. Temporary construction, access and dewatering, temporary structures and discharges, including cofferdams, necessary for construction activities or access fills or dewatering of construction sites; provided the associated permanent activity was previously authorized by the Corps of Engineers or the U.S. Coast Guard, or for bridge construction activities not subject to federal regulation: Appropriate measures must be taken to maintain near normal downstream flows and to minimize flooding. Fill must be of materials and placed in a manner that will not be eroded by expected high flows. Temporary fill must be entirely removed to upland areas following completion of the construction activity and the affected areas restored to the pre-project conditions. Cofferdams cannot be used to dewater wetlands or other aquatic areas to change their use. Structures left in place after cofferdams are removed require a Section 10 Permit if located in navigable waters of the United States. (See 33 CFR Part 322.) The permittee must notify the district engineer in accordance with the "notification" general condition. The

notification must also include a restoration plan of reasonable measures to avoid and minimize impacts to aquatic resources. The district engineer will add special conditions, where necessary, to ensure that adverse environmental impacts are minimal. Such conditions may include: limiting the temporary work to the minimum necessary, requiring seasonal restrictions, modifying the restoration plan, and requiring alternative construction methods.

32. All temporary fills shall be removed in their entirety.

- E. Detail Drawings - Special detail drawings made to a scale to clearly show the nature of the design shall be furnished to show the following particulars:
 - i. All stream crossings and storm drain outlets with elevations of the stream bed of normal and extreme high and low water levels.
 - ii. Details of all special sewer joints and cross sections.
 - iii. Details of special sewer appurtenances such as manholes, service connections, elevated sewers, piers, pipe bedding, special highway crossings, railroad crossings, etc.
 - F. The Soil and Erosion Control plan must be shown in relation to the proposed sanitary sewer system. (See Section 301.04)
- 2) The approved sanitary sewer plan shall not be changed except by written approval of the BLW.
- 3) As-Built Drawings:
- a. As-built drawings will be the same format (plan and profile; scale) as the original construction plans.
 - b. Road names and lot numbers (if applicable) shall be on plans.
 - c. "As-Builts" or "Record Drawings" is to be stamped in large clear print on plans.
 - d. Sheet size is to be 22" x 34".
 - e. Manhole invert and rim elevations, based upon mean sea level..
 - f. When a phase of a subdivision is completed, a location sketch of entire subdivision with said phase outlined shall appear on plans.
 - g. Stationing for all manholes, underground structures, casings, changes in pipe materials, and stub-outs.
 - h. Field measured distances between manholes.
 - i. Actual azimuths and grades of all sewer lines between manholes.
 - j. Contour lines are not required.
 - k. Lateral wye locations must show distance from the downstream manhole. Ends of lateral lines must show the distance from the downstream manhole and offset distance from the main line. Approximate depth of end of lateral should be shown.
 - l. Show all permanent easements.
 - m. Maximum error of as-built measurements shall be:
 - i. Manhole inverts: Measure to 0.01' with maximum vertical error of 0.15 feet per 1000 feet of horizontal transverse.
 - ii. Manhole rims: Measure to 0.10' with maximum vertical error of 0.5' per 1000

feet of horizontal transverse.

- iii. Horizontal locations: Measure to nearest 1.0' with allowable error of 1.0' per 1000 feet of horizontal transverse.

301.03 Contractor Qualifications

Contractors performing sewer line installations must be licensed in accordance with State of Georgia law and local ordinances and approved by the BLW. They should be completely familiar with the procedures and contract requirements associated with this type of project. Unsatisfactory work will cause a contractor to not be approved for future work. Any and all subcontractors must be approved by the BLW.

301.04 Erosion and Sedimentation Control Plan

- A. The Georgia Soil and Water Conservation Commission has taken provisions of ACT 599 and published a **MANUAL FOR EROSION AND SEDIMENT CONTROL IN GEORGIA**, 1997 Edition (or any more current edition as they are published). Sanitary sewer construction plans and specifications shall include appropriate segments of this manual. Developers, Engineers, Design Professionals and Contractors performing work within the BLW service boundary are responsible for acquiring a copy of this manual and using the best management practices contained therein to control the erosion and sedimentation of the construction site in conformance with the intent of ACT 599.

Copies may be purchased from the Georgia Soil And Water Conservation Commission, P.O. Box 8024, Athens, Georgia 30603. For additional information, call the Commission at 706-542-3065.

- B. Plan: An erosion and sediment control plan, meeting the requirements of applicable state regulations, shall be provided as part of the overall construction drawings.
- C. Stream Buffer: Cross-country sanitary sewers adjacent to state waters shall be designed and constructed so as to comply with the buffer requirements as discussed in ACT 599. 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.
- D. Erosion Control Details: Erosion Control Details and Symbols may be taken directly from the **Manual For Erosion and Sediment Control In Georgia**, 1997 referenced above.

301.05 Easement Acquisition

- A. 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 BLW for all facilities which are to be conveyed to the BLW. This process must be started early enough to allow construction of the sanitary sewer before any building construction is to begin. No building permits, water meter, or sanitary sewer tap applications can be issued until off-site water mains and sanitary sewers have been constructed and accepted. A sample sanitary sewer easement agreement is included at the end of Section 301.
- B. All easements shall allow adequate room to construct the sanitary sewer and appurtenances. Permanent easements shall be a minimum of 20 feet wide, 10 feet on each side of the line; Except that when the depth of the sanitary sewer exceeds 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.
- C. Easement drawings shall be prepared 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 drawing will show property lines, the name of property owners with the length of line encroaching on each property owner, size of line, line designation, manhole numbers and stations, width of permanent and construction easement, scale of drawing, north arrow, land lot and district numbers, and a tie to the nearest land lot corner. Any streets or other existing easements shall also be shown. Easement agreements referencing these drawings shall be prepared and attached to the drawings, signed by the property owners, and recorded at the Cobb County Clerk of Superior Court's office. A copy of the recorded easement agreement shall be provided to the BLW prior to the construction of off-site facilities.

