

ACTON MUNICIPAL UTILITY DISTRICT

GENERAL DEVELOPMENT POLICY

AND

CONSTRUCTION STANDARDS

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GENERAL

1. GENERAL:

1.1 Users:

This General Development Policy and Construction Standards is prepared for use by Developers and Individuals for Construction of water and sanitary sewer facilities. Deviation will be permitted only by action of the Board of Directors. It is the general policy of the District that all water and sewer improvements within the district boundaries shall be in strict compliance with these Standards. All developments outside of the District boundaries which request to be served by the District shall also comply with these Standards.

1.2 Intent:

It is the intent of these Standards to comply with all requirements of the Texas Department of Health and the Texas Department of Water Resources. In the event that a conflict exists between these Standards and the Texas Department of Health or Water Resources, the requirements of the two state agencies shall prevail.

2. PERMITS AND INSPECTIONS:

2.1 Permits:

An application for a water main, water service, underground lawn sprinkler system, sanitary sewer main, or sanitary sewer service must be filed prior to start of construction of any residence or building. All required fees shall accompany the application. Construction shall not commence until authorized in writing by the District.

2.2 Inspection fees:

An inspection fee shall accompany each permit application. Inspection fees shall be as follows:

2.2.1 Water service:

The inspection fee for water service (meter to building foundation) shall be \$25.00.

2.2.2 Underground lawn sprinkling system:

An inspection fee for an underground lawn sprinkling system shall be \$25.00.

2.2.3 Water main extension:

The inspection fee for water main extension shall be \$0.30 per linear foot. (Minimum inspection fee shall be \$25.00). Length shall be determined from approved drawings.

2.2.4 Sanitary sewer service:

The inspection fee for sanitary sewer service (sewer main or lateral to building foundation) shall be \$25.00.

2.2.5 Sanitary sewer main or lateral extension:

The inspection fee for sanitary sewer main or lateral extension shall be \$0.30 per linear foot. (Minimum inspection fee shall be \$25.00). Length shall be determined from approved drawings.

2.2.6 Miscellaneous construction:

The inspection fee for lift stations, wastewater treatment facilities, water supply wells, water booster stations, water storage facilities and other similar construction shall be 4 percent of the construction cost.

2.3 Scheduling:

When the facility, to be inspected, is in place but prior to any backfill, the Developer-Contractor shall request an inspection of the installation by the District. Requests for inspection must be made at least 24 hours in advance. Inspections will not be made after 4:00 P.M. nor on Saturdays, Sundays or Holidays. Backfill shall be completed immediately after the installation is approved.

3.0 SANITARY SEWER SERVICE CONNECTION REQUIRED:

Residences or commercial buildings constructed on property located within 100 feet of a District sanitary sewer must be connected to the District sewerage system. Each dwelling unit or commercial establishment shall have a single sanitary sewer connection.

4.0 WATER SERVICE CONNECTION REQUIRED:

Residences or commercial buildings constructed within the District must be connected to the District water system. Each dwelling unit or commercial establishment shall have a single metered connection.

5.0 EXCLUDED WASTES:

Waste material, which is not biologically degradable in the District's treatment facilities, will not be permitted to discharge into the District's sewerage system, including mud and debris accumulated during sewer service line construction. Downspouts, foundation drains, yard or street drains, gutters or any other storm water sources will not be permitted to be connected to the District's sanitary sewerage system. Swimming pool connections shall not be permitted.

6.0 BACKFLOW AND SIPHONAGE:

6.1

There shall not be any water connection to any condensing, cooling, industrial process, swimming pool, or any other system of non-potable water usage unless the connection is made through an air gap. The use of check valves, double check valves or other backflow prevention devices, which are subject to mechanical failure, malfunction or inoperability under certain conditions is not acceptable.

6.2

There shall not be any water connection between District water and any underground lawn sprinkler system unless the connection is made through an approved backflow prevention device. If the lawn sprinkling system is supplied **ONLY** by District water, the connection may be through an air-gap or through an approved backflow prevention device. If the lawn sprinkling system is also supplied by **ANY** source other than the District water supply, the sprinkler system shall be connected to the District supply through an approved air-gap.

6.3

All sill cocks, threaded faucets or any other outlet to which a hose could be connected, shall be equipped with an approved hose bibb vacuum breaker.

6.4

The District shall inspect all water facilities on the customers' side Of the meter prior to providing service. The inspection is to prevent Possible cross-connection between potable (safe) water and any non-potable (unsafe) water.

7.0 LOCATION:

7.1 General:

Water and sewer mains shall be located along streets where ever possible to facilitate services and repairs. As far as practical, water and sewer mains will not be laid under streets or in other areas subjected to heavy traffic. When water mains and sanitary sewers are installed, they shall be installed no closer to each other than 9 feet in all directions and parallel lines must be installed in separate trenches. Where the 9 foot separation distance cannot be achieved, the following procedures shall be used.

7.2 Sanitary sewer force main:

Where a sanitary sewer force main parallels the water main, the force main shall be constructed of materials required for "Water Pipe, Fittings and Accessories" as specified herein. The water main and force main shall be separated by a minimum vertical distance of 2 feet, and a minimum horizontal distance of 4 feet., measured between the nearest outside diameter of the pipes, and the water main shall be located above the force main.

7.3 Gravity sanitary sewer:

When gravity sanitary sewers and water mains are constructed in proximity of each other the following shall be adhered to:

7.3.1 Parallel construction:

When a gravity sanitary sewer parallels a water main, the sanitary sewer shall be constructed of materials required for "Water Pipe, Fittings and Accessories" as specified herein. The water line may not be placed closer than 2 feet vertically and 4 feet horizontally from the sewer, with the separation distance measured between the nearest outside pipe diameters. The water main shall be installed at a higher elevation than the sanitary sewer.

7.3.2 Crossing construction:

When a gravity sanitary sewer and a water main cross, all sewer pipe within 9 feet of the water main shall be constructed of materials as required for "Water Pipe, Fittings and Accessories" as specified herein. The water main shall not be placed closer than 6 inches to the sewer. The separation distance must be measured between the nearest outside diameters. The water line shall be located at a higher elevation than the sewer and one length of the sewer pipe must be centered on the water line.

7.4 Manholes:

Water mains shall not be constructed within 9 feet (clear distance) of sanitary sewer manholes.

7.5 Fire hydrants:

Fire hydrants shall not be installed within 9 feet vertically or horizontally of any sanitary sewer.

8.0 OPERATION OF EXISTING FACILITIES:

The Developer-Contractor shall NOT, under any circumstances, operate any valve, pump, hydrant or any other District facility. Operation of these facilities shall be by District personnel only.

9.0 COSTS:

All costs, including but not limited to the costs of labor, materials, equipment, supplies, permits, easements, acquisitions, fees, assessments, bonds, and any other costs associated with the complete planning, design and construction of any water or sewer facility, including service laterals, to be served by the District shall be borne by the Developer-Contractor. Upon completion of construction and acceptance by the District, the Developer-Contractor shall provide to the District good and sufficient title to all facilities except water service and sanitary sewer service laterals, free from all liens and encumbrances.

10.0 DISTRICT PARTICIPATION:

The District may participate in the cost of water or sewer improvements if oversized facilities are determined by the District to be necessary or beneficial to the proper and efficient operation of the District. Participation shall be limited to costs over and above those necessary to serve the subject development. When a participation project takes place, all construction must be according to this General Development Policy and Construction Standards, according to applicable Statutory requirements, and as a result of a contract between the District and the Project Developer.

