WATER AND SANITARY SEWER
STANDARD SPECIFICATIONS

MERIDIAN
METROPOLITAN DISTRICT

12111 East Belford Avenue
Englewood, CO 80112
(303) 790-0345

September 5, 2024 - Update
July 10, 2020 - Update
January 2, 2019

MERIDIAN METROPOLITAN DISTRICT
WATER DISTRIBUTION SYSTEM

TABLE OF CONTENTS

MERIDIAN METROPOLITAN DISTRICT

MERIDIAN

06 WATER SERVICE INSTALLATION

07 WATER METER DESIGN CRITERIA

08 CROSS CONNECTION CONTROL CRITERIA

MERIDIAN
METROPOLITAN DISTRICT

WATER DISTRIBUTION SYSTEM

01 WATER MAIN DESIGN

A. Flow Design Criteria

Water system design shall be based on the hydraulic capacity of the system using the following criteria:

1. Domestic Demand Criteria

The domestic demand criteria are set forth in Table IV-I.

The criteria in Table IV-I are minimum criteria, and at the discretion of the District Engineer, different unit flow factors may be required.

The demand for Commercial/Industrial developments shall be based on the net footage of the building.

2. Irrigation Demand Criteria

All developments shall estimate its irrigation by completing an “Application for Site Connection and Service”. Demand criteria are contained within the application.

3. Fire Flow Criteria

Fire flow requirements shall be determined by South Metro Fire and Rescue and the current fire code.

Before final MMD acceptance, all utility plans shall have South Metro Fire and Rescue signature approving the required fire flow for the project.

MERIDIAN
METROPOLITAN DISTRICT

B. Hydraulic Design

1. Analysis Criteria

Water distribution systems shall be analyzed for pressure, velocities, head loss and surge allowance using a pipe network analysis methods. Surge allowance shall be calculated by using the guidelines set forth in AWWA C-900-75 Appendix A or Uni-Bell Handbook for the design and construction of PVC pipe.

The distribution system shall be sized to meet the following criteria:

Average Day Demand
Minimum Pressure: 60 psi
Maximum Pressure: 120 psi
Maximum Velocity: 5 ft/sec.
“C” Factor = 120 for 8” & 130 for 12” and Larger (all scenarios)

Maximum Day Demand (2.1 x Avg. Day) + Needed Fire Flow
Minimum Pressure: 20 psi
Maximum Pressure: 120 psi
Maximum Velocity: 10 ft/sec.

Peak Day Demand (4.94 x Avg. Day)
Minimum Pressure: 40 psi
Maximum Pressure: 120 psi
Maximum Velocity: 10 ft/sec.

Demand points for the Needed Fire Flow shall be determined from adjacent fire hydrants as outlined in Table IV-2. All fire hydrants shall meet the minimum criteria as noted above.

2. Water Line Looping

Water lines shall be looped so that no more than one fire hydrant is out of service at any time when any repair of the water line or an interruption of service occurs. No more than one fire hydrant or fire sprinkler system shall be installed on a single line that is not looped.

In the event that the looping is to be constructed as part of future phases, it shall be included as part of the pipe network analysis. Upsizing, at developer's cost, of distribution lines shall be required when the hydraulic analysis indicates that upsizing is needed for current or future phases to meet the hydraulic criteria for all construction phases.

C. Location and Alignment

I. Streets

Water mains shall be located within dedicated rights of way along an alignment that generally follows the roadway 6' inside of the flowline. On streets running north and south, the water line shall be placed on the east side of the street. On streets running east and west, the water line shall be placed on the north side of the street. On roadways which meander in each direction, the water line shall not zig-zag across the street.

2. Easements

When water mains cannot be located within dedicated right-of-ways, they shall be located within a dedicated easement at least 20' wide. Within residential developments, the easement shall be located within an open space tract. Under exceptional circumstances, the District Engineer may allow the easement to be located between two residential lots; however the easement shall be at least 20' wide. In some instances, additional width may be required in accordance with these specifications.

METROPOLITAN DISTRICT

The water main shall be placed 2' on either side the centerline of the easement with a minimum depth of cover of 4.5'. Horizontal deflections in water mains located in easements between lots are not permitted. Valves may be located in dedicated "open space" or "common" areas.

Grading within the District easement is permissible; however the side slope may not exceed a 4:1. The grade along the length of the easement may not exceed 5% unless otherwise approved by the District Engineer. Vehicle access must be maintained at all times. Curvilinear water mains are not permitted within easements.

When a water main crosses an existing or future open space drainageway, the line shall cross perpendicular to the drainageway or as close to perpendicular as feasible. If the slope of the drainageway downstream from the crossing exceeds a grade of 0.5 percent within 200' of the crossing, a cutoff wall, a minimum of 5' deep located 10' to 15' downstream from the crossing shall be required.

3. Alignment with other Utilities

In the event that a water main must cross a sanitary sewer or storm sewer main, the following criteria shall apply:

a. Horizontal

Water mains shall be located a minimum of 10' horizontally from existing or proposed sanitary and storm sewer lines (measured edge to edge).

b. Vertical

Where water mains cross sewers, they shall be installed to provide a vertical clearance above the sewer of at least 18" between the bottom of the water main and the top of the sewer line only if the lower utility is bedded in accordance with these specifications.

c. Water Lines Above

The water and sanitary sewer or storm sewer lines at the point of crossing must have proper bedding and compaction to assure the stability of both the water main and sewer line. If the vertical clearance is less than 18”, the sewer shall have a concrete cap constructed per the details.

d. Water Lines Below

The water and sanitary sewer or storm sewer lines at the point of crossing must have proper bedding and compaction to assure the stability of both water mains and sewer lines. If the vertical clearance exceeds 18", no special provisions shall apply. If the vertical clearance is less than 18" the sanitary sewer main shall be encased in concrete, for 10' on each side of the crossing and the storm sewer shall have a concrete cradle constructed from invert to springline across the width of the water main trench and 2' either side beyond the water main trench.

4. Straight Alignment

Straight alignments shall be permitted on in accordance with the criteria outlined in these specifications. The straight alignments shall follow the same location criteria set forth in these specifications.

5. Curvilinear Alignment

Curvilinear alignments shall be permitted only in accordance with the criteria outlined in these specifications. Curves shall be designed using "standard length" pipe. The field cutting of pipe to achieve a smaller radius shall not be permitted. Curvilinear alignments shall follow the same location criteria set forth in these specifications.

D. Materials

All materials for the water distribution system shall be in accordance with these specifications. Color of potable water pipe is blue (non-potable, irrigation & reclaim pipe is purple; sanitary sewer is green).

1. Sizing of Mains

Water mains shall be standard diameters of: 4", 6", 8", 10", & 12".

a. Ductile iron pipe may be used in all pressure zones.

b. DR 18 Class (150 PVC pipe) may be used in all pressure zones with a combined operating pressure and surge pressure of less than 150 psig.

c. DR 14 Class (200 PVC pipe) may be used in all pressure zones.

d. Water lines in side lots or tracts shall be a minimum of C-900 (Class 200 PVC or Class 50 DIP).