The title block shall be shown as follows:

Marietta Board of Lights and Water
NAME OF OUTFALL OR SUBDIVISION
EASEMENT FOR PROPOSED
SANITARY SEWER
CROSSING PROPERTY OF
John Doe

LL: District: Section: Date: Revised Date:

301.06 Construction Permitting

The preparation and cost of all required permit applications shall be the responsibility of the Developer. Permit applications shall be submitted to the BLW and the BLW will submit the applications to the governing authority. Required permits may include but are not limited to USACOE Wetlands Permits, EPD, EPA, D.O.T. Utility Encroachment Permits, Cobb D.O.T., NRCS (Soil and Erosion Control), Railroad Crossing Permits, Utility Crossings, etc.

Construction permits will not be issued until the utility encroachment permit has been obtained and until any special conditions such as insurance requirements have been complied with.

State of Georgia
County of Cobb

**Grant of Easement
Sanitary Sewer**

This Easement Agreement is made and entered into this _____ day of _____
20____, by and between _____

Of the aforementioned State and County as party of the first part, hereinafter referred to as
“Grantor,” and Marietta Board of Lights and Water, a political subdivision of the State of
Georgia, as a party of the second part hereinafter referred to as “Grantee”:

W I T N E S S E T H

That Grantor for in consideration of the sum of ONE & 0/100 dollar(s) (\$ 1.00) and other good
and valuable consideration the receipt and sufficiency of which are hereby acknowledged, does
hereby grant, bargain, sell, and convey unto Grantee, a perpetual sanitary sewer easement over
and under Grantor’s property being more particular described as follows:

All that tract or parcel of land lying and being in Land Lot _____ of the
_____ District, 2nd Section of Cobb County, Georgia, and being more particularly
described on the plat shown as Exhibit “A”, which shows the dimensions of this
easement and which is made a part hereof by reference.

The actual sewer easement area may differ from the description shown on Exhibit "A." The
actual sewer easement shall be a strip of land _____ feet wide, being _____ feet on
either side of the sewer line as actually installed, together with a
construction/installation easement up to _____ feet in width, as shown on the
attached plat Exhibit “A”.

The sanitary sewer easement conveyed herein by Grantor is for the purpose of a sanitary sewer
line and includes the rights to enter upon Grantor’s property to install, inspect, maintain, replace,
or repair the same, as may from time to time be necessary, or whenever Grantee deems fit, with
all rights, members and appurtenances to said easement and right-of-way in anywise
appertaining or belonging thereto.

Grantor for both itself and its heirs and assigns understands and agrees in connection with this
conveyance that any and all construction, digging, grubbing, clearing, filling, or other earth
moving or construction activities within or in the easement area conveyed herein are specifically
in violation of the rights conveyed herein and are, therefore, prohibited written permission from
the Marietta Board of Lights and Water.

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Grantor hereby covenants with Grantee that it is lawfully seized and possessed of the real estate previously described herein and that it has good and lawful right to convey the easement covered by this document, or any part thereof, and that the said easement is free from all encumbrances. The easement herein granted shall bind the heirs and assigns of Grantor and shall inure to the benefit of the successors in title of Grantee.

Additional Stipulations:

IN WITNESS WHEREOF, Grantor has hereunto set its hand and seal the day and year above first written.

Witness (printed name)

Grantor (printed name)

(Signature)

(Signature) SEAL

Grantor (Printed Name)

(Signature) SEAL

Sworn to and subscribed before me
this the ___ day of _____ 20 ____.

Grantee: Board Manager

(SEAL)
Notary Public

Return To:
Marietta Water
627 B. North Marietta Parkway
Marietta, GA 30060
Attn: Kim Holland

****Attach an 8 1/2" x 11" Plat – Exhibit "A".****

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302. DESIGN CRITERIA

302.01 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 BLW. For more detailed criteria, the reader should refer to standard references such as "Ten States Standards", Georgia EPD Regulations, Water Pollution Control Federation Manual of Practice No. FD-5, and other available literature.

All sanitary sewers to be accepted by the BLW for ownership and maintenance shall connect to the BLW sewer system by gravity.

302.02 Sanitary Sewers Separate From Storm Sewers

Sanitary sewers shall be designed as separate sanitary sewers only in which rainwater from roofs, streets, and other areas and groundwater from foundation drains are excluded. Overflows from sanitary sewers to storm sewers are not permitted.

302.03 Non-Domestic Users

All non-domestic users of the sanitary sewer system must comply with the Cobb County Wastewater Ordinance, Chapter 122, Division 6. Copies of this ordinance are available at the BLW.

302.04 Sand and Oil/Grease Interceptors

All users involved in the preparation of food for commercial purposes shall provide oil/grease interceptors. The design criteria is specified in the Cobb County Wastewater Ordinance, Chapter 122, Division 6, Section 122-188.

All users whose wastewater is generally accompanied by unusually large quantities of grit, sand, or gravel shall be required to install a sand trap. All car/truck wash systems shall be required to install sand traps. The design criteria is specified in the Cobb County Wastewater Ordinance, Chapter 122, Division 6, Section 122-188.

302.05 Non-Wastewater Connections Prohibited

No person shall make connection of roof down-spouts, foundation drains, area way drains, swimming pools, dumpster pads or other sources of surface runoff or groundwater to a building sewer or building drain which in turn is connected directly or indirectly to the BLW sanitary sewer system unless such connection is approved for purposes of disposal of polluted surface drainage and for which a discharge permit has been issued.

302.06 Sanitary Sewers Through Ponds and Lakes

The design professional shall make every effort to avoid locating sanitary sewers in detention basins, ponds, lakes, dam structures, berms or spillways. Consideration for approval of a design with a sewer line located in such a structure shall be given on a case-by-case basis.

302.07 Sizing Factors

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

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

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

New sanitary sewer systems shall be designed on the basis of an average daily flow of sewage of not less than 400 gallons per household per day. Normally, all sanitary sewers shall be designed with a peaking factor of not less than four (4) and this may be increased as required by the BLW. Peak factors will be higher for smaller basins. Sanitary sewers should be designed to carry the peak flow when flowing at a depth of 2/3 pipe diameter. When deviation from the foregoing per capita rates are demonstrated, a description of the procedure used for design shall be included.