11.0 PROCEDURE:

The Developer-Contractor of any tract of land within the District or of any tract of land to be served by the District, shall apply to the District for service according to the following procedure:

Step 1.

Developer-Contractor shall obtain from the District copies of all applicable policies and procedures.

Step 2.

Developer-Contractor shall prepare, at his expense, and submit to the District a preliminary plat showing the following information:

- a boundary survey by a Texas registered Land Surveyor.
- the course, distance, and description of all streets, easements, lots, lines, and utilities, both proposed and existing, as may be required by the District to be dedicated for proper operation of the District.
- all watercourses, watersheds, and storm drainage paths affecting the development.
- date, scale, north arrow, and names of all developers, engineers, and surveyors.

Step 3.

Upon approval by the District of the preliminary plat, the Developer-Contractor shall prepare, a final plat and complete plans and profiles of proposed street and utility improvements, such improvements being compatible with existing and/or intended improvements. All plans, profiles and specifications for street and utility improvements shall be prepared by a Texas registered Professional Engineer.

Step 4.

Upon District approval of the final plat and improvement plans, the Developer-Contractor shall record the plat.

Step 5.

The District shall authorize commencement of construction. All individual service connections shall be made by the District or under contracts approved by the District.

Step 6.

Upon completion of construction and prior to its acceptance by the District, the Developer-Contractor shall supply to the District as-built drawings of the constructed street and utility improvements, and convey to the District proper title to all property, right-of-way, easements, equipment, and materials installed as part of the utility project. Connection to the system shall not be made until all of the above described provisions have been satisfied.

12.0 POLICY REVIEW:

The General Development Policy of A.M.U.D. shall continue in effect until duly changed by the Board of Directors. Any development project under construction shall continue to comply under the terms of the Policy existing at the time of its original application approval and according to the project scope described in the application. However, if a development project is not diligently pursued for a period of ninety days, except for circumstances beyond the control of the Developer-Contractor, the District may, at its option, require a new application under the Policy terms existing at such time of the new approval. Any suggested changes in the Policy may be submitted, in writing, to the District office for consideration by the Board of Directors.

TRENCH AND BACKFILL

1.0 APPLICABLE PUBLICATIONS:

The following publications form a part of these specifications to the extent indicated by references thereto. Only the most recent revisions of these publications shall be used.

1.1 American Society for Testing and Materials (ASTM):

- D 698 Moisture-Density Relations of Soils, Using 5.5 Pound (2.5 kg) Rammer and 12-Inch (304.8 mm) Drop

2.0 GENERAL:

The Developer shall perform all trenching, boring, tunneling, backfilling, cushioning, surf ace dressing, dewatering, shoring, surface restoration and disposal of waste as required for piping and appurtenances as shown on the drawings. It is contemplated that all pipeline construction will be accomplished by open trench methods except crossing existing highways. Typical trench details are shown on the included Drawings.

3.0 EXCAVATION:

3.1 Sheeting and bracing

Where necessary, satisfactory sheeting and bracing shall be used to hold the sides of the excavation at all points where damage might result from slides. All sheeting and bracing shall be removed as the backfill is placed. All voids left or caused by the withdrawal of sheeting shall be filled immediately with suitable material and tamped.

3.2 Trenching:

Trenches shall be excavated to the lines, grades and elevations shown on the drawings. In the event that water line grades and elevations are not shown on the drawings, the following minimum depths of cover shall govern:

- 6" or smaller line 30"
- 8" or larger line 36"

The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite work. 300 feet shall be the maximum allowable length of open trench ahead of pipe laying.

3.2.1 Limiting trench widths:

Trenches shall be excavated to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, and embedment, However, the limiting trench widths below an elevation 6 inches above the top of the installed pipe shall be as follows:

Pipe Size	Minimum Trench Width in Earth	Maximum Trench Width in Earth	Minimum Trench Width in Rock
Less than 6"	24"	30"	24"
6"	24"	30"	24"
8"	26"	32"	24"
10"	30"	34"	24"
12"	32"	36"	24"

Where necessary to reduce earth load on trench banks to prevent sliding and caving, banks may be cut back on slopes which shall not extend lower than 1 foot above the top of the pipe.

3.2.2 Unauthorized trench widths:

Where, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in the foregoing tables, either pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required by loading conditions and as determined by the District, shall be furnished and installed.

3.2.3 Trench bottom in earth:

The trench in earth shall have a flat bottom the full width of the trench and shall be excavated to the grade to which the pipe is to be laid. The surface shall be graded to provide a uniform bearing and continuous support for each pipe at every point along its entire length. Bell holes for the pipe shall be dug after the trench has been cut to proper grade and immediately prior to the laying of the pipe length. No part of the bell shall be in contact with the trench bottom.

3.2.4 Stabilization:

When the trench bottom is soft and in the opinion of the District cannot support the pipe, a further depth and/or width shall be excavated and refilled to the desired pipe foundation grade as required by the District to assure a firm foundation for the pipe.

4.0 BACKFILL:

Backfill materials and placement shall be as hereinafter specified.

4.1 Trench backfill:

Backfill for all pipeline trench excavation shall be placed by the end of each working day around all pipe laid that day leaving only the working end of the pipe uncovered.

4.1.1 Embedment:

Embedment is defined as trench backfill placed under and around the pipe. Embedment materials shall be as specified for the particular pipe material.

4.1.2 Select backfill:

Select backfill is defined as trench backfill placed above the embedment and up to 12 inches above the pipe. Select backfill material shall be absolutely free of any stones, bricks, concrete, etc., except gravel or crushed rock of 3/4 inch size or less. Select backfill shall be placed in layers not to exceed 4 inches in compacted thickness. Extreme care shall be used in compaction operations to prevent compacting equipment from contacting the pipe.

4.1.3 Random backfill:

Random backfill is defined as trench backfill placed above the select backfill and up to the existing ground surface or the bottom of pavement. Random backfill material shall be material excavated from the trench with 4 inch maximum diameter. Except where crossing or in traveled ways, random backfill shall be placed in 12-inch non-compacted lifts and compacted by tracks or wheels of graders, tractors, high loaders or similar equipment. Random backfill shall be compacted until its density is equal to the density of surrounding material. All random backfill in traveled ways shall be placed in 6 inch lifts and compacted with hand or mechanical tampers to a density of 95 percent of maximum density as determined by ASTM D 698.

WATER PIPE, FITTINGS AND ACCESSORIES

1.0 APPLICABLE PUBLICATIONS:

The following publication form a part of these specifications to the extent indicated by references thereto. Only the most recent revisions of these publications shall be used.