MERIDIAN METROPOLITAN DISTRICT

e. Water line depressions shall be a minimum of C-900 (Class 200 PVC or Class 50 DIP).

f. Fire hydrant leads shall be Class 50 DIP.

g. Fire suppression lines shall be Class 50 DIP.

E. Depth

All water mains shall be designed so that a minimum of 4.5' feet of cover shall exist over the top of pipe after final grade has been established. Where the water line is constructed in an easement between lots, the minimum depth shall be 6' from final grade to top of pipe. The maximum depth of a water main shall not exceed 10' to top of pipe after final grade has been established.

F. Valves

1. Placement Criteria

Valves shall be placed in the distribution system in accordance with the criteria below. These criteria shall be the minimum requirement and additional valves may be required where the District Engineer determines they are necessary. Valves shall be placed in the distribution system such that:

No more than 15 dwelling units will be out of service as a result of a single main break.

No adjacent fire hydrants or fire suppression system will be out of service as a result of a single main break.

No more than three valves shall be necessary to isolate a main.

The maximum spacing between valves on a single line shall not exceed 500' for mains 8" through 12" only.

Any connection to the transmission system (mains 16" diameter and larger will be a minimum of a 4-inch tap) shall have a means of isolation directly adjacent to the transmission line. If a connection results in an adjacent service and fire hydrant being out of service as a result of a transmission main break, an additional valve will be required on the transmission main.

Any future extensions of distribution lines may be accomplished without interruption of service.

When a water line is placed through a side lot easement or tract for the purpose of looping or connecting to an infrastructure water line, isolation valves shall be placed at the points of connection. No water services shall be permitted on this portion of the water line.

Valves may not be moved from the location shown on the approved Construction Drawings.

2. Location and Alignment

Valve locations shall be determined in accordance with the following:

a. At intersections, valves shall be located 2.5 feet from the center of the tee or cross to the center of the valve.

b. In the middle of blocks, valves shall be located along the projection of a property line, and adjacent to a fire hydrant.

MERIDIAN METROPOLITAN DISTRICT

c. Valves shall be located within paved areas at a minimum of 1' from the lip of the curb and gutter or the edge of pan on the street side.

d. Valves in landscaped or open space areas shall have an 18" round concrete collar poured around the box within a 12” SDR 35 form to be left in place.

e. When a water line is placed through a side lot easement or tract for the purpose of looping or connecting to an infrastructure water line, isolation valves shall be placed at the connection in the street and on the connection to the infrastructure line. No water services shall be permitted on this portion of the water line.

Exceptions to the above criteria may be permitted for wet taps or in areas where a valve would be deeper than 8'.

3. Resilient Wedge Gate Valves
Resilient wedge gate valves shall be installed on water mains 12" in diameter and smaller. Resilient wedge gate valves shall comply with all specifications.

4. Butterfly Valves
Butterfly valves shall be installed on water mains 16" in diameter and larger. Butterfly valves shall comply with all specifications.

5. Operators
All buried valves shall have standard AWWA 2" square operating nut. Valves located in vaults or meter pits shall have a hand-wheel operator. All valve operators shall open the valves by means of clockwise rotation (OPEN RIGHT) of the nut or hand-wheel. Blow off assemblies shall have a 2" brass nut attached with a brass cotter pin.

MERIDIAN
METROPOLITAN DISTRICT

6. Zone Valves
Zone valves located within a manhole shall have a 2" square operating nut centered in the manhole.

G. Fire Hydrants

The South Metro Fire and Rescue (SMFR) shall approve the number, location and spacing of fire hydrants. The SMFR will determine the required fire flows and locate the appropriate number of fire hydrants on the water main construction plans

Fire hydrants shall be located on the same side of the street as the water main. At intersections, fire hydrants will be located on the northeast corner. If hydrants are to be installed at locations other than street intersections, they shall be located along the projection of a property line.

The actual number and spacing of hydrants will depend on access road/parking lot configurations and the degree of hazard which the new development presents. Hydrants shall be no more than 400' apart in single-family residential areas, 400' apart in multi-family developments, and 300' apart in commercial or industrial areas.

Fire hydrants shall be at least 5' from the edge of any driveway. In the event that fire hydrants are located within parking lots or alleys without curbs, vertical steel pipe (minimum 4" diameter) barriers shall be placed around the fire hydrants. Fire hydrants located behind curbs and sidewalks shall be placed 18" behind the back of curb or sidewalk to the center of the

hydrant. The maximum allowable distance between tracer wire valve boxes shall not exceed 400'.

Fire hydrant branch lines shall be set at right angles to street mains. The branch line from the main to the fire hydrant may not exceed 25 feet unless otherwise approved by the District Engineer. Lines that exceed 25 foot in length would need to be upsized to the next normal pipe size and reduced adjacent to the isolation valve of the fire hydrant assembly. The hydrant shall be set at the end of the branch line and shall face the branch line. No horizontal or vertical bends or reducers shall be used in installing fire hydrant branch lines. Under no circumstances shall any size or manner of tap be made on a fire hydrant branch line.

Each hydrant shall be connected to the main with a 6" branch of ductile iron pipe controlled by an independent 6" gate valve and restrained to the tee on the main. The branch line and hydrant shoe shall be rodded to the main line tee and fire hydrant shall be thrust blocked. The entire hydrant shall be wrapped in plastic, including any extension installed on the hydrant to raise it to final grade.

Any fire hydrant within the District's service area shall be owned and maintained by the District, whether in public right-of-way or on private property, except where master meters are installed between the treatment plant and anyone or a group of fire hydrants. All hydrants connected to the mains of the District are provided for the primary purpose of furnishing water for fire suppressing and shall be opened and used only by persons authorized to do so by the District.

MERIDIAN

Any other use of fire hydrants shall be allowed by permit issued by MMD and shall require the use of a hydrant meter and regulating valve for the monitoring of water use. Authorized personnel shall make the connection and disconnection only. Rates to be charged for water extracted from each hydrant shall be in accordance with the current fee schedule.

Use of hydrant water shall cease for the duration of any fire within the District or for any other reason upon notice by the District. Any damage to the hydrant, hydrant meters or the contractor shall pay for other property of the District.

H. Fire Sprinkler Lines

Fire sprinkler lines shall be installed using ductile iron pipe at right angles to distribution mains and shall run straight from the main to the property line and from the property line to the proposed structure. No horizontal or vertical bends shall be permitted, except in the case of wet tap where the tap location conflicts with an existing pipe joint or where interference prohibits a straight line installation.

All fire sprinkler lines shall be 100% restrained from the main to the proposed structure by means of using restrained joint pipe, restraining rods, or other devices approved by the District Engineer. Tie-rod retaining clamps shall be placed at the bells of every second pipe or at a maximum distance of 40' to support the restrain rodding if used.

Post indicator valves are permissible; however, the District does not require them. A post indicator valve may be installed on the fire sprinkler line provided it is designed to operate in an open right position (clockwise) only.