No sewer main shall be less than 8"; No service lateral shall be less than 6".

The Cobb County and City of Marietta land use plans should be consulted and special consideration given to commercial and industrial areas. Where developers are installing major trunk lines or interceptor sewers, the City's long range plan should be consulted as a guide and the sanitary sewer should as a minimum be of the size called for in the long range plan. If proposed land use conditions have changed subsequent to the plan, these changes should be factored into the determination.

302.08 Depth Requirements

Any sewers installed in the street shall be sufficiently deep to provide 6 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 three feet of cover. In extraordinary circumstances where there is no other alternative, ductile iron pipe shall be used where there is less than three feet of cover. 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.

302.09 Slope

All sewers shall be so designed and constructed to give mean velocities, when flowing full, of not less than 2 feet per second based on Manning's Formula using an "n" value of 0.013. The following are the minimum slopes which should be provided; however, slopes greater than these are desirable:

Minimum Slope in Feet

<u>Sewer Size</u>	<u>Per 100 Feet</u>
6"	1.00
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 will be used only when sufficient flows are expected to maintain a velocity of 2 feet per second and maintain a cleansing action in the line. Sewers shall be laid with uniform slope between manholes. Sewers on 20 percent slope or greater shall be ductile iron pipe and shall be anchored securely with concrete anchors to prevent displacement by erosion or shock. Maximum slope of sewers shall be 30 percent and sewers shall be designed at less than 20 percent whenever possible.

302.10 Increasing Size

When a small sewer is connected to a larger one, the connection shall be made by matching the crowns of both sewers to the same elevation.

302.11 Ductile Iron Pipe

Ductile iron pipe shall be required for sanitary sewer mains:

- 1) Over or under all storm sewers
- 2) Crossing water mains
- 3) Under all stream crossings
- 4) With less than 3' of cover or over 18 feet of cover
- 5) With 20% or greater slope
- 6) Inside casings
- 7) At all other locations specified by the BLW

302.12 Sanitary Sewer Pipe Material Requirements

The BLW reserves the right to disallow any manufacturer that does not have a consistent, long-term record of quality control and successful product performance. Acceptable sanitary sewer pipe materials include Polyvinyl Chloride (PVC) or Ductile Iron Pipe (D.I.P.). Ductile Iron Pipe (D.I.P.) shall be used where certain conditions exist (see Section 302.11).

302.13 Subgrade and Pipe Bedding

All Ductile Iron Pipe shall have a minimum of Class "C" bedding. Wherever water or wet soil is encountered, Class "B" bedding shall be provided. All PVC pipe shall be bedded in accordance with Standard Detail 402-17. If specifically designated on the plans, Class "A" or "B" bedding may be required. Typically the manufacturer's recommendations shall govern the bedding requirements of the various pipes at the varying depths. However, the BLW reserves the right to increase the bedding requirements for any sewer main where the BLW believes the manufacturer's recommendations are not sufficient.

302.14 Manholes

Manholes shall be installed at the end of each line; all changes in grade, size, or alignment; at all intersections; and at distances not greater than 400 feet. In no circumstance will a spacing of greater than 300 feet be allowed when the slope exceeds 10 percent. Cleanouts may be used only for service laterals and special conditions and shall not be substituted for manholes. Manholes in cross-country areas shall be elevated so that the top is 18 inches above ground.

A drop pipe shall be provided for a sewer entering a manhole at an elevation of more than two feet above the manhole invert. Drop manholes shall be constructed in accordance with the Standard Details. The drop pipe shall be of ductile iron materials with push-on joints with American "Fast-Grip" gaskets or approved equal gaskets. Also, at least one

piece of ductile iron pipe shall be used on the incoming line to reach a solid, unexcavated foundation. All outside 90 degree elbows shall have thrust block poured below the elbow. Outside drop manholes will be noted on the construction plans. Where the difference in elevation between the incoming sanitary sewer and the manhole invert is less than two feet, the invert shall be sloped from invert to invert to prevent solids deposition.

The flow channel through manholes should be made to conform in shape and slope to that of the sewers. Minimum drop through a manhole should be 0.1 feet. Precast inverts shall not be used.

302.15 Protection of Water Supply

There shall be no physical connection between a public or private potable water supply system and a sanitary sewer which would permit the passage of any sewage or polluted water into the potable supply.

A horizontal separation of at least 10 feet is required between sanitary sewer lines and existing or proposed water mains (measured edge to edge). Should conditions prevent a separation of 10 feet, the lines shall be laid in separate trenches and sanitary sewers shall be ductile iron. Where sewer mains cross existing or proposed water lines, 18" vertical separation is required between the two mains (measured edge to edge).

Whenever possible, the elevation of the crown of the sewer shall be at least 18 inches below the invert of the water main. The two pipes shall be installed such that a full length of pipe will be centered over the crossing so that all joints will be separated as much as possible. Ductile iron pipe shall be installed for both mains at points where the two lines cross.

When sewers are laid within public streets, the manholes and lines shall normally be laid along the center of the street at a depth of not less than 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 BLW.

302.16 Service Laterals

A separate 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 cleanout at the right-of-way and extend the PVC cleanout to a height of 3' above the finished grade with a water tight plug in all laterals until the builder ties into the line. The Contractor shall also place a 4" x 4" 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 6' of cover at the right-of-way. Where 6' of cover cannot be achieved, services shall be ductile iron.

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 in Section 303.04.1. 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. Where a lot elevation is lower than the manhole rim elevation the Contractor shall install a backflow check valve in the sewer lateral.

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 BLW will not be responsible for any house built too low to be served nor for any service covered by construction.**

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 be flush with the finished grade. The cleanout shall be provided with a concrete collar at finished grade.

302.17 Provisions for Future Extensions

In accordance with Section 302.07, sanitary sewers will be built to the uppermost property line of the development being served. In addition, a 20 foot sanitary sewer easement shall be provided. All of the 20 foot width must comply with the DNR stream buffer requirements. This easement must be shown and recorded on the final development plat and recorded at the Court House in the appropriate records section.