1.1 American Society for Testing and Materials (ASTM):

A53	Welded And Seamless Steel Pipe
D3139	Joints For Plastic Pressure Pipes Using Flexible Elastomeric Seals

1.2 American Water Works Association (AWWA):

C 104	Cement-Mortar Lining For Ductile-Iron And Gray-Iron Pipe And Fittings For Water
C 110	Ductile-Iron And Gray-Iron Fittings, 3 Inch Through 48 Inch, For Water And Other Liquids
C 111	Rubber Gasket Joints For Ductile-Iron And Gray-Iron Pressure Pipe And Fittings
C 150	Thickness Design Of Ductile-Iron Pipe
C 151	Ductile-iron Pipe, Centrifugal Cast In Metal Molds or Sand-Lined Molds, For Water Or Other Liquids
C 509	Resilient-Seated Gate Valves, 3 Through 12 NPS, For Water And Sewage Systems
C 502	Fire Hydrants For Ordinary Water Works Service
C 600	Installation Of Cast Iron Water Mains
C 601	Disinfecting Water Mains
C 900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inch Through 12 Inch, For Water
C 902	Polybutylene (PB) Pressure Pipe, Tubing And Fittings, 1/2 Inch Through 3 Inch For Water

2.0 GENERAL:

These specifications include all material requirements for pipe, fittings and accessories, and their installation required completing the construction of the water system. Minimum size pipe shall be 6", except for service lines, unless directed otherwise by the District.

2.1 External load:

External load for pipe and fittings shall be determined by trench conditions as specified herein, depths as shown on the drawings or specified herein, soil density of 120 pounds per cubic foot, and H-20 truck wheel load.

3.0 MATERIALS:

Materials shall conform to the respective publications and other requirements specified herein.

3.1 Gray-iron fittings:

All gray-iron fittings shall be designed in accordance with and Shall conform to AWWA C I 10.

3.1.1 Wall thickness:

Fittings shall be suitable for a working pressure of 150 psig and trench conditions and depths as shown on the drawings and specified herein.

3.1.2 Joints:

Mechanical joints and push-on joints shall conform to AWWA C 111 with neoprene or synthetic rubber gaskets.

3.1.3 Lining:

Gray-iron fittings shall be lined with cement mortar in accordance with AWWA C 104 Bituminous coatings shall be manufacturer's standard.

3.1.4 Embedment:

Embedment shall be select backfill. Embedment shall include the area around the fitting from a point 3 inches below fitting to the fitting centerline. Rock trenches shall include an additional 3 inches of embedment beneath the fitting.

3.2 Ductile-iron pipe and fittings:

All ductile-iron pipe shall be designed in accordance with AWWA C 150. Ductile-iron pipe shall conform to AWWA C 151. Ductile-iron fittings shall be designed in accordance with and shall conform to AWWA C 110.

3.2.1 Wall thickness:

Wall thickness class shall be as determined by the applicable tables of the specified AWWA standards for ductile-iron pipe and fittings. Minimum wall thickness shall be Class 51 for 4-inch pipe and shall be Class 50 for all other pipe. Pipe and fittings shall be suitable for a working pressure of 150 psig, trench conditions as specified herein and depths as shown on the drawings or specified herein.

3.2.2 Joints:

Mechanical joints and push-on joints shall conform to AWWA C 111 with neoprene or synthetic rubber gaskets.

3.2.3 Lining:

Ductile-iron pipe and fittings shall be lined with cement mortar in accordance with AWWA C 104. Bituminous coatings shall be manufacturer's standard.

3.2.4 Embedment:

Embedment shall be select backfill. Embedment shall include the area around the pipe from a point 3 inches below the pipe to the pipe centerline. Rock trenches shall include an additional 3 inches of embedment beneath the pipe.

3.3 Plastic pipe:

Plastic pipe shall meet the requirements of Cell Classification 12454-6 for PVC compounds, AWWA C 900 with cast-iron pipe OD Materials from which the pipe is manufactured shall have been tested and approved for conveying potable water by the National Sanitation Foundation. The plastic pipe shall be suitable for a working pressure of 150psi. Where fittings are required, gray-iron or ductile-iron fittings shall be used. Tracer tape, in 3-inch widths, shall be installed in the trench on top of the select backfill.

3.3.1 Wall thickness:

Pipe wall thickness shall be as determined by the applicable tables in AWWA C 900 except that minimum wall thickness shall be as required to provide a DR of 18.

3.3.2 Joints:

Joints for PVC pipe shall be slip-on type with integral bell and spigot pipe meeting the requirements of ASTM D 3139.

3.3.3 Embedment:

Embedment shall be granular with a maximum size of 3/4". Embedment shall include the area around the pipe from a point 3 inches below the pipe to 6 inches above the top of the pipe. Embedment in rock trenches shall include an additional 3 inches beneath the pipe.

3.4 Copper tubing:

Copper tubing for services shall be designed in accordance with AWWA C 902. Tubing shall be suitable for 160 psig working pressure.

3.4.1 Wall thickness:

Tubing wall thickness shall be as determined by the applicable tables in AWWA C 902 except that minimum wall thickness shall be as required to provide a DR of 13.5.

3.4.2 Sizes:

All service lines shall be 3/4 inch for single meter sets and 1 inch for duplex meter sets except that ALL road crossings shall be 1 inch.

3.4.3 Fittings:

All fittings shall be brass compression fittings. Corporation stops and tapping saddles for tapping 6 inch and 8 inch plastic mains shall be as manufactured by Ford Meter Box Company.

3.4.4 Embedment:

Embedment shall be granular with a maximum size of 3/4". Embedment shall include the area around the pipe from a point 3 inches below the pipe to 6 inches above the top of the pipe. Embedment in rock trenches shall include an additional 3 inches beneath the pipe.

3.5 Sleeves:

All sleeves installed in bored or tunneled holes shall be steel pipe conforming to ASTM A 53. Unless shown otherwise on the drawings, steel sleeves shall have the following minimum wall thickness:

Sleeve Size	Minimum Wall Thickness
Diameter (inches)	Road & Highway Crossings
6, 8, 10 & 12	0.188 inches
14 & 16	0.188 inches
18	0.250 inches
20	0.250 inches
22	0.250 inches
24	0.281 inches
26	0.281 inches

3.6 Gate Valves:

All gate valves shall be resilient-seated iron body, bronze mounted, complying with AWWA C 509. Gate valves shall have "O"-ring type packing, non-rising stems, and mechanical joint ends. All gate valves shall open left (counter clock-wise). All buried gate valves shall be equipped with a square operating nut. Gate valves shall be installed so as to permit isolation of not more than 20 services or be spaced at 1200 feet, whichever is less. The District may require additional valves at intersections.

3.7 Valve extension stems:

When the distance from grade to the top of the operating nut exceeds 3 feet buried valves shall be provided with a valve stem extension.

3.8 Valve boxes and covers:

Valve boxes shall be constructed using a length of 6-inch pipe, cover and lid as shown on the included drawings. Valve covers and lids shall be Model 340-1 as manufactured by Bass and Hays Foundry Inc., of Grand Prairie, Texas.

3.9 Fire hydrants:

Fire hydrants shall be 3-way, dry-barrel type with 5-1/4" compression-type main valve conforming to AWWA C 502, improved type. Hydrants shall be equipped with dual 2-1/2" hose and a single 4-1/2" pumper outlet with National Standard threads. Main valve operating nut and outlet nozzle nuts shall be 1 - 1/2 inch pentagonal. Main valve shall be brass seated and open counter clockwise. Valve stem shall be equipped with "O"-ring seals. Base inlet connection of hydrant shall be 6-inch standard mechanical joint with strapping lugs. All hydrants shall be Mueller Centurion or American Darling B-62-6. Maximum spacing of hydrants shall be 600 feet.