I. Pressure Regulating Stations

Pressure regulating valve (PRV) stations are used to control pressures between distribution zones. When main extension plans are submitted for review, the need for a pressure regulating valve station shall be determined based on existing pressure zones and the impact on the proposed development. Pressure reducing and regulating valves shall be of a type capable of maintaining pre-adjusted downstream pressures with varying rates of flow and upstream pressure without causing water hammer. Four inch and larger pressure reducing valves shall have double pilots. Pressure reducing and regulating valves shall be installed in concrete vaults in accordance with the standard details.

J. Air and Vacuum Valves

Combination air and vacuum release valves shall be installed at each high point on all water mains of 6" diameter and larger. Air and vacuum release valves shall be installed in processed concrete manholes or vaults fitted with air vents.

K. Blowoff Assemblies

All water mains, which are not looped, shall have a blowoff assembly installed at the end of the main. Water mains located in cul-de-sacs that are designed as dead-end lines shall have a 2" assembly installed on the end plug in accordance with the standard detail drawing. Water mains which are part of phased construction and are, in effect, dead end lines until future looping shall have a 2" assembly installed on the main or on the end plug in accordance with the standard details.

In instances where the water mains are stubbed out for future phasing, the in-line valve shall be restrained from the tee to the valve, and sufficient pipe placed past the in line valve to prevent the valve from blowing off when the main is extended in the future.

MERIDIAN

L. Rods, Clamps and Restraining Devices

All bends, plug, reducers, fire hydrants, and fire suppression systems shall be rodded and clamped in accordance with the standard details. Rods and clamps shall be used on ductile iron and PVC pipe systems. Where mechanical joint pipe is used, rods may be bolted through the joint bolt holes in accordance with the standard details. All clamps shall be covered with an epoxy coating. In all cases where reducers with a reduction ratio equal to or greater than 2 to 1 are used, special rodding and clamping procedures shall be required.

M. Thrust Blocks

Concrete thrust blocks shall be installed at all tees, plugs, bends, and fire hydrants in accordance with the standard details. Where thrust blocks are used to block plugs or valves, the valves or plugs shall be protected from concrete by 8 mil polyethylene. Size of thrust block, type of concrete, and dimensions shall be in accordance with the standard details.

N. Wet Taps

When a connection is required on an existing distribution or transmission main, the District Engineer may require a wet tap. This determination is based on the effect any connection may have on the interruption of service to owners, the effect on the transmission system or the time restrictions involved with working in an existing street.

Wet taps shall be in accordance with specifications and the person actually making the tap shall be approved by the District Engineer.

The minimum size wet tap is 4" diameter and the maximum size wet tap is 12" diameter. The maximum size of the wet tap shall be limited to 75% of the nominal diameter of the distribution or

transmission main (i.e.: maximum diameter wet tap on 16" main is 12"). Wet taps shall not be permitted within 48" of a bell or coupling. Wet taps shall only use a flanged resilient wedge gate valve for tapping.

O. Limits of Accuracy (Allowable Error)

A limit of accuracy refers to the horizontal and vertical deviation permissible during the laying of water mains. The allowable error shall be a maximum of plus or minus 0.3' in a vertical direction, but no deviation will be allowed which results in less than 4.5' of cover. In a horizontal direction the allowable error shall be a maximum of 0.3'. Any line that does not meet these criteria shall be removed and re-laid. On curvilinear mains the maximum horizontal deflection shall not exceed plus or minus 0.3'.

02 WATER MAIN MATERIALS

All pipe materials used in the construction of the water system shall conform to the requirements specified herein. Any material proposed as an equal must be approved by the District in writing prior to construction. All materials furnished shall be new and undamaged. All installations shall be constructed in accordance with these specifications. All necessary pipes, joints and appurtenances shall be furnished and installed whether shown on approved construction drawings or not. All installations shall be completed as fully operable.

A. Ductile Iron Pipe

1. Manufacture

Ductile iron pipe shall be manufactured in strict accordance with AWWA Standard Specification C151.

MERIDIAN

2. Size of Pipe

This specification shall cover all sizes of ductile iron pipe 12" in diameter and smaller.

3. Joint Type

All ductile iron pipe joints shall be "push on joint single gasket" or "mechanical joints single gasket". The rubber gasket shall conform to the requirements of AWWA C111.

4. Thickness Class

Pipe furnished shall be Class 50 for all diameter sizes 6" through 16”. Pipe furnished shall be Class 51 for diameter sizes 4” & 20”. The preceding classes are minimum and higher classes may be required.

5. Laying Length

Pipe furnished shall have a normal laying length of 18' or 20'.

Grade of Iron

Iron used in the manufacture of pipe shall have 60/42/10 iron strength.

Cement Mortar Lining

All pipe furnished shall have standard thickness cement mortar lining in accordance with AWWA C104.

B. Polyvinyl Chloride Pipe - PVC

1. Manufacture

All polyvinyl chloride pipe shall be manufactured in strict accordance with AWWA Standard C900-75.

2. Size of Pipe
This specification shall cover all sizes of PVC pipe 12" and smaller.

3. Joint Type
Joints shall use a standard elastomeric joint.

4. Thickness Class
Pipe furnished under this specification shall have a DR ratio of 18 (235 PSI) or DR ratio of 14 (305 PSI).

5. Laying Lengths
Pipe shall have a normal laying length of 20'.

C. Use of Water Line Materials
Water mains shall be: 4", 6", 8", 10", and 12".

The hydraulic analysis criteria shall control the size of all water mains. Four-inch mains may be required in cul-de-sacs serving eight or fewer residences. Six-inch mains may be used in accordance within the limits of the hydraulic analysis criteria.

Fire hydrants shall not be connected to a 4" main. Only one fire hydrant may be connected to a 6" main. Six and 8" mains that exceed 600' in length shall be looped.

1. Ductile iron or DR 14 (305 PSI) pipe may be used in all pressure zones.
2. DR 18 Class (235 PSI) pipe shall be used in all pressure zones with a static pressure less than 100 psig.
3. Water line depressions shall be a minimum of C-900 (DR 14 or Class 50 DIP).

MERIDIAN
METROPOLITAN DISTRICT

D. Tapping Requirements
See Table IV-6.

E. Water Main Fittings
1. Fittings shall be ductile iron mechanical joint, Class 250 or 350. Class 250 fittings shall conform to AWWA C110 and C111. Class 350 fittings shall conform to AWWA C111 and C153. All fittings shall have cement-mortar lining in accordance with AWWA C104 and shall have a factory-applied seal coat of bituminous material. All rods, bolts and nuts shall be fabricated from a low alloy, high strength steel known in the industry as "Cor-Ten", "US Alloy" or approved equal.

2. All bends shall be restrained by means of a Meg-a-lug or approved equal restraint device.

3. Solid sleeve fittings shall be restrained with Meg-a-lugs or approved equal restraint device.

F. Resilient Wedge Gate Valves
All gate valves shall be resilient seated, cast iron body, with a non-rising stem. Gate valves shall conform to AWWA C509, with a minimum working pressure of 200 PSI. Valve stems shall be sealed with two "O" rings, each of which shall be designed as to allow replacement under full line pressure when the valve is in the full open position. Valves shall have 2" square operating nut and shall open by turning the nut clockwise.