Sanitary sewer lines must end at a manhole. Stubbing out sewer lines for future extensions without placing a manhole at the end of the sewer line is not allowed.

302.18 Sanitary Sewer Line Extension Requirements

- 1) Developers are required to extend existing sanitary sewer lines to serve their property.
- 2) Sewer line extensions shall be sized in accordance with the requirements of Section 302.07. If the size of the trunk main extension required by the BLW is larger than the minimum size required to serve the development, the cost of the over sizing may be funded by the BLW. The developer may be required to pay all of the initial costs.

302.19 Polyethylene Encasement

Where crossing a Gas Company easement or right-of-way, the sewer main shall be encased in polyethylene tubing from beginning to end of the easement or R/W. Otherwise, the sewer main shall be encased in accordance with the Ductile Iron Pipe Research Association's (DIPRA) recommendations. The Developer shall submit a report prepared by DIPRA, detailing their recommendations regarding the pipe, cathodic protection, and polyethylene encasement, to the BLW for review.

302.20 Easements

- 1) Permanent sanitary sewer easements of 20 feet in width shall be provided for all sanitary sewer lines not located within the right-of-way. Permanent easements shall be reserved adjacent to the right-of-way for sewer lines located within 10 feet inside of the right-of-way, thereby giving the BLW 10 feet of accessible property on each side of the sewer line. If sanitary sewer lines are excessively deep, wider easements may be required to maintain a 1:1 open cut slope.
- 2) Easements for sanitary sewer lines and drainage purposes may be combined, but must be a minimum of 30 feet wide if designed for combination.
- 3) Sewer easements off the street right-of-way shall be clearly defined on the plat of the individual property owner.
- 4) 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.
- 5) No permanent structures shall be constructed within a permanent easement. Permanent structures include buildings, mobile homes, swimming pools, and utility buildings. The property owner may be required to remove such obstructions, at his expense, upon the request of the BLW.

302.21 Aerial Crossings of Creeks and Ravines

Pipe used for aerial crossings shall be D.I.P. encased in steel casings. Steel casing shall be supported by piers built outside of the creek banks.

303. MATERIALS

All materials used in the work including equipment shall be new and unused materials of a reputable U.S. Manufacturer conforming to the applicable requirements of the Specifications, and no materials shall be used in the work until they have been approved by the BLW. Any reference to a AWWA, ANSI, ASTM or other such specification shall mean the latest revision published.

303.01 Sanitary Sewer Pipe

1) Ductile Iron Pipe (D.I.P.)

Ductile Iron Pipe shall be designed in accordance with AWWA C150. Minimum wall thickness shall be Class 50. 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.

All D.I.P. shall be subject to inspection and approval by the BLW after delivery. No broken, cracked, imperfectly coated or otherwise damaged or unsatisfactory pipe or fittings shall be used. The exterior shall be seal coated with an approved bituminous seal coat in accordance with AWWA C151.

Pipe shall be lined with standard cement mortar lining at the point of manufacture, in accordance with AWWA C104, with the following modifications. Cement mortar shall be composed of 100% Portland cement Type II and Type V, sand and water. Cement-mortar lined pipe shall have smooth dense interior surfaces and shall be free from fractures, excessive interior surface crazing, disbondment and roughness. Linings shall be manufactured using equipment capable of sufficient rotational speed to sustain 60 G's to 100 G's of compaction force. Simultaneous application of controlled vibration shall be applied to the pipe during rotation to produce a dense and highly compacted lining. After the mortar has been distributed to a uniform thickness, the rotational speed and vibration shall be increased to produce a mortar lining with a uniform smooth surface. Immediately after lining, the surface of the lining shall be flushed with a large volume of water to remove excess latence. Cracks in mortar lining greater than 0.016 inches in width are unacceptable. Linings shall have no "looseness" or disbondment from the inner surface of the pipe. The lining shall be manufactured without a seal coat. The lining shall be cured in a facility with controlled temperature and humidity.

In locations where the BLW believes the sewage contains a level of hydrogen sulfide sufficient to damage the cement mortar lining, the BLW may require that the pipe interior be Polybond II, Polyline, polyurethane or Protecto 401 ceramic epoxy lined with a minimum thickness of 40 mm.

Pipe joints shall be push-on joints conforming to AWWA C111, unless specified otherwise on plans. Where called for, mechanical joints shall conform to AWWA C111.

2) Polyvinyl Chloride (PVC) Sewer Pipe

- a. Pipe and Fittings: 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 water tight seal. Standard laying lengths shall be 13.0 - 20.0 feet (\pm 1 inch). The pipe shall be capable of passing all test 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 18 feet of cover.

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 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.

All PVC fittings 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.

- b. Pipe and Fittings Tests: All shipments of pipe and/or fittings shall be tested and certified to by an approved independent testing laboratory. Up to 0.5 percent of the number of pipe of each size furnished shall be tested, except that in no case shall less than two specimens be tested. The contractor shall be responsible for providing three (3) certified copies of the test results obtained by the testing laboratory under provisions for testing in the applicable test procedures listed below. Testing shall be done at the contractor's expense, and no pipe shall be installed until the test results are approved by the BLW.
- c. Pipe Stiffness: Minimum "pipe stiffness" (F/Y) at 5 percent deflection shall be 46 psi for all sizes, when tested in accordance with ASTM Standard Method of Test D2412, 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 percent of the original diameter.

- d. Extrusion Quality: There shall be no evidence of flaking, swelling, of disintegration when the pipe material is tested in accordance with ASTM D2152, "Quality of Extruded Poly (Vinyl Chloride) Pipe and Molded Fittings by Acetone Immersion".
- e. Joint Tightness: Pipe and fitting joints shall comply with ASTM D3212 for "Joints for Drain and 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.
- f. Impact Resistance: 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)."
- g. Installation: PVC pipe will be installed in accordance with ASTM D2321 (Latest Revision). The minimum bedding requirement for PVC pipe shall be as shown in Detail 402.17. In any area where the pipe is below existing ground water level or below the 100 year flood plain level, the contractor will embed PVC pipe in sand or graded gravel.
- h. Deflection Limit: Vertical deflection of installed pipe shall not exceed 5 percent 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 (subject to the one year maintenance period - Section 106). The test shall be performed by the Contractor pulling a mandrel of specified dimensions through the pipeline.