3.10 Backflow Prevention Device:

All backflow prevention devices shall be Reduced Pressure Principle Backflow Preventer, Series 909 or an Atmospheric Vacuum Breaker, Model 288A or a Pressure Type Vacuum Breaker, Model 800, all as manufactured by Watts Regulator Company. These devices may be purchased from the District.

3.11 Hose Bibb Vacuum Breaker:

All hose bibb vacuum breakers shall be Hose Connection Vacuum Breakers, Model 8A for protected installations and Model NF8 for installations subject to freezing, as manufactured by Watts Regulator Company. These devices may be purchased from the District,

4.0 INSPECTION OF MATERIALS:

All pipe, fittings and other materials to be used in the construction shall be inspected by the District before being installed or used. The Developer shall furnish all necessary labor and equipment as requested by the District in his inspections and no pipe, fittings or other materials of construction shall be used or placed until they have been inspected and approved by the District.

5.0 INSTALLATION:

5.1 General:

All pipe, fittings and other accessories shall be carefully lowered into place, piece by piece, by means of derrick ropes or other suitable tools or equipment, in such manner as to prevent damage to pipe. Under no circumstances shall pipe or accessories be dropped or dumped. Any defective, damaged or unsound pipe shall be removed from the job site. All foreign matter or dirt shall be removed from the inside of the pipe before it is placed in position and it shall be kept clean by approved means during and after installation.

5.2 Pipe lying:

Pipe shall be laid so that the finished line has a smooth uniform alignment, free from sags, humps and sways. All exposed ends and openings to the pipe shall be suitably protected at all times and shall be closed to keep out all foreign matter. Only the "working end" of the line shall be open while pipe is being laid. A "night cap" shall be provided and kept in the end of the line at ALL times when pipe laying is not in progress.

5.2.1 Mechanical joint piping:

Installation of mechanical joint ductile-iron pipe shall conform to the following:

- After proper joint cleaning the rubber gasket and packing gland shall be in position on the spigot before shoving the pipe to its final position. It is important that the entering spigot is centered in and that the gland or follower ring is parallel to the face of the connecting bell. At joints where angular deflections are required, the gasket shall be shoved "home" and the gland properly positioned with respect to the connection bell, with the connecting pipes in as nearly perfect alignment as practicable. The bolts shall be slightly and uniformly tightened. Then the required deflection maybe made, after which the bolts shall be tightened.
- Immediately prior to connecting any two mechanical joint piping units, the gaskets shall be coated with lubricant and all surfaces of the bell, spigot, and gland which will come in contact with the gasket at any time during assembly shall be wire brushed, wiped clean, coated with lubricant, and the gland and gasket slipped over the spigot end of the pipe. The spigot shall then be inserted to the full depth of the socket and then retracted, (a) 1/8 inch in straight runs, or (b) one-half the amount of the calculated joint opening in the place of deflection (assuming that the pipe is shoved "home" and the amount of the retraction assured with the two connecting pipes in alignment).
- The gasket shall then be carefully pushed into position and evenly seated in the bell. The gland shall be shoved into place against the gasket, the bolts inserted and the nuts tightened with the fingers until snug. Final tightening of the bolts shall be done with a ratchet torque-wrench.

- It is essential that the gland be brought toward the pipe flange (bell face) evenly, maintaining approximately the same distance between the gland and the face of the bell at all points around its circumference. This may be done by partially tightening the bottom bolt, then the top bolt, next the bolts on either side, and finally the remaining bolts, alternately tightening bolts 180 degrees apart. This cycle is then to be repeated until all bolts are tightened to a torque for:
 - 5/8" bolts 40 to 60 foot pounds
 - 3/4" bolts 60 to 90 foot pounds
 - 1" bolts 70 to 100 foot pounds
 - 1-1/4" bolts 90 to 120 foot pounds
- If effective sealing is not obtained at the maximum torque specified for the size of bolt used, the joint shall be disassembled, thoroughly cleaned and reassembled.

5.2.2 Slip-on joint piping:

Installation of slip-on joint ductile-iron pipe shall conform to the following:

The joints shall be made by thoroughly brushing and cleaning the bell of the previously laid section and the spigot of the section to be laid, after which the bell, spigot and the rubber gasket shall be properly lubricated. The gaskets and lubricant shall be as recommended and supplied by the pipe fabricator. The lubricated gasket shall then be positioned in the groove of the bell-end of the pipe after which the spigot-end shall be entered into the bell of the previously laid pipe and carefully centered. The joint shall then be pushed "home".

5.2.3 Plastic pipe:

Plastic pipe shall be installed in strict accordance with the requirements of AWWA C 900, AWWA C 902 and instructions of the pipe manufacturer.

5.3 Sleeves:

Joints of the steel sleeve installed in the tunnel or bored hole shall be made by full-butt welds. After the sleeve is placed in the tunnel or bored hole, all void spaces between the steel sleeve and the surrounding soil shall be completely filled with Portland cement grout.

5.4 Pipe in sleeves:

Each end of each joint of pipe shall be protected prior to insertion in the sleeve, to prevent damage by abrasion. The pipe may be installed in the sleeve either by jacking or by pulling with a cable. The end of the pipe shall be protected for jacking or pulling by the use of heavy timbers or other suitable pads.

5.5 Valves:

All valves shall be set and jointed in the manner described for cleaning, laying and jointing pipe and as shown on the included Drawings. Valves shall be set vertically in horizontal pipelines. Valve covers, lids and stem extensions shall be installed and shall be supported and maintained, centered and plumb over the operating nut of the valve. The cover shall be set flush with surface of the ground or roadway.

5.6 Fittings:

All fittings shall be set and jointed in the manner described for cleaning, laying and jointing pipe. All fittings shall be provided with adequate backing. When a reducer is used in conjunction with a fitting, the backing shall be sized to conform to the larger-size pipe. Backing shall conform to AWWA C 600 and as shown on the included drawings.

5.7 Fire hydrants:

When installing hydrants, reaction backing shall be placed between the back of the elbow and the end of the trench. The bottom of the hydrant shall be placed on a flat stone slab approximately two feet square. Before backfilling the trench one cubic yard of coarse stone, approximately six inches in size, shall be placed around the hydrant. The weep holes of the hydrant shall be kept clear and free to drain. When placed behind curbs, the centerline of the hydrant shall be at least 24 Inches from the back of the curb. All

hydrants shall stand plumb with bottom- of lower nozzle maintained at least eighteen inches above ground. All new hydrant settings shall be made with the pumper nozzle facing the street. Installation shall be in accordance with the included Drawings.

5.8 Backflow Prevention Device:

The backflow prevention device shall be installed in strict accordance with manufacturer's instructions. The device may be installed either inside a protective structure or outside in an unprotected area. If installed outside, winter freeze protection shall be provided. The device shall NOT be installed in a pit and shall not be subject to flooding, under any circumstances. The device must be available for inspection and testing by District personnel at all times.

5.9 Hose Bibb Vacuum Breaker:

Hose bibb vacuum breakers shall be installed in strict accordance with manufacturer's instructions.

5.10 Tap Saddles:

All Tap Saddles shall be Double strap Bronze manufacture.

6.0 ACCEPTANCE TEST:

All carrier pipes shall be pressure tested prior to being placed into service. Pressure for the test shall be maintained at a minimum of 150 psi for at least two hours. Should the actual leakage exceed the allowable leakage as set forth in AWWA C 600, the test pressure shall be maintained for an additional period of time so that the location of the leak may be exposed. All exposed pipe, fittings and joints will be inspected and all evidence of leakage during the test shall be investigated by excavation where the pipe has been covered with backfill. A District representative shall witness testing.