All buried gate valves shall have mechanical joint ends in conformance with AWWA C111. Tee-head bolts and hexagon nuts shall be fabricated from a high strength, low alloy steel known

in the industry as "Cor-Ten", "US Alloy", or approved equal. Gate valves shall have flanged ends sized and drilled in accordance with ANSI-B16.1 Class 125. Flanges shall be machined to a flat face with a finish of 250 micro-inches, AARH maximum or machined to a flat surface with a serrated finish in accordance with AWWA C207.

All gate valves shall have the year of manufacture cast as part of the valve body. Any valve that is more than two (2) calendar years old shall not be installed unless approved in writing by the District Engineer.

The following resilient wedge gate valves have been approved for installation within the District:
-Mueller
-Clow
-APC
-Waterous
-U.S. Pipe Metro Seal

G. Tapping Valves

Tapping valves shall be resilient wedge gate valves with centering ring on flanged face of valve, for proper alignment. Tapping valves shall conform to these specifications.

H. Butterfly Valves

All butterfly valves shall conform to AWWA C504 and shall be Class 150B. Valves shall be furnished with manual operators designed and sized to develop output torques for Class 150B operating service and shall be sufficient to seat, unseat and rigidly hold the disc in any intermediate position for the above conditions. In addition, the operator shall be designed for buried service and to operate indefinitely in a fully buried condition. The operator shall be equipped with a standard AWWA 2" square operating nut. The valve shall open with a clockwise rotation of the nut. The operator shall be capable of withstanding an overload input torque of 300 foot-pounds at full open or closed position without damage to the valve or valve operator. All gearing shall be totally enclosed and sealed from ground water. The operator shall be designed to resist submergence in water to 25' head pressure. The gear case shall be filled with lubricant to 80% of full prior to installation. The lubricant shall be formulated for a temperature range of -10° Fahrenheit to 150^{o} Fahrenheit. The maximum input torque required to fully open or close the valve for Class 150B conditions shall not exceed 150 foot-pounds when applied to the operating nut.

All buried butterfly valves shall have mechanical joint ends in conformance with AWWA C111. Tee-head bolts and hexagon nuts shall be fabricated from high strength low alloy steel known in the industry as "Cor-Ten", "US Alloy" or approved equal. When specified, butterfly valves shall have flanged ends sized and drilled in accordance with ANSI-B16.1 Class 125. Flanges shall be machined to a flat face with a finish of 250 micro-inches, AARH maximum or machined to a flat surface with a serrated finish in accordance with AWWA C207.

The following butterfly valves have been approved for installation within the District:
-Mueller
-M&H
-Pratt

I. Pressure Reducing and Regulating Valve

All pressure reducing valves shall be Cla-Val 90-01 series or an approved equal. The pressure reducing valve shall be hydraulically operated with a free floating guided piston having a seat diameter equal to the size of the valve. The valve shall be fully bronze mounted and all packing

shall have rubber seals to provide tight closure and prevent metal to metal friction. An indicator rod shall be furnished as an integral part of the valve to show the position of the piston within the valve body. The valve shall be designed to provide an access opening in the valve body for removing the piston and other internal parts without removing the main valve body from the line.

Material for valve body shall be cast-iron. Flanges and covers shall conform to ASTM Standard Designation A48. Bronze castings or parts for internal trim shall conform to ASTM Standard B61.

All valves shall be furnished with flanged ends and drilled in accordance with ANSI B-16.1 Class 125 specifications. Flanges shall be machined to a flat face or machined to a flat surface with a serrated finish in accordance with AWWA Standard C-207.

The pilot valve for controlling operation of the main valve shall be a single seated, diaphragm operated and spring loaded type. The pilot valve shall be attached to the main valve with piping and isolation valves arranged for easy access in making adjustments and for removal from the main valve while the main valve is under pressure. Pilot control system shall be cast bronzed ASTM B-62 with 303 stainless steel trim. The needle valve shall be all bronze and included with the main valve to control the speed of piston travel.

The operating pressure shall be 150 psi.

The body of the pressure reducing valve shall be given and withstand a hydrostatic test of 50 percent more than the operating pressure specified. A second test to check seating of the cylinder shall be made at the operating pressure.

MERIDIAN

All pressure reducing and regulating valves shall be installed in concrete vaults, as shown in Standard Details.

All pressure reducing and regulating valves shall be certified by the manufacturer that the assembly has been inspected and all of the specified tests have been performed. A copy of the certification shall be sent to the District Engineer upon request.

J. Swing Check Valves

Swing check valves shall be manufactured in accordance with AWWA Standard C508, with the following additional requirements or exceptions.

All valves shall be iron body, fully bronze mounted, metal to metal seating and the disc shall be swing type.

All check valves shall be installed in vaults in a horizontal position with exterior lever and adjustable spring operation.

The operating pressure shall be 175 psi.

Bolts and hex nuts used for attaching top cap to the body shall be the manufacturer's standard fabrication from low alloy steel for corrosion resistance. The flat gasket, either ring type or full faced type, required at the body and cap connection shall be fabricated from compressed asbestos sheet with a rubber compound binder.

All check valves shall be furnished with flanged ends. The size and drilling shall be in accordance with ANSI B-16.1 Class 125 specifications. Flanges shall be machined to a flat face or machined to a flat surface with a serrated finish in accordance with AWWA Standard C207.

K. Fire Hydrants

Fire hydrants shall be Waterous Pacer 150 or Mueller Centurion, open left, and the threaded hose connections shall be 2 ½" nominal diameter with 4 ½ threads per inch on the steamer nozzle, in compliance with South Metro Fire and Rescue requirements. Fire hydrant assemblies shall include all pipe, fittings, open right valves, and materials necessary to install the hydrant complete and in place. All hydrants are to be painted Waterous Hydrant Color Meridian Tan #4168 or MMD pre-approved equal (see Page 44 for specification).

L. Valve Boxes

Valve boxes shall be the three piece adjustable screw type 6" in diameter, manufactured by the Tyler Pipe Company series #6860 with # 160 oval base or an approved equal. Valve box covers shall be marked with the word "WATER" and shall have a lip or flange extending into the valve box shaft. No slip-type boxes will be allowed. The valve box shall be of a design which will not transmit shock or stress to the valve and shall be centered and plumb over the operating nut of the valve with the box cover ¼" below the surface of the pavement.

M. Polyethylene Wrapping

Polyethylene wrapping manufactured in accordance with AWWA specification C105, shall be installed around all ductile iron pipe, fittings, valves, fire hydrant barrels, and rods and clamps. The minimum thickness shall be 8 mils. The doubling of thinner material is not permitted.

N. Combination Air Relief-Vacuum Breaker Assemblies

1. Air Release Valves

Air and vacuum release valves shall have cast-iron bodies, stainless-steel float and working parts and shall conform to APCO 143C, or equal. All pipe and fittings used in the relief valve system shall be copper and/or brass and connections shall be threaded.