303.02 Casing Pipe

Steel casing pipe shall be schedule 40 thickness with a 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 bitumastic coating. The casing pipe diameter shall be six to eight 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 shall be used to secure the pipe on grade. A manhole shall be placed at each end of the cased section at a distance of 5 to 10 feet beyond the end of the

casing. Ductile iron pipe shall be continuous from manhole to manhole.

303.03 Service Wyes and Bends

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

303.04 Manholes

1) Precast Manholes

Precast manholes shall be constructed 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 Standard Detail No. 402.04. The wall thickness shall not be less than 5 inches. Manholes over 12' deep shall be placed on a reinforced slab as shown on the detail sheets. 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 C443, 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.

Each section of the precast manhole shall have not more than two holes for the purpose of handling and laying. These holes shall be sealed with cement mortar using one part Portland Cement to two parts clean sand, meeting ASTM Standard Specifications, Serial Designation C144.

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 BLW. Materials found defective by the BLW will not be delivered to the job site. Material on the job site that is found defective shall be removed immediately after being notified that such materials are unacceptable. Precast manhole shall conform to ASTM C478.

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.

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 the 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 feet from the invert of the outlet pipe. All manholes shall be water tight when completely built.

2) 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.

3) Manhole Cover and Frame

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.

4) Waterproof Manhole Frame and Cover

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.

5) Manhole Foundation

The manhole base shall be set on a compacted mat of Size #57 crushed stone graded

level at the thickness shown on the standard detail drawings. In wet areas, the crushed stone mat shall be thickened as needed to provide a non-yielding foundation.

6) Brick

Brickwork required to complete the precast concrete manhole shall be constructed using 1 part portland cement to 2 parts clean sand, meeting ASTM Specifications, Serial Designation C 144, thoroughly mixed to a workable plastic mixture. 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 4 courses of brick with 12 inch maximum total depth of bricks may be used to adjust manhole covers.

303.05 Concrete and Mortar

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 a 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 1-1/2 inch screen and be retained on a 1/4 inch 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 surface rubbed uniformly with neat cement.

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

303.06 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.

303.07 Brick

All brick shall be best grade, hard-burned, common, giving a ringing sound when struck and acceptable to the BLW. 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.

303.08 Subgrade Stabilizer Stone

Stabilizer for subgrade shall be either approved crushed stone or gravel, uniformly graded from 1/4" to 1-1/4" in size.

303.09 Polyethylene Tubing For Ductile Iron Pipe

Polyethylene tubing shall be manufactured of virgin polyethylene material conforming to ASTM Standard Specification D-1248-78, Type I, Class A or C, Grade E-1. The polyethylene film shall have a minimum thickness of 8 mm.

303.10 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.

303.11 Concrete for Thrust Blocks and Thrust Collars

Concrete for thrust blocks and thrust collars shall have a minimum compressive strength of 3000 PSI at 28 days.

304. EXCAVATION AND CONSTRUCTION

304.01 General

- 1) It shall be expressly understood that these specifications are for installation of all sanitary sewer mains and appurtenances.
- 2) All work shall conform to the applicable provisions of specifications prepared by the AWWA, ANSI and ASTM of latest revision except as otherwise specified herein.
- 3) Compliance with applicable safety regulations is the responsibility of each company engaged in the work. The BLW assumes no responsibility for the actions of others on the job site. It is the responsibility of those installing sanitary sewer lines and appurtenances to conform to OSHA regulations.

304.02 Trench and Manhole Excavation

- 1) Sanitary sewer lines shall normally be installed by open-cut trench excavation. Pipe trenches shall be excavated straight and true to grade and line and in the location shown on the plans. Trenches shall be dug so that the pipe can be laid to the alignment and depth required, and the trench shall be of such width and shall be braced and drained so that the workmen may work therein safely and efficiently. No chocking under the pipe will be permitted. All joints shall be as specified herein. Excavation must be made under the bell of each pipe so that the entire length of the pipe will lie uniformly on the bottom of the trench and the pipe weight shall not rest on the bells. Trenches shall be free of water during the work.

Trenches shall have a minimum width of twelve (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 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.

In cases where a sanitary sewer crosses a water main, there shall be a minimum vertical clearance of 18 inches separation between the mains. Both mains shall be D.I.P. At crossings, one full length of sewer pipe must be located so that both joints are as far from the water main as possible. In cases where sanitary sewer mains parallel water mains, there shall be a minimum of ten (10) feet horizontal separation maintained between the mains. These distances are measured edge to edge.

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.

When possible, all crossings of paved highways or driveways by pipe line 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.

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.

Backfilling, compaction, dressing and clean-up shall be kept as close to the line laying crew as is practical, and negligence in this work will not be tolerated.

In excavation and backfilling and laying pipe, care must be taken not to remove or injure 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.

All excavation shall be placed on one side of the trench, unless permission is given by the BLW 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.

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.

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.

Construction occurring around active sanitary sewerage systems shall be done in such

a way so as to prevent the spillage of sewage.

- 2) 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 one-half 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 filing 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 BLW and property owner.
- 3) Rock in trenches shall be excavated over the horizontal limits of excavation and to depths as follows:

<u>Size of Pipeline Inches</u>	<u>Depth of Excavation Below Bottom of Pipe, Inches</u>
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.

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.

304.03 Installation of Sanitary Sewer

Construction stake-out will 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 stake-out notes will be provided to the BLW.

Pipe and accessories shall at all times be handled with care to avoid damage. Whether moved by hand, skidways or hoists, material shall not be dropped or bumped. The interior of all pipe 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. All such material that is defective in manufacture or has been damaged in transit or after delivery shall be removed from the job site.