7.0 DISINFECTION OF WATER MAINS:

In conjunction with or subsequent to the hydrostatic test, the Developer-Contractor shall disinfect the new water lines prior to placing them in service. Disinfecting shall be in accordance with AWWA C 601 except that disinfecting by the tablet method will not be permitted.

7.1 New mains:

7.1.1 Preliminary Flushing:

The water main shall be flushed prior to disinfecting. The flushing velocity shall be not less than 2.5 ft/sec. The rate of flow required to produce this velocity in various diameters is shown in Table 1 of AWWA C 601. No site for flushing should be chosen unless it has been determined that drainage is adequate at that site.

7.1.2 Form of chlorine for disinfecting:

The chlorine used for the disinfecting solutions shall be liquid chlorine or chlorine-water solutions made from calcium Hypochlorite or sodium Hypochlorite.

7.1.3 Method of chlorine application:

Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the newly laid pipeline. The water shall receive a dose of chlorine, also fed at a constant measured rate. Liquid chlorine shall be applied to the water main by using pressurized steel storage cylinders. Hypochlorite solutions shall be applied with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. Feed lines shall be of such material and strength as to withstand safely the maximum pressures that may be produced. The water and chlorine solution feed rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of 50 mg/ l available chlorine. To assure this concentration is maintained, the chlorine residual should be measured at regular intervals in accordance with the procedure described in the Appendix of AWWA C 601. Table 2 of AWWA C 601, gives the amount of chlorine required for each 100 ft. of pipe of various diameters. During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. Chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main

for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24 hour period, appurtenances. At the end of this 24-hour period, the treated water shall contain no less than 25 mg/ l chlorine throughout the length of the main.

7.1.4 Final flushing:

After the applicable retention period the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 mg/ 1. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline.

7.1.5 Sampling:

Subsequent to final flushing, samples shall be collected for bacteriological analysis to check the efficiency of the disinfecting procedure, which shall be repeated if contamination persists. A minimum of one sample for each 1000 feet of main will be required. The main shall not be placed in service until the District has approved the results of the bacteriological analysis.

7.2 Existing mains:

The procedures outlined in this section apply primarily when existing mains are wholly or partially dewatered for making connections to new water lines.

7.2.1 Trench treatment:

When existing lines are opened and the excavation may be contaminated from existing sewers, a liberal quantity of Hypochlorite shall be applied to lessen the danger of pollution.

7.2.2 Main disinfecting:

The interior of all pipe, valves, couplings and fittings for making a connection to an existing main shall be swabbed with a 5 percent Hypochlorite solution before they are installed. Flushing shall be started as soon as the connections are completed and continued until discolored water is eliminated.

8.0 SUBMITTALS:

The Developer-Contractor shall submit certified statements for material manufacturing and testing for all material. This statement shall certify that ALL material conforms to these specifications.

GRAVITY SANITARY SEWER MATERIALS AND CONSTRUCTION

1.0 APPLICABLE PUBLICATIONS:

The following publications forma part of these specifications to the extent indicated by references thereto. Only the most recent revisions of these publications shall be used.

1.1 American Society for Testing and Materials (ASTM):

A 48	Gray Iron Castings
A 53	Welded and Seamless Steel Pipe
C 12	Installing Vitrified Clay Sewer Pipe
C 32	Sewer and Manhole Brick (Made From Clay or Shale)
C 270	Mortar For Unit Masonry
C 425	Compression Joints For Vitrified Clay bell-And-Spigot Pipe
C 443	Joints For Circular Concrete Sewer And Culvert Pipe, Using Rubber Gaskets
C 478	Pre-cast Reinforced Concrete Manhole Sections
C 594	Compression Couplings For Vitrified Clay Plain-End Pipe
C 700	Extra Strength And Standard Strength Clay Pipe And Perforated Clay Pipe
D 1784	Rigid Poly (Vinyl Chloride) Compounds And Chlorinated Poly (Vinyl Chloride) Compounds
D 2321	Recommended Practice For Underground Installation Of Flexible Thermoplastic Sewer Pipe
D 3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe And Fittings
F 477	Elastomeric Seals (Gaskets) For Joining Plastic Pipe

1.2 American National Standards Institute (ANSI):

A 21.4	Cement-Mortar Lining For Cast Iron Pipe And Fittings For Water
A 21.10	Gray Iron And Ductile Iron Fittings, 2 Inch Through 48-Inch, For Water And Other Liquids
A 21.11	Rubber Gasket Joints For Cast Iron
A 21.50	Thickness Design Of Ductile Iron Pipe
A 21.51	Ductile Iron Pipe, Centrifugally Cast In Metal Molds Or Sand-Lined Molds, For Water or Other Liquids

2.0 GENERAL:

Gravity sanitary sewer construction shall include the furnishing and installation of pipe, joint materials, appurtenances Such as manholes and connections to the existing system as required.

2.1 Size and Slope:

The minimum size gravity sanitary sewer shall be 6-inch. All gravity sanitary sewers shall be designed and constructed with hydraulic slopes sufficient to give a velocity of between 2 feet per second and 10 feet per second. The grades shown in the following table shall be minimum acceptable slopes:

Size of Pipe Inches ID	Fall in Feet per 100 Feet
6	0.50
8	0.33
10	0.25
12	0.20

2.2 Alignment:

All gravity sanitary sewers shall be laid in a straight horizontal and vertical alignment between manholes.

2.3 Manhole spacing:

Maximum spacing between manholes shall be 400 feet. Manholes shall be constructed at all changes in alignment, slope, pipe diameter, pipe junctions and at the end of a] I sewer lines.

3.0 MATERIALS:

Materials shall conform to the respective specifications and other requirements specified below:

3.2 PVC sewer pipe:

Poly (Vinyl Chloride) (PVC) sewer pipe shall conform to the requirements of ASTM D 3034 Pipe and fittings shall be made of PVC plastic compound conforming to ASTM D 1784 as required by ASTM D 3034.

3.2.1 Wall thickness:

The minimum wall thickness shall be that resulting from a Standard Dimensional Ratio (SDR) of 35, except for 4" diameter pipe which shall be SDR 33.5.

3.2.2 Joints:

Joints for pipe and fittings shall be of the Elastomeric gasket type conforming to ASTM F 477.

3.2.3 Embedment:

Embedment shall be granular with a maximum size of 3/4". Embedment shall include the area around the pipe from a point 3 inches below the pipe to 6 inches above the top of the pipe. Embedment in rock trenches shall include an additional 3 inches beneath the pipe.

3.3 Ductile iron pipe:

All ductile iron pipe shall be designed in accordance with ANSI A 21.50. Ductile iron pipe shall conform to ANSI A 21.50. Ductile iron pipe shall conform to ANSI A21.21.

3.3.1 Wall thickness:

Minimum wall thickness class shall be as determined by the applicable tables of the specified ANSI standards for ductile iron pipe. Pipe shall be suitable for trench conditions and depths as shown on the drawings and specified herein.

3.3.2 Joints:

Push on joints shall conform to ANSI A 21.11 with neoprene or synthetic rubber gaskets.