2. Vault

The vault shall be a 60" diameter precast concrete manhole with 24" manhole grade rings, frame and cover. Grade beams shall be precast concrete with dimensions of 12" by 9" by 8' long.

3. Vent Piping

Vent piping below ground shall be 6" nominal diameter, PVC pipe, Schedule 40. Above ground piping shall be a Husky Residential Street Vent or an approved equal. The exterior shall be black, see standard details.

O. Tapping Sleeves

1. Tapping sleeves shall utilize steel plate conforming to ASTM Designation A36 or A285, Grade C. Flanges shall be fabricated from steel plate, and all dimensions shall conform to AWWA Standard C207, "Steel Pipe Flanges," Class D. Flanges shall be machined to a flat rate with finish of 250 micro-inches or machined to a flat surface with a serrated finish in accordance with AWWA Standard C207, "Steel Pipe Flanges". In addition, the machined face shall also be recessed for tapping valves in accordance with the MSS Standard SP60.

   Gaskets shall be compounded from new materials, and the shape of cross-section of gasket shall provide adequate seal for the design pressure. Gaskets shall be shop glued to the groove provided in the body section.

   Bolts and hex nuts shall be stainless steel or low alloy high strength steel known as Cor-Ten.

A ¾” NPT welded coupling shall be attached to the outlet nozzle or each tapping sleeve assembly complete with a ¾” square head pipe plug.

All surfaces of the sleeve shall be clean, dry and free from grease and dirt before painting. All surfaces of tapping sleeve except the face of the flange, bolts and nuts, shall be given a shop coat of manufacturer's standard coating along with a fusion bonded epoxy coating. The face of the flanges shall be shop coated with a rust preventive compound, such as Dearborn Chemical "No-Ox-Id" Houghton "Rust-Veto 344", or Rust-Oleum "R9" or an approved equal.

2. Stainless Steel Sleeve

All stainless steel tapping sleeves shall be fabricated from Grade 18-8 Type 304 stainless steel. All welds shall be chemically treated to prevent contamination of the surface.

Flanges shall be fabricated from high tensile ductile (nodular) iron, ASTM A536-80, grade 65-45-12 and AWWA C207 Class D ANSI 150 lb drilling. Bolt holes shall straddle the pipe centerline. In addition, the machined face shall be recessed for tapping valves in accordance with the MSS Standard SP-60.

Gaskets shall be virgin GPR or SBR compounded for water service and conform to ASTM D2000-80M 4AA607. Gaskets shall be full circle and shop glued to the body of the sleeve.

Bolts and hex nuts shall be 18-8 Stainless Steel NC threads. Bolt threads shall be fluorocarbon coated to prevent galling. The use of low alloy, high strength steel bolts, known as Cor-Ten is also acceptable.

A ¾” NPT welded coupling shall be attached to the outlet nozzle of each tapping sleeve assembly complete with a ¾” square head pipe plug.

MERIDIAN

P. Rods and Clamps

Harness rods shall be mild steel conforming to ASTM A-36 with hex nuts conforming to ASTM A-307, Grade A or B, Hexagon heavy series. The number and size of rods shall be as indicated in the Standard Details.

Q. Pipe Restraint

1. Ductile Iron Pipe

Mechanical joint restraint shall consist of a majority of single activated griping surfaces to maximize restraint of the pipe. Glands shall be manufactured of Ductile-iron conforming to ASTM A536-80. The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized mechanical joint bell conforming to the current requirements of ANSI/AWWA A21.11 C111 and ANSI/AWWA A21.53/C153. Twist-off nuts, sized same as tee-head bolts, shall be used to insure proper actuating of restraining devices. The mechanical joint restraint shall have a working pressure of at least 100 psi with a minimum safety factor of 2:1 and shall be Meg-a-lug Series 1100, Uni-Flange Series 1400 or a pre-approved equal.

2. PVC Pipe

Mechanical joint restraint shall consist of a majority of single activated gripping surfaces to maximize restraint of the pipe. Glands shall be manufactured of ductile-iron conforming to ASTM A536-80. The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized mechanical joint bell conforming to the current requirements of ANSI/AWWA A21.11 C111 and ANSI/AWWA A21.53/C153. Twist-off nuts, sized the same as tee-head bolts, shall be used to insure proper actuating of restraining

devices. The restraining glands shall have a pressure rating equal to that of the PVC pipe on which it is used and shall be Meg-a-Iug Series 2000, Uni-Flange Series 1500 or a pre-approved equal.

3. Bolt Through Restraint

Bolt through MJ restraints may be used in the jointing of two MJ fittings when a combination of two fittings is required. Adaptors shall be manufactured of Ductile-iron conforming to ASTM A536-80. Adaptors shall be Foster as manufactured by In-fact Manufacturing or pre-approved equal.

4. Solid Sleeves

Two solid sleeves shall be used when making a connection to an existing water main to install a branch line either the same size or smaller.

R. Thrust Blocks

Concrete thrust blocks shall be installed at all tees, plugs, bends greater than 5^{o}, fire hydrants or where designated on the plans in accordance with the standard details. Size of thrust block and dimensions shall be in accordance with standard details. Thrust blocks shall be constructed of concrete (minimum strength of 4000 psi after 28 days) as defined in these specifications and standard details.

S. Pre-Cast Concrete Vaults and Manholes

Precast vaults and manholes shall conform to the size, shape, form, and details shown on the standard details. Concrete for precast manhole units shall be concrete defined in these specifications (minimum strength of 4000 psi after 28 days). The precast cylinder units, the precast concrete taper sections, and precast eccentric cone sections shall meet the strength requirements for ASTM C478. All vaults and manholes shall be adequate to withstand AASHTO HS20 loading and shall be designed in accordance with ACI 301. All structures not specified in the standard details shall be submitted to the Engineer for acceptance as a shop drawing at least 3 weeks prior to installation. A minimum amount of steel hoops of No 4 wire shall be cast into each unit at adequate spacing for handling. A flexible plastic joint sealing compound shall be used on the tongue and the groove between each manhole section to provide a watertight joint.

T. Pipe Encasement

All concrete encasements shall be reinforced in accordance with the applicable standard detail. Concrete for encasement shall be (minimum strength of 4000 psi after 28 days) as defined in these specifications.

U. Concrete

Minimum strength concrete, described below, shall be used for all cast in place and precast concrete structures. The concrete shall have a maximum allowable water/cement (w/c) ratio of 0.50 by weight. The w/c ratio may be increased to 0.56 by weight by the addition of an approved water reducing agent (WRA) conforming to ASTM Designation C-494 Type A. The WRA, in suitably diluted form, may be added to water containing an air-entraining agent for the batch providing the materials are compatible with each other. If the two are incompatible, they shall be introduced separately.

The concrete shall have a minimum 28 day compressive strength of 4,000 psi for cast in place structure and a minimum 28 day compressive strength of 4,000 psi for pre-cast structures.