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 BLW. Wyes and/or service connections and stubs from manholes shall be placed where shown on plans and as approved by the BLW. All such connections shall be blanked off with suitable stopper and made watertight with jute and cement mortar.

The preferred order of construction is to connect to existing sanitary sewers after all other construction is complete and conditionally accepted by the BLW. Connections to existing sanitary sewers can be done at the beginning of construction, however, the new main shall be plugged where it enters 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.

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 BLW.

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 that the pipe barrel will rest on a solid foundation for its entire length as shown on the plans. Pipe shall be laid with joints close and even, butting all around, so that it will form a close concentric joint with adjoining pipe with no sagging at the hub and so that a true surface is given to the invert throughout the entire length of the sewers. After the pipe is laid, backfilling shall be completed as directed in Section 304.07.

The contractor will be required to provide and operate any equipment necessary to keep the trenches free from water while pipe is being laid and the joints made. The installed pipe shall not be used for draining water from the ditch.

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 100% of the full circle of the pipe from manhole to manhole without obstruction.

Sewers shall be laid tight and the rate of infiltration in any section of line between adjacent manholes shall not exceed 0 G.P.D. per inch diameter of pipe per mile of line when the trenches are saturated with water.

ALL OPENINGS ALONG THE LINE OF THE SEWERS SHALL BE SECURELY CLOSED AT NIGHT, DURING SUSPENSION OF WORK, AND AT THE END OF EACH WORK PERIOD, WITH A WATER-TIGHT STOPPER.

NO LENGTH OF PIPE SHALL BE LAID UNTIL ONE PRECEDING IT SHALL HAVE SUFFICIENT QUANTITY OF FINE EARTH TAMPED AROUND IT TO HOLD IT FIRMLY IN PLACE.

304.04 Making of Joints

When joining gravity sewer pipe, both the spigot end and the bell end of the pipe shall be perfectly clean and free from dirt, oil, grease, or other foreign matter. The spigot end shall be lightly coated with the lubricant recommended and furnished by the manufacturer, and the pipe then shall be securely and firmly seated in the bell end of the adjoining pipe. In making the joint, the spigot end of the pipe, after being cleaned and coated with lubricant, shall not be allowed to touch the sides or bottom of the trench before being inserted in the bell end of the adjoining pipe. In addition to the above, joints shall be made in strict accordance with the specifications and recommendations of the manufacturer.

304.05 Subgrade and Pipe Bedding

All Ductile Iron pipe shall have a minimum of Class "C" bedding. All PVC pipe shall have a minimum bedding as described below and shown in the standard details (402.17). Wherever water or wet soil is encountered, Class "B" bedding shall be provided for D.I.P. If specifically designated on the plans, Class "A" or "B" bedding may be required. A description of Class "A", "B", and "C" bedding is as follows:

1) Class "A" Bedding (Detail 402.14)

Class "A" bedding refers to bedding with concrete cradle, arch or encasement. The Contractor shall conform to details shown in the detailed drawings when Class "A" bedding is required.

2) Class "B" Bedding (Detail 402.15)

The pipe shall be bedded in crushed granite material, conforming to Section 303.08, "Subgrade Stabilizer Stone", or other suitable materials approved by the BLW. The bedding shall be placed on a flat trench bottom with a minimum thickness beneath the pipe of one-eighth the outside pipe diameter, but not less than 6 inches (150 mm) and sliced under the haunches of the pipe with a shovel or other suitable tool to height of one-half the outside pipe diameter, or to the horizontal centerline. The initial backfill shall be hand placed to a level of 12" (300 mm) over the top of the pipe and shall consist of finely divided materials free from debris, organic material, and large rocks or stones.

3) Class "C" Bedding (Detail 402.16)

The pipe shall be bedded in subgrade stabilizer stone placed on a flat trench bottom. The bedding material shall have a minimum thickness beneath the pipe of 6" (150 mm) or one-eighth of the outside diameter of the pipe, whichever is greater and sliced under the haunches of the pipe with a shovel or other suitable tool to a height of one-sixth of the outside diameter of the pipe. The initial backfill shall be hand placed to a level of 12" (300 mm) over the top of the pipe and shall consist of finely divided materials free from debris, organic material, and large rocks or stones. Bedding materials shall be as described in Section 303.08, "Subgrade Stabilizer Stone".

4) Special Bedding for PVC Pipe (Detail 402.17)

PVC pipe shall be bedded in crushed granite material, conforming to Section 303.08, "Subgrade Stabilizer Stone", or other suitable materials approved by the BLW. The bedding shall be placed on a flat trench bottom with a minimum thickness beneath the pipe of one-fourth the outside pipe diameter, but not less than 6 inches (150 mm) and sliced under the haunches of the pipe with a shovel or other suitable tool to height of two-thirds the outside pipe diameter. The initial backfill shall be hand placed to a level of 12" (300 mm) over the top of the pipe and shall consist of finely divided materials free from debris, organic material, and large rocks or stones.

304.06 Dewatering Trenches

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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. 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. 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 to 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. All soil and erosion control standards must be followed during dewatering operations. Best management practices must be used.

304.07 Backfilling

- 1) 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 twelve (12") inches above the top of the pipe shall be placed by hand in four (4") inch layers for the full width of the trench and thoroughly compacted by hand with vibratory 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 that 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.
- 2) Backfill under permanent concrete or bituminous pavement 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 not more than ten percent (10%) by weight of loam or clay. This backfill shall be compacted to one hundred percent (100%) as determined by the Standard Proctor test for the top two (2) feet of trench and ninety-five percent (95%) by the Standard Proctor test from pipe bedding to two (2) feet below trench top. Mechanical vibrating equipment shall be used to achieve the required compaction. Pavement shall be replaced immediately after the backfilling is completed.
- 3) Backfill under gravel or crushed stone surfaced roadways shall be the approved suitable excavated material placed in six (6) inch layers thoroughly compacted for the full depth and width of the trench, conforming to the compaction, density compaction method and materials as specified in "2" above.