3.3.3 Fittings:

Ductile iron fittings shall be designed in accordance with and shall conform to ANSI A 21.10.

3.3.4 Lining:

Ductile iron pipe shall be lined with cement mortar in accordance with ANSI A 21.4. Bituminous coatings shall be manufacturer's standard.

3.3.5 Embedment:

Embedment shall be select backfill. Embedment shall include the area around the pipe from a point 3 inches below the pipe to the pipe centerline. Rock trenches shall include an additional 3 inches of embedment beneath the pipe.

3.4 Sleeves:

All sleeves installed in bored or tunneled holes shall be steel pipe conforming to ASTM A 53. Unless shown otherwise on the drawings, steel sleeves shall have the following minimum all thickness.

SLEEVE SIZE	MINIMUM WALL THICKNESS
Diameter	Road & Highway Crossings
6, 8, 10 & 12 inches	0.188 inches
14 & 16 inches	0.188 inches
18	0.250 inches
20	0.250 inches
22	0.250 inches
24	0.281 inches
26	0.281 inches

3.5 Manholes:

Manholes may be constructed of brick, precast concrete with developed base or precast concrete without developed base. Manhole materials shall conform to the following:

3.5.2 Precast concrete manholes without developed base:

The precast concrete manholes shall conform to ASTM C 478. Joints between the riser sections shall be "0" ring joints conforming to ASTM C 443 or a double gasketed joint of flexible butyl rubber joint sealant.

3.5.3 Precast concrete manholes with developed base:

The precast concrete manhole shall conform to ASTM C 478. The developed base shall be poured monolithic with the bottom riser section. The base reinforcement shall be continuous with the reinforcement of the bottom riser section. The diameter of the base shall be 8 inches larger than the outside diameter of the bottom riser section. Joints between the riser sections shall be "0" ring joints conforming to ASTM C443 or a double gasketed joint of flexible butyl rubber joint sealant. Pipe opening shall be furnished with cast-in-place flexible entrance seals. ALOK flexible seals manufactured by A LOK corporation or Press Wedge I I manufactured by Press-Seal Gasket Corporation are approved.

3.5.4 Castings:

Manhole rings and lids shall be constructed of gray cast iron conforming to ASTM A 48. Castings for standard and shallow manholes shall be Bass and Hays Foundry, Pattern 300-24 manhole ring and cover.

3.5.5 Protective coating:

The protective coating for the exterior of manholes shall be Koppers Company, Inc. Bitumastic No. 50 or Tnemec Company, Inc. asphalt base foundation coat. Brick manholes shall be field coated. Precast manholes shall be shop coated.

4.0 INSTALLATION:

4.1 General:

All pipe, fittings and other accessories shall be carefully lowered into place, piece by piece, by means of derrick ropes or other suitable tools or equipment, in such manner as to prevent damage to pipe. Under no circumstances shall pipe or accessories be dropped or dumped. Before lowering and while suspended, the pipe shall be inspected for defects. Any defective, damaged or unsound pipe shall be removed from the job site. All foreign matter or dirt shall be removed from the inside of the pipe before it is placed in position and it shall be kept clean by approved means during and after installation.

4.2 Pipe laying:

Pipe laying shall proceed upgrade with the spigot end of the pipe pointing in the direction of flow. Pipe shall be laid so that the sewer has a uniform invert. All exposed ends and openings to the pipe shall be suitably protected at all times and shall be closed to keep out all foreign matter. Only the "working end" of the line shall be open while pipe is being laid. A "night cap" shall be provided and kept in the end of the line at ALL times when pipe laying is not in progress.

4.2.2 PVC sewer Pipe:

Installation of PVC sewer pipe shall conform to ASTM D 2321, Installation of PVC slip-on joint pipe shall be made by thoroughly brushing and cleaning the bell of the previously laid section and the spigot of the section to be laid. After which the bell, spigot and the rubber gasket shall be properly lubricated. The gaskets and lubricant shall be as recommended and supplied by the pipe fabricator. The lubricated gasket shall then be positioned in the groove of the bell-end of the pipe after which the spigot-end shall be entered into the bell of the previously laid pipe and carefully centered. The joint shall then be pushed "home".

4.2.3 Ductile iron slip-on joint piping:

Installation of slip-on joint ductile iron pipe shall be made by thoroughly brushing and cleaning the bell of the previously laid section and the spigot of the section to be laid, after which the bell, spigot and the rubber gasket shall be properly lubricated. The gaskets and lubricant shall be as recommended and

supplied by the pipe fabricator. The lubricated gasket shall then be positioned in the groove of the bell-end of the pipe after which the spigot-end shall be entered into the bell of the previously laid pipe and carefully centered. The joint shall then be pushed "home".

4.3 Sleeves:

Joints of the steel sleeve installed in the tunnel or bored hole shall be made by full butt welds. After the sleeve is placed in the tunnel or bored hole, all void spaces between the steel sleeve and surrounding soil shall be completely filled with Portland cement grout.

4.4 Pipe in sleeves:

Each end of each joint of pipe shall be protected prior to insertion into the sleeve, to prevent abrasion damage. The pipe may be installed in the sleeve either by jacking or by pulling with a cable. The end of the pipe shall be protected for jacking or pulling by the use of heavy timbers or other suitable pads.

4.5 Manholes:

Manholes shall be constructed of brick or precast concrete rings, with cast iron frames and covers as specified herein. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1-inch per foot nor more than 2 inches per foot.

4.5.1 Brick manholes:

Brick manholes shall be constructed on a cast-in-place concrete foundation slab. Mortar joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Manholes shall be plastered with 1/2 inch of mortar over the entire outside surface of the walls. Brick shall be laid radial with every sixth course laid as a stretcher course. Pipe connection to the manholes for all pipe, except iron, shall be made by placing a tight fitting rubber gasket around the outside of the pipe where the pipe enters the manhole. And then filling Road & Highway Crossings the void between the gasketed pipe and the manhole wall with non-shrink grout. The gasket shall be omitted for iron pipe. The exterior of the manholes shall be painted with two coats of protective coating to a total dry film thickness of 17-24 mils. The method of application shall conform to the recommendations of the paint manufacturer.

4.5.2 Precast concrete manholes without developed base:

Precast concrete manholes without a developed base shall be constructed on a cast-in-place concrete foundation slab. Pipe connection to the manholes for all pipe except iron shall be made by placing a tight fitting rubber gasket around the outside of the pipe where the pipe enters the manhole and then filling the void between the gasketed pipe and the manhole wall with non-shrink grout. The gasket shall be omitted for iron pipe. Gasketed joints between each riser section shall be installed in strict conformance with manufacturer's recommendations. Damaged exterior coating shall be field touched up prior to backfilling.

4.5.3 Precast concrete manholes with a developed base:

Precast manholes, with a developed base, shall be placed on a crushed rock base. The crushed rock base shall be graded smooth, level and to the correct grade. The bottom riser section shall be placed upon the crushed rock base and checked for alignment, elevation and plumbness. If not correct, the bottom riser section shall be completely removed from the excavation and the crushed stone base reshaped. Pipe connections to the manholes shall be in strict conformance with manufacturer's instructions for installation of the flexible entrance seals. Gasketed joints between each riser section shall be installed in strict conformance to manufacturer's recommendations. Damaged exterior coating shall be field touched up prior to backfilling.