A minimum of 10 days prior to starting concrete work, the contractor shall submit to the Engineer for review samples of the various aggregates to be used in the final mix and the concrete mix

proposed to be use. The source of each sample of aggregate shall be stated. After approval of the aggregates and concrete mix, neither the source of aggregates nor the mix of the concrete shall be changed without written approval of the Engineer.

V. Concrete Reinforcement

All deformed reinforcing bars shall conform to ASTM Standard A-615, Grade 40 or 50, or ASTM Standard A-617, Grade 40 or 60. All welded steel wire fabric shall conform to ASTM Standard A-185 except that the weld shear strength requirement shall be extended to include a wire size differential up to and including six gauges.

W. Manhole Rings and Covers

Manhole rings and covers shall be cast iron in accordance with ASTM A48, Class 35
B. Twenty four inch diameter assemblies shall be the "Denver heavy" style with a combined weight of not less than 400 pounds (approximate distribution: Frame 235 lbs., Lid 165 lbs.). Covers shall be manufactured as shown on the standard details with the appropriate lettering and checkered pattern. All bearing surfaces shall be machined to the tolerances shown on the construction drawings. Manhole lifting holes shall be manufactured with an elongated oval hole per standard detail. Manhole lids with more than one lifting hole shall not be accepted. Rim elevation shall be 4" to 8" above grade in open space and shall be 0 to ½" below grade of any finished surface.

X. Bedding Material

Pipe bedding shall be defined as that portion of the pipe zone which extends from 6" below the bottom of the pipe to 12" above the top and along the sides of the pipe. The contractor shall provide certified test results of the bedding material confirming compliance with the following standards and a sample of the bedding material.

1. Squeegee Bedding

Squeegee bedding shall be used for the bedding of Ductile Iron water main and PVC water main. Squeegee bedding shall conform to the following limits when tested by means of laboratory sieves:

Sieve Size	Total Percent Passing by Weight
3/8"	100%
No.4	60%-90%
No.8	0%-45%
No. 50	0%-6%
No. 100	0%-6%
No. 200	0%-2%

MERIDIAN

2. Crushed Rock Bedding

Crushed rock bedding shall be used for all bedding of PVC sanitary sewer main. Crushed rock bedding shall be clean, crushed aggregate, conforming to ASTM D448 as follows:

Sieve Size	Total Percent by Weight
1”	100%
¾”	90%-100%
3/8”	20%-55%
No.4	0%-10%
No.8	0%-5%

3. Concrete Cradle Bedding

Concrete Cradle Bedding - Concrete cradle bedding shall be used only when approved by the District Engineer. The pipe shall be bedded in non-reinforced concrete having a minimum thickness of one-fourth of the inside pipe diameter or a minimum of 6" whichever is greater under the pipe bottom and extending up the sides to the horizontal center of the pipe ("spring line"). The backfill above the cradle shall be compacted to obtain a Standard Proctor density of 90% (AASHTO T99), and shall extend 12" above the crown of the pipe. Where blasting is likely in the vicinity, the concrete cradle shall be cushioned from the shock of the blasting that can be transmitted through the rock.

Flowable Fill Bedding

Flowable Fill Bedding shall conform to the following mix proportions per cubic yard:

MERIDIAN
METROPOLITAN DISTRICT

Cement	ASTM C-150	42 lbs.
Sand	ASTM C-33	1,845 lbs.
Size 57% Aggregate	ASTM C-33	1,700 lbs.
AEA	ASTM C-260	5 oz.
Water	ASTM C-94	325 lbs. (39.0 gal)

Note: Air entraining agent is used to increase flowability.

This bedding shall have a maximum 28 day compressive strength of 60 psi. Flowable fill shall be Mobile Premix Identification No. 0934 or approved equal.

Y. Damp-proofing for Buried Vaults

All exterior surfaces for pressure reducing vaults shall be covered with emulsified asphalt coating as manufactured by Celotex Building Products or approved equal.

Z. Flexible Plastic Joint Sealing Compound

Pre-forming flexible plastic joint sealing compound shall meet Federal Specification SS-S00210 and AASHTO M 198 75 1, Type B. The sealing compound shall show no visible deterioration when immersed separately in a solution of acid, alkalize and saturated hydrogen sulfide for a period of 30 days. The plastic gasket shall be "Ram-Nek" as manufactured by KT Snyder Company or an approved equal.

03 WATER MAIN INSTALLATION

A. Excavation

1. Limits of Excavation
   Except with the written approval of the District Engineer, the maximum length of open trench shall be 600', or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is less. The distance is the collective length at any location, including open excavation, pipe laying and appurtenances and backfill that have not been brought to finished grade. No trench shall be left open at any time that construction operations are not ongoing.

2. Trench Width
   Trenches shall be excavated so that a minimum clearance of 6" shall be maintained around the pipe for proper placement and densification of the bedding and backfill material. The maximum trench width, measured at the top of the pipe shall be the outside diameter plus 24". The District Engineer may require installation of a higher class pipe for any trenches in excess of this width.

3. Tunneling and Boring
   Tunneling or boring may be permitted when approved by the District Engineer and, if boring is to occur within Douglas County right-of-way, the Douglas County Public Works Department. If the earth in the tunnel sloughs off, the roof of the tunnel shall be broken down, and the trench excavated as an open trench.

MERIDIAN
METROPOLITAN DISTRICT

4. Trench Support
   All excavations shall be properly sloped and supported as required by State and Federal Laws.

5. Grading and Stockpiling
   Stockpiling and grading shall be controlled to prevent water from flowing into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water can flow uninterrupted into existing gutters, other surface drains or temporary drains. Excavated material shall not be placed or stockpiled closer than 2' from the top edge of the trench.

6. Dewatering (CDPHE Dewatering Permit may be required)
   Ample devices shall be provided at all times to promptly remove and dispose of all water from any source entering the trench or structure excavation. Dewatering may be accomplished by the use of well points, sump pumps, rock or gravel drains placed below sub-grade foundations or subsurface pipe drains. Water shall be disposed of in a suitable manner without damaging adjacent property or endangering public health or safety. The water shall not be drained into work completed or under construction. The dewatering operation shall continue until such time that, in the opinion of the District Engineer, it is safe to allow the water table to rise. Pipe trenches shall contain sufficient backfill to prevent pipe flotation. Contractor is solely responsible for acquiring and complying with all necessary permits for dewatering.

7. Blasting
   Blasting will be allowed only if permitted by the District Engineer, Fire Marshall, and appropriate Douglas County authorities. Occupants of nearby structures of facilities must be notified in writing at least 72 hours in advance of blasting. The notice shall state the date, the

time of blasting and who is responsible for the blasting. The District shall fix the hours of blasting.

All explosives and appurtenances shall be transported, handled, stored and used in accordance with the laws of the local, state and federal governments, as applicable.

If, in the sole opinion of the District Engineer, blasting is liable to damage rock foundations or supports, concrete or structures, all blasting shall be terminated and excavation shall be continued by jack hammering, barring, wedging or other methods.