- 4) Backfill in unpaved areas shall be compacted with mechanical vibrating equipment to ninety-five percent (95%) as determined by the Standard Proctor Test. Backfill material from pipe bedding to ground surface shall be excavated earth free from large stones and other debris.
- 5) 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 or better than before the work began to the satisfaction of the BLW.
- 6) 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.

304.08 Stream Crossings

The preferred method of crossing a river, stream, creek, impoundments, or wet weather ditch is with a minimum of two feet of cover between the lowest point in the stream and the top of outside diameter of the pipe. Ductile iron pipe is required for all stream crossings and shall extend a minimum of ten feet (10') beyond the top of bank on each side. Precast concrete collars may be required to prevent flotation.

The stream bed and banks at the crossing site 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, 1997 or most current edition.

Aerial crossings will require detailed plans and will be allowed only when, in the BLW's opinion, there is no reasonable alternative.

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 all work should be performed as quickly and safely as possible. As soon as conditions permit, the stream bed shall be cleared of all falsework, debris, and other obstructions placed therein or caused by the construction operations.

Erosion control measures can include, but is not limited to, the following items:

- a. Silt fencing, types A, B, and/or C
- b. Erosion control checkdams
- c. Channel diversion through temporary storm drain pipe.
- d. Rock filter dams

The construction and installation of these various structures are detailed in the **Manual For Erosion And Sedimentation Control In Georgia** or the Georgia Department of

Transportation Standards and Construction Details, both of which are available for purchase by the Contractor.

304.09 Casing for Sanitary Sewers

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 utility, and shall not weaken the roadbed or structure.

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 a 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 which develop during the installation operation shall be pressure grouted. Each segment of the casing pipe shall be welded (full circumference butt weld) to the adjoining segment. The completed casing shall have no sags or crowns which cause the grade for any segment to be less than the minimum slope for the size pipe being installed.

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 under Section 304.07. Carrier pipe shall be D.I.P. and shall be inserted within the casing by use of approved casing spacers.

At each end of the casing pipe, the void between the carrier pipe and casing shall be sealed with brick and mortar.

304.10 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.

304.11 Location and Protection of Existing Underground Utilities

It is the responsibility of the Contractor to locate the underground utilities and to protect same. Utility lines or services damaged by the Contractor shall be repaired by the Contractor at his own expense.

304.12 Connection to the Existing BLW Sanitary Sewer System

1) The Developer's private Contractor shall make all required connections to the BLW's

sewer system. The BLW's Inspector will supervise the connection and all associated work. The Contractor shall give the BLW a minimum of 48 hours notice prior to any sewer 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 BLW's system shall be pre-arranged with the BLW.

304.13 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 permission is granted by the Georgia D.O.T., Marietta Public Works Department, or Cobb County D.O.T. Submittal of an authorization letter from the appropriate governing agency is required.
- 3) One lane of traffic shall be maintained open at all times. Construction work shall be limited to time between 9 A.M. and 4 P.M.
- 4) The Contractor shall furnish traffic control devices and certified personnel to direct traffic, if required.
- 5) The above requirements may be altered with the written approval of the BLW in extenuating circumstances.
- 6) Assuming that a road bore has been attempted and failed, and 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 shall 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.

304.14 Standard Detailed Drawings

Installation of sewer mains, service laterals, manholes, casings, cleanouts, etc. shall be made in accordance with the Standard Detailed Drawings in these specifications.

304.15 Clean-Up

- 1) The Contractor shall remove all unused material, excess rock and earth, and all other debris from the construction site as closely behind the work as practical. If the contractor fails to maintain clean-up responsibilities as directed by the BLW's representative, the BLW may choose to use their own forces to do so, followed by an invoice to the Developer for the BLW's work. All trenches shall be backfilled and tamped before the end of each days work.
- 2) Prior to requesting the final inspection, the Contractor shall do the following:
 - a. Remove and dispose of in an acceptable manner all shipping timbers, shipping bands, excess materials, broken material, crates, boxes and any other material brought to the job site.
 - b. Repair or replace any work damaged by the sewer line construction.
 - c. Regrade and smooth all shoulder areas disturbed by the sewer line construction.
 - d. All easement areas shall be cleared of trees, stumps and other debris and left in a condition such that the easement can be maintained by bush-hog equipment.
 - e. All shoulders, ditches, culverts, and other areas impacted by the sanitary sewer construction shall be at the proper grades and smooth in appearance.
 - f. All manhole covers shall be brought to grade.
 - g. 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 BLW's acceptance of the sanitary sewer.
 - h. If work is performed on a Georgia D.O.T., City of Marietta, or Cobb County right-of-way, a letter from the governing agency is required to be submitted after construction is complete stating that grassing, clean-up, drainage, etc. is acceptable.
 - i. Outfall sewers shall require Army COE Post-Construction Notification if Pre-Construction Notification was obtained for Wetlands Nationwide Permit.

304.16 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. Street closures must be approved by Marietta Public Works. 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 (5) feet apart, and lights shall be kept burning from sunset to sunrise.

304.17 Grassing

All areas outside structures and along pipelines where the earth is disturbed shall be grassed. After the soil has been properly prepared, the seed shall be planted. After the seeds have been planted, the moisture content of the soil shall be maintained at the optimum amount to insure germination of the seed and growth of the grass.

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 1-1/2 ton of mat to the acre. The minimum depth of the straw shall be 2 inches and the maximum depth 3 inches. After placing mat or hay or straw, emulsified asphalt shall be sprayed over the mat at a uniform rate of 0.15 gallon per square yard. After the grass has shown a satisfactory growth (approximately 30 days after planting), nitrate of soda shall be applied at a uniform rate of 100 pounds per acre, followed by sufficient water to dissolve the fertilizer.

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 water 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.

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 necessary to produce a satisfactory stand.

305. INSPECTION AND TESTS

305.01 General

- 1) All lines designed to operate as gravity sanitary sewers and all force mains shall be successfully tested. Tests of installed piping shall be completed as described below.
- 2) All piping to be tested must satisfactorily comply with these tests before being eligible for acceptance.
- 3) These tests must be performed in the presence of the BLW's Inspector in order for the test to be accepted as valid.