4.5.4 Frames and covers:

Unless shown otherwise on the drawings, all castings shall be set flush with finish grade in all roadways, 2 inches above grade in lawns, and at least 12 inches above finish grade in all other areas.

4.5.5 Connections to existing manholes:

Pipe connections to existing manholes shall be made in such manner that the finish work will conform to the essential applicable requirements specified for new manholes, including all necessary concrete work, cutting and shaping.

5.0 Acceptance Tests:

Prior to acceptance of the sewers, both visual inspection and leakage tests must be satisfactorily completed. Inspections and testing shall be completed in the presence of a District inspector. Tests shall not be performed until after the completion of the installation of pipe and appurtenances and backfill of the trench.

5.1 Visual inspection:

All sewers shall be inspected to determine the presence of any misalign, displaced or broken pipe, any excessive pipe deflection, any infiltration or any other physical defects. All defects shall be satisfactorily corrected prior to conducting leakage tests.

5.2 Leakage tests:

All sewers shall be tested for leakage by use of water or air, at the Developer's option. Only one of the methods (water or air) shall be used throughout the project.

5.2.1 Water leakage test:

If the ground water level is at least 2 feet above the top of the sewer pipe, infiltration leakage test shall be used. If the ground water level is below 2 feet above the pipe, Exfiltration test shall be used,

5.2.1.1 Infiltration leakage test procedure:

Infiltration leakage test shall be performed on a] 1 sewer pipe when the ground water level is at least 2 feet above the top of the pipe. The test shall be maintained as long as necessary to locate all leaks, but not less than 2 hours. Repeat as necessary after repairs until measured leakage does not exceed 0.15 gallons per inch of internal diameter per hour per 100 feet of pipe length (200 gallons/inch I.D./day/mile).

5.2.1.2 Exfiltration leakage test procedure:

Exfiltration leakage test shall be performed on all sewer pipe when the ground water level is below 2 feet above the top of the sewer pipe. Exfiltration tests shall be performed with not less than 2 feet of head above the top of the pipe or above the water table, whichever is higher. The test shall be maintained as long as necessary to locate all leaks, but not less than 2 hours. Repeat as necessary after repairs until measured leakage does not exceed 0.15 gallons per inch of internal diameter per hour per 100 feet of pipe length (200 gallons/inch I.D./day/mile). Protect manholes and other structures by means of bulkheads to prevent bursting pressures from being applied to the inside surfaces of structures. Dewater pipe upon completion of testing.

5.2.2 Air leakage test:

All testing equipment including pipe and pipe connections, test pumping equipment, pressure gauges, bulkheads, pressure regulators and other materials and equipment shall be furnished. The length of line tested with one specific test shall be between manholes or structures.

5.2.2.1 Testing equipment:

All testing equipment used for air tests shall be standard equipment and materials except pressure gauges. Pressure gauges shall be 6 inch diameter with 0 to 15 psig range, 1 psig figure intervals, 0.05 psig minor subdivisions, bronze Bourdon tube, nylon or stainless steel movement and an accuracy within 0.25% of full scale range.

5.2.2.2 Test procedure:

Plug ends of line and cap or plug all connections to withstand internal pressure. A tap installed in a pipe plug shall make the test connection. After connecting air control equipment to the air hose, monitor air pressure so that internal pressure does not exceed 5.0 psig. After reaching 4.0 psig, throttle the air supply to maintain between 4.0 and 3.5 psig for at least 2 minutes in order to allow equilibrium between air

temperature and pipe walls. During this time, check all plugs to detect any leakage. If plugs are found to leak, bleed off air, tighten plugs, and again begin supplying air. After temperature has stabilized, the pressure is allowed to decrease to 3.5 psig. At 3.5 psig, begin timing to determine the time required for pressure to drop to 2.5 psig. If the time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than that shown in the following table, the pipe shall be presumed free of defects.

Pipe Size	Required Time Per 100 LF
8"	70 seconds
10"	110 seconds
12"	158 seconds
15"	248 seconds

If air test fails to meet above requirements, repeat test as necessary after all leaks and defects have been repaired. In areas where there is ground water the test shall be performed at 3.5 psi above the ground water head exerted to the top of the sewer pipe.

5.3 Deflection test:

All poly (vinyl chloride) sewer pipes shall be tested by pulling a mandrel through the entire length thereof. The test shall be conducted not less than one month after backfill has been properly installed. The maximum allowable deflection shall not exceed five percent of the pipe's base inside diameter. The diameter of the mandrel shall be five percent less than the base inside diameter of the pipe.

Pipe Diameter	Base Inside Diameter
8"	7.665"
10"	9.563"
12"	11.361"
15"	13.898"

Any pipeline found not conforming to these requirements shall be replaced.

6.0 SUBMITTALS:

The Developer-Contractor shall submit certified statements for material manufacturing and testing for all material. This statement shall certify that ALL material conforms to these specifications.

SANITARY SEWER SERVICE MATERIALS AND CONSTRUCTION

1.0 APPLICABLE PUBLICATIONS:

The following publications form a part of these specifications to the extent indicated by references thereto. Only the most recent revisions of these publications shall be used.

1.1 American Society for Testing and Materials (ASTM):

A 74	Cast-iron Soil Pipe and Fittings
C 12	Installing Vitrified Clay Sewer Pipe
C 425	Compression Joints For Vitrified Clay bell-And-Spigot Pipe
C 564	Rubber Gaskets For Cast-iron Soil Pipe And Fittings
C594	Compression Couplings For Vitrified Clay Plain-End Pipe
C 700	Extra Strength And Standard Strength Clay Pipe And Perforated Clay Pipe
D 1784	Rigid Poly (Vinyl Chloride) Compounds And Chlorinated Poly (Vinyl Chloride) Compounds
D 2321	Recommended Practice For Underground Installation Of Flexible Thermoplastic Sewer Pipe
D 3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe And Fittings
F 477	Elastomeric Seals (Gaskets) For Joining Plastic Pipe

1.2 American Water Works Association (AWWA):

C 104	Cement-Mortar Lining for Ductile-Iron and Gray-Iron Pipe and Fittings for Water
C 110	Ductile-Iron and Gray-Iron Fittings, 3 inch through 48 inch, for water and other liquids.
C 111	Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
C 150	Thickness Design of Ductile-Iron Pipe
C 151	Ductile-Iron Pipe, Centrifugally Cast in metal molds or sand-lined molds, for water or other Liquids

2.0 General:

These Specifications include material and construction requirements for construction of gravity sanitary sewer services.

2.1 Definitions:

A sanitary sewer service is defined as the drainage pipe from the foundation limit of a house, building or other structure to the sewerage system of the District.

2.2 Sizes:

The minimum sizes of sewer services shall be as follows:

Residential	4"
Commercial	6"

3.0 MATERIALS:

Materials shall conform to the respective specifications and other requirements specified below:

3.2 PVC sewer pipe:

Poly-Vinyl Chloride (PVC) sewer pipe shall conform to the requirements of ASTM D 3034. Pipe and fittings shall be made of PVC plastic compound conforming to ASTM D 1784 as required by ASTM D 3034,

3.2.1 Wall thickness:

The minimum wall thickness shall be that resulting from a Standard Dimensional Ratio (SDR) of 35, except for 4" diameter pipe which shall be SDR 33.5.

3.2.2 Joints:

Joints for pipe and fittings shall be of the Elastomeric gasket type conforming to ASTM F 477.