B. Pipe Foundations and Bedding

1. Pipe Foundation

The trench bottom shall be excavated at least 6" below the bottom of the pipe.
Before the pipe is laid, the foundation shall be prepared by backfilling with bedding material conforming to these specifications. The bedding shall be thoroughly tamped to achieve a relative density of 70% (ASTM 02049).

Where rock is encountered during excavation, it shall be removed below the pipe and the trench backfilled with bedding material to provide a compacted foundation cushion with minimum thickness of 12" below the pipe bell. Any ledge rock, boulders and large stones encountered shall be removed to provide a clearance of at least 12" below and on the side of the pipe and fittings.

If the bottom of the excavation is soft or unstable, and in the opinion of the District Engineer, cannot satisfactorily support the pipe or structure, additional excavation on the bottom and sides of the trench may be required. The excavation shall continue until in the opinion of the District Engineer, the foundation can be backfilled with crushed rock uniformly graded between ¾” and 1 1/2” to provide an adequate foundation for the pipe or structure. Once the pipe has been installed, the District Engineer may require the same crushed rock bedding in the pipe zone if migration of the finer bedding is likely to occur.

2. Pipe Bedding

Pipe shall be centered in the trench, adjusted to line and grade and the pipe bedding shall be placed so as not to disturb alignment or grade. The bedding material shall be sliced under the haunches of the pipe to fill all voids. The slicing shall be performed when the bedding material is no higher than one fourth of the pipe diameter.

The pipe shall be bedded as shown in the bedding standard detail. Each joint shall be recessed in bedding material in such a manner as to relieve the bell or coupling of the pipe of all load and to insure continuous bearing along the pipe barrel upon the pipe foundation.

The pipe bedding, using squeegee conforming to these specifications, shall be placed from the pipe foundation to a point 6" minimum above the top of pipe and compacted to the requirements set forth in these specifications. Backfilling shall be carried on simultaneously on each side of the pipe to assure proper protection and alignment of the pipe.

C. Trench Backfilling and Compaction

All trenches shall be backfilled after pipe, fittings, and appurtenances have been installed, inspected and approved by the District Engineer. Bedding and "pipe zone" backfill shall be installed in accordance with these specifications.

1. Procedure within the Pipe Zone

The bedding material within the pipe zone shall be compacted to a relative density of 70% (ASTM D2049). When backfilling within the pipe zone, special care shall be exercised to prevent settling or lateral movement of the pipe. To safeguard against movement of pipelines, backfill shall be placed in layers not exceeding 12" in thickness. Each layer shall be thoroughly compacted with hand-operated, power driven tampers.

2. Compaction above the Pipe Zone

The backfill material from the pipe zone to the proposed finished grade shall be compacted to a Standard Proctor density of 95% (ASTM D698) at near optimum moisture content. In existing or proposed roadways all backfill material from the pipe zone to the road sub-grade shall be compacted in accordance with the requirements of the Douglas County Highway Department. Backfill to be compacted by heavy compaction equipment shall be placed in uniform horizontal lifts not exceeding 24" prior to compaction. Heavy compaction equipment shall not be used closer than 3' to walls at the top of any structure nor closer than 3' to the top of the pipe. Before each lift is compacted, the material therein shall be brought within 1% above or 3% below the optimum moisture content for the specified compaction. Backfilling shall be done with material free of rubbish, frozen debris, oil cake, bituminous pavement, concrete, rock or other lump materials. Material of organic, spongy or otherwise improper nature shall not be used in backfilling and no material greater than 4" in any dimension shall be placed within 1' of any manhole or structure. All backfill material shall be subject to the approval of the District Engineer and the Douglas County Highway Inspector.

3. Compaction Tests

Compaction tests shall be taken at locations designated by the geotechnical engineer and tested by an approved testing laboratory. All expenses involved in these tests shall be borne by the contractor. Copies of test results shall be provided to the District Engineer.

MERIDIAN

In all cases where the tests indicate compaction less than that required in these specifications, additional compaction and tests will be required until these specifications are met. Final acceptance of the lines by the District will be contingent upon satisfactory compaction results. No testing of the pipeline shall be allowed until compaction meets standard specifications.

4. Final Clean up

After backfill and compaction has been completed, the surface shall be dressed smooth and graded to a condition to the satisfaction of the District Engineer.

D. Installation of Water Main

1. General

Pipe shall be installed to the lines and grades as shown on the approved plans to form a closed joint with the adjoining pipe and prevent sudden offsets of the line. Deflections of pipe joints shall be within the pipe manufacturer's deflection tolerances. The interior of the water pipe shall be cleaned as the work progresses.

At any time when pipe installation is not in progress, including work breaks, the noon hour and overnight, the open end of the pipe shall be closed with a tight fitting cap or plug to prevent the entrance of dirt and debris into the pipe.

All water lines shall have a minimum of 4.5' and a maximum of 10' of cover from finished grade.

Whenever obstructions not shown on the plans are encountered during the progress of the work and interfere to such an extent that an alteration in the approved plans is required, work shall proceed only after the District Engineer approves the deviation.

All pipe and fittings shall be carefully examined for cracks and other defects before installation. All lumps, blisters and excessive coating shall be removed from the bell or coupling and spigot ends of each pipe and the outside of the spigot end of each pipe. The outside of the spigot and the inside of the bell or coupling shall be wire brushed and wiped clean. The District Engineer who may require repairs or reject the pipe shall lay defective pipe or fittings aside for inspection.

All pipe, fittings, valves and hydrants shall be carefully lowered into the trench to prevent damage to the water main materials, protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.

2. Ductile Iron Pipe

Ductile iron pipe shall be delivered, handled and installed in accordance with AWWA C600 and these specifications.

a. Push-on Joint Pipe

The inside of the bell or coupling and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating and other debris. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket, or the coupling end of the pipe. A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the outside of the spigot end of the pipe or both. Gasket lubricant shall be supplied and approved by the pipe manufacturer. The spigot end of the pipe shall be placed into the bell or coupling end without touching the ground with the spigot end after cleaning. The joint shall then be completed by pushing the plain end to the bottom of the socket with a smooth steady motion. Stabbing of pipe shall not be permitted.

Pipe shall be marked with a depth mark to insure that the spigot end is inserted to the full depth of the joint. Painting a depth mark at the appropriate location on the pipe shall mark field-cut pipe lengths. The spigot end shall be ground or filed to resemble manufactured pipe end. Any damage or spalling of the cement mortar lining shall be repaired with a coal tar epoxy compound.