305.02 Concealed Work

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

305.03 Minimum Tests

All new gravity sewer lines constructed will be tested for infiltration, exfiltration, and deflection. Flexible pipe sewers (PVC) shall be subjected to the Mandrel Test. The sewer lines may be televised if the BLW's Inspector cannot see through the line properly or suspects that the joints may be offset or broken. Slopes of sewer mains that are close to minimum grade will be checked to ensure cleansing velocity. The BLW may require manholes to be subjected to a vacuum test to check potential infiltration. The backfill in the trench above the pipeline will be subjected to compaction tests as detailed below. Any defects located during testing must be corrected before construction of the project may proceed. All costs associated with testing will be paid by the Developer. Tests will be performed as follows:

1) Measurement of Infiltration

In no case will an infiltration rate greater than 0 GPD per inch diameter per mile of pipe be allowed. Any visible or audible leak must be dug up and repaired. Any increase in flow between two adjacent manholes must be corrected.

2) Exfiltration Test (Low Air Pressure Test)

After completing backfill of a gravity sewer line section, conduct a low pressure air test of all pipe constructed, using methods and devices acceptable to the BLW. Perform such test using the following general procedures:

- a. Temporarily plug line segment between two manholes using plugs having air tight fittings through which low pressure air can be introduced into the pipe segment being tested.
- b. Introduce low pressure air into the test pipe segment until the internal air pressure reaches 4.5 psig above ground water pressure, if any.
- c. Wait at least two minutes for air temperature in the test segment to stabilize while internal air pressure remains no less than 3.5 psig above ground water pressure.
- d. Bleed internal air pressure to exactly 3.5 psig above ground water pressure.
- e. Accurately determine the elapsed time for internal pressure to drop to 2.5 psig above ground water pressure.
- f. The air test is acceptable if elapsed time is no less than shown by the following table:

<u>Pipe Dia.</u> <u>Inches</u>	<u>Seconds Per</u> <u>100 Ft. of Pipe</u>	<u>Pipe Dia.</u> <u>Inches</u>	<u>Seconds Per</u> <u>100 Ft. of Pipe</u>
6	17	30	85
8	23	36	102
10	28	42	119
12	34	48	136
15	43	54	153
18	51	60	170
21	60	66	187
24	68	72	204

Air leakage time is based on pipe being damp. If pipe and joints are dry, dampen line if helpful in meeting air test time requirement.

Permanently correct leakage determined by air testing, and repeat operations until the inspector witnesses a successful test on each line segment.

3) Deflection Test

Every section of sewer line will be visually checked for deflection. A passing section shall show 100% of a full circle when observed from one end. This may be done using mirrors to reflect sun light or by using lamps. Any section which fails this visual test shall be further checked as follows:

The section shall have water run through it sufficient to fill any sags that may exist. Then it shall have a television camera pulled through it to check for sags. Any sag holding more than one inch of water will require that the pipe be removed and replaced to proper grade after which the section shall be televised again to verify correction.

4) Mandrel Test for Flexible Pipe (PVC)

All PVC gravity sewer mains shall be subjected to the Mandrel Test. The procedure for testing flexible pipe for maximum allowable deflection shall be generally as follows. See ASTM specifications for mandrel dimensions and more details.

- a. Completely flush the line making sure the pipe is clean of any mud or trash that would hinder the passage of the mandrel.
- b. 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).
- c. 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.
- d. Connect a second rope to the back of the mandrel. This will enable the mandrel to be retrieved if excessive deflection is encountered.
- e. Draw the mandrel through the sanitary sewer line.
- f. 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 BLW approval, for correcting the problem.
- g. Retest after correcting the problem.

5) T. V. Inspection

In the event that the Inspector cannot see through the line properly or conditions cause him to suspect that the line may be settled or broken or that the joints may not be made properly, he may direct that a T.V. camera be passed through the line. A video tape of the inspection will be made. Any discrepancies noted such as sagged pipes, broken pipes, bad joints, etc., will be dug up and will be corrected. Internal grouting to repair new lines will not be allowed. After correction of the discrepancies, the line will be reinspected.

6) Cleansing Velocity / Slope Test

In areas where the design call for minimum grade, or the Inspector suspects a line has been installed close to minimum grade, the Inspector shall work with the Contractor to survey the inverts to check the grade of the sewer mains. If the minimum grade required to provide cleansing velocity, the line shall be dug up and relaid at the proper grade.

7) Manhole Construction

Every manhole will be visually inspected to check for plugging of lift holes, use of connecting boots, use of joint material, leakage, proper invert construction, proper setting of frame and cover. Vacuum testing of the manhole structure will be required at the BLW's discretion.

8) Compaction Testing

Compaction testing will be required for sanitary sewers constructed in paved areas or where pavement is planned. A minimum of five tests per 1,000 feet of sanitary sewer will be conducted at varying depths.

The BLW may require additional compaction tests be conducted in any other areas where the BLW's Inspector suspects the backfill has not been compacted in accordance with Section 304.07 of these specifications. If any of these tests show failing results, then the failing backfill will be removed, re-compacted and re-tested, and one additional area will be tested as well.

Compaction tests shall be conducted by an independent laboratory at the Developer's expense.

305.04 Timing of Service Connections

In no circumstances shall any homes, buildings or plumbing fixtures be connected to the sanitary sewers until the sewers have been inspected and approved by the BLW.

306. PRE-TREATMENT REQUIREMENTS FOR INDUSTRIAL WASTEWATER

Some industrial and other developments may be required to pre-treat sewage prior to discharge into the BLW's collection system. Requirements for pre-treatment shall be as specified or amended in the Cobb County Wastewater Ordinance.

307. OTHER REQUIREMENTS

No part of these specifications is intended to relieve the developer of his responsibility to comply with requirements of the Georgia D.O.T., the Georgia DNR, the NRCS, the USACOE, the EPA, the EPD, Cobb County, City of Marietta or other appropriate regulatory agency.