3.2.3 Embedment:

Embedment shall be granular with a maximum size of 3/4". Embedment shall include the area around the pipe from a point 3 inches below the pipe to 6 inches above the top of the pipe. Embedment in rock trenches shall include an additional 3 inches beneath the pipe.

3.3 Cast iron soil I pipe:

All cast iron soil pipe shall be designed and manufactured in accordance with ASTM A 74

3.3.1 Wall thickness:

Minimum wall thickness shall be determined by trench conditions specified herein and by depth of burial.

3.3.2 Joints:

Push-on joints shall conform to ASTM C 564 rubber gasket joint coupling.

3.3.3 Fittings:

Cast iron soil I pipe fittings shall be designed and manufactured in accordance with ASTM A 74.

3.3.4 Lining:

Cast iron soil pipe shall be lined with bituminous coating. Bituminous coating shall be manufacturer's standard.

3.3.5 Embedment:

Embedment shall be select backfill. Embedment shall include the area around the pipe from a point 3 inches below the pipe to the pipe centerline. Rock trenches shall include an additional 3 inches of embedment beneath the pipe.

3.4 Ductile iron pipe:

All ductile iron pipes shall be designed in accordance with AWWA C 150. Ductile iron pipe shall conform to AWWA C 15 1.

3.4.1 Wall thickness:

Minimum wall thickness class shall be as determined by the applicable tables of the specified AWWA standards for ductile iron pipe. Pipe shall be suitable for trench conditions and depths as shown on the drawings and specified herein.

3.4.2 Joints:

Push-on joints shall conform to AWWA C 111 with neoprene or synthetic rubber gaskets.

3.4.3 Fittings:

Ductile iron fittings shall be designed in accordance with and shall conform to AWWA C 110.

3.4.4 Lining:

Ductile iron pipe shall be lined with cement mortar in accordance with AWWA C 104 Bituminous coatings shall be manufacturer's standard.

3.4.5 Embedment:

Embedment shall be select backfill. Embedment shall include the area around the pipe from a point 3 inches below the pipe to the pipe centerline. Rock trenches shall include an additional 3 inches of embedment beneath the pipe.

3.5 Cleanouts:

Each sewer service line shall be provided with a cleanout at its connection to the structure waste outlet near the structure foundation. Each service line that is more than 90 feet in length shall be provided with a

cleanout for each 90 feet or fraction thereof. Each cleanout shall be provided with an airtight mechanical plug.

4.0 INSPECTION OF MATERIALS:

All pipe, fittings and other materials to be used in the construction shall be inspected by the District before being installed or used. The Developer-Contractor shall furnish all necessary labor and equipment as requested by the District in his inspections and no pipe, fittings or other materials of construction shall be used or placed until they have been inspected and approved by the District.

5.0 INSTALLATION:

5.1 General:

All pipe, fittings and other accessories shall be carefully lowered into place, piece by piece, by means of derrick ropes or other suitable tools or equipment, in such manner as to prevent damage to pipe. Under no circumstances shall pipe or accessories be dropped or dumped. Any defective, damaged or unsound pipe shall be removed from the job site.

All foreign matter or dirt shall be removed from the inside of the pipe before it is placed in position and it shall be kept clean during and after installation.

5.2 Pipe laying:

Pipe laying shall proceed upgrade with the spigot end of the pipe pointing in the direction of flow. Pipe shall be laid so that the sewer has a uniform invert. No bends or turns at any point shall be greater than 45 degrees. All exposed ends and open openings to the pipe shall be suitably protected at all times and shall be closed to keep out all foreign matter. Only the "working end" of the line shall be open while pipe is being laid. A "night cap" shall be provided and kept in the end of the line at ALL times when pipe laying is not in progress.

5.2.1 Vitrified clay Pipe:

Installation of vitrified clay pipe shall conform to ASTM C 12.

5.2.2 PVC sewer pipe:

Installation of PVC sewer pipe shall conform to ASTM D 2321. Installation of PVC slip-on joint pipe shall be made by thoroughly brushing and cleaning the bell of the previously laid section and the spigot of the section to be laid, after which the bell, spigot and the rubber gasket shall be properly lubricated. The gaskets and lubricant shall be as recommended and supplied by the pipe fabricator. The lubricated gasket shall then be positioned in the groove of the bell-end of the pipe after which the spigot-end shall be entered into the bell of the previously laid pipe and carefully centered. The joint shall then be pushed "home". Any joint with an improperly positioned gasket shall be remade so that the gasket is in proper position. A leaking joint discovered during testing will be evidence of a poorly made joint. Each defective joint discovered after the pipe has been laid shall be repaired by the Developer-Contractor.

5.2.3 Cast-iron soil pipe and ductile-iron pipe:

Installation of cast-iron soil pipe and ductile-iron pipe shall be made by thoroughly brushing and cleaning the bell of the previously laid section and the spigot of the section to be laid, after which the bell, spigot and the rubber gasket shall be properly lubricated. The gaskets and lubricant shall be as recommended and supplied by the pipe fabricator. The lubricated gasket shall then be positioned in the groove of the bell-end of the pipe after which the spigot-end shall be entered into the bell of the previously laid pipe and carefully centered. The joint shall then be pushed "home". Any joint with an improperly positioned gasket shall be remade so that the gasket is in proper position.

5.2.4 Wye branches or stub-outs:

All joints shall be watertight. Water tight adapters of a type compatible with the materials being joined shall be used at the point of connection of the sewer service line to the service stub-out or wye from the sewer main or lateral and to the structure waste outlet. PORTLAND CEMENT GROUT MATERIALS WILL NOT BE PERMITTED

5.2.5 Cleanouts:

Cleanouts shall be installed vertically above the flow line of the pipe except for wye branch Cleanouts at the end of the line.

5.3 Grades:

Minimum grades for service lines shall be as follows:

4 inch	12 inches of drop per 100 foot of length
6 inch	7 inches of drop per 100 foot of length
8 inch	5 inches of drop per 100 foot of length

Maximum grades for service lines shall be as follows:

4 inch	30 inches of drop per 100 foot of length
6 inch	18 inches of drop per 100 foot of length
8 inch	12 inches of drop per 100 foot of length

6.0 ACCEPTANCE TESTS:

Prior to acceptance of the sanitary sewer service both visual inspection and leakage tests must be satisfactorily completed. A District inspector shall witness testing. Tests shall not be performed until after the completion of the installation of pipe and appurtenances and backfill of the trench.

6.1 Visual inspection:

All sanitary sewer services shall be visually inspected to determine the presence of any misalign, displaced or broken pipe, any excessive pipe deflection, any infiltration or other physical defects. All defects shall be satisfactory corrected prior to backfill and conducting leakage tests.

6.2 Testing:

Testing shall consist of a water test. The water test shall require that a plug be inserted in the sewer service line at the test tee. The sewer service lines and the structure waste lines shall be filled with clear water up to the Level of the finished floor elevation of the foundation. After the District's inspector has determined the installation is water tight and that Exfiltration does not exist, the developer-Contractor shall remove the plug from the test tee and allow the test water to drain into the District's sewer system.

7.0 SUBMITTALS:

The developer-Contractor shall submit certified statements for material manufacturing and testing for all material. This statement shall certify that ALL material conforms to these specifications. The certification shall be submitted to the District prior to request for inspection of the installation.