Deflecting push-on joint pipe to form a long radius curve shall not exceed the maximum limits shown in Table IV-3.

b. Mechanical Joint

The last 8" of the outside spigot and inside bell of mechanical joint pipe shall be thoroughly cleaned to remove oil, grease, grit, excess coating and other debris from the joint and painted with a soap solution made by dissolving 1/2 cup of liquid soap in 1 gallon of water. The cast iron gland shall be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket, or bell end. The rubber gasket shall be painted with the soap solution and placed on the spigot end with the thick edge towards the gland. The entire section of pipe shall be pushed forward to seat the spigot end in the bell. The gasket shall then be pressed into place within the bell. The gasket shall be seated evenly around the entire joint. The cast iron gland shall be moved along the pipe into position for bolting, all of the bolts inserted, and the nuts screwed hand tight. All nuts shall be tightened with a torque limiting wrench. The torque for various sizes of bolts shall be as follows:

MERIDIAN METROPOLITAN DISTRICT

Pipe Size (inches)	Bolt Size (inches)	Range of Torque (ft-lbs)
3	5/8	45-60
4-24	¾	75-90
3-36	1	100-120
42-48	1 ¼	120-150

Nuts spaced 180^{o} apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland. Whenever it is desirable to deflect mechanical joint pipe in order to form a long radius curve, the amount of deflection shall not exceed the maximum limits shown in the specifications.

3. Polyvinyl Chloride Pipe

Polyvinyl chloride pipe shall be installed in accordance with AWWA Manual M23, the manufacturer's recommendation, and these specifications.

Pipe stored outside which will not be laid within 10 days shall be covered with an opaque material to prevent exposure to sunlight. Clear plastic sheets shall not be used. Both ends of the pipe shall be clear to allow for air circulation under the covering.

Immediately before joining two lengths of PVC pipe, the inside of the bell or coupling, the outside of the spigot and the elastomeric gasket shall be thoroughly cleaned. Lubrication of the joint and rubber gasket shall be done in accordance with the manufacturer's specifications.

Care shall be taken that only the correct elastomeric gasket, compatible with the annular groove of the bell, is used. Insertion of the elastomeric gasket in the annular groove of the bell or coupling must be in accordance with the manufacturer's recommendations. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint. The spigot and bell or coupling shall be aligned and pushed until the reference line on the spigot is flush with the end of the bell or coupling. Pushing shall be done in a smooth, steady motion.

E. Installation of tracer wire for PVC pipe

The installation of all PVC water line shall require tracer wire 12 gauge strand copper, with water tight insulation for direct bury. The copper wire shall be taped to the top of the pipe at four foot intervals and brought to the surface at the tracer wire valve box that is located immediately behind all fire hydrants.

F. Installation of Polyethylene Wrapping

All ductile iron pipe, valves and fittings shall be wrapped with polyethylene wrapping, minimum 8 mil thickness in accordance with AWWA C600.

A polyethylene tube which is approximately 2' longer than the pipe shall be slipped over the plain end and leaving it bunched up accordion style prior to the installation of the pipe in the trench.

After the pipe has been assembled in the trench, each joint shall be overlapped by pulling one bunched-up tube over the bell, folding it around the adjacent plain end, and securing it in place with three wraps of 2" wide, 10 mil thickness polyethylene adhesive tape, the polyethylene wrapping at the center of the pipe shall be bunched up and secured with three wraps of tape. Repeating the same procedure with the bunched-up tube on the adjacent pipe shall complete the overlap. Any rips, punctures or other damage to the polyethylene shall be repaired with tape or by cutting open a short length of tube, wrapping it around the pipe and securing with tape.

Tees, valves, crosses, fire hydrants and other fittings shall be wrapped with a flat sheet obtained by splitting open a length of polyethylene tube. The sheet shall pass under the valve or fitting and be wrapped up around the body. The seams shall be secured firmly with polyethylene adhesive tape.

Polyethylene encasement tube shall conform to the following minimum size:

Nominal Pipe Diameter	Flat Tube Width
6"	20"
8"	24"
12"	30"

G. Installation of Valves and Valve Boxes

Valves shall be handled in such a manner as to prevent any injury or damage. All joints shall be thoroughly cleaned before installation. Valves shall be located as specified on the construction drawings.

Valves shall be set and jointed to pipe in the manner previously specified for cleaning, laying and jointing of mechanical joints. Valves shall be set in such a manner that the valve stems are plumb. Valves shall be wrapped with polyethylene encasement material to protect the mechanical joint and valve body.

If requested by the District Engineer, valves shall be operated prior to installation to verify good operating condition.

When butterfly valves are installed on mains 16" diameter and larger, the valve operator shall be placed on the north side of mains running predominately east-west and on the east side of mains running predominately north-south.

A valve box shall be provided for every valve. The valve box shall not transmit shock or stress to the valve, and shall be centered and plumb over the wrench nut of the valve, with the box cover set to the elevation determined by the developer's Engineer. It shall be the responsibility of the contractor to insure that valve boxes are plumb and raised to the proper elevation.

H. Installation of Fittings

All fittings shall be mechanical joint connections and installed in compliance with these specifications. Fittings shall be wrapped with a polyethylene encasement material in conformance with these specifications. All tees, valves, fittings and bends shall have Meg-a-lug type restraint glands and thrust blocks in conformance with these specifications.

I. Installation of Tapping Sleeves ("Wet Tap")

Tapping sleeves shall be used where indicated on the construction drawings when a connection is required to an existing main that cannot be taken out of service. The tapping sleeve shall be manufactured for the specific outside diameter (OD) of the existing main and shall conform to these specifications. A tapping sleeve shall not be installed closer than 48" from a bell or coupling. The tapping sleeve and valve shall a slope of 0% from the main.

All excess debris, uneven coating or other material which may interfere with the sealing of the saddle shall be removed from the existing main prior to the bolting of the saddle. Once the saddle has been completely bolted and prior to the actual tapping operation, the saddle shall be

MERIDIAN METROPOLITAN DISTRICT

air-tested with soap at the joints in order to check for leaks. If any leak, however small cannot be stopped, the actual tapping operation shall not be permitted.

Upon completion of the tap, the tapping sleeve and valve shall be wrapped in polyethylene in conformance with these Standard Specifications and a thrust block shall be poured behind the tapping sleeve. The entire excavation shall be backfilled in accordance with these specifications or as otherwise specified by the Douglas County Highway Department. All excavation, shoring, dewatering, permitting, traffic control and backfill shall be the responsibility of the contractor.

J. Installation of Fire Hydrants

All hydrants shall stand plumb and shall have the steamer nozzle facing the main at a right angle to the main. Fire hydrants located behind curbs and sidewalk shall be placed 18" behind the back of curb or sidewalk to the center of the hydrant.

Hydrants shall be set to finished grade such that the elevation of the center of the traffic flange is not more than 6" nor less than 4" finished grade or top of sidewalk. In the event that a hydrant must be raised to meet the standard details, an approved barrel extension kit supplied by the manufacturer shall be used. When the barrel is raised, the breakaway coupling on the operating stem shall also be raised so that it matches the new elevation of the traffic flange. The maximum height of extension shall be 18". In the event extensions are required in excess of the 18" limit, a new hydrant shall be installed which was manufactured for the required depth of bury.

Each hydrant shall be connected to the main with a 6" branch line of ductile iron pipe controlled by an independent 6" gate valve rodded to the tee on the main, a swivel adapter or a locked hydrant tee. The branch line shall be rodded and the entire assembly including the hydrant shall be restrained with eye bolts and wrapped with polyethylene. The hydrant shoe and main line tee shall be thrust blocked in accordance with these specifications. The weep holes on the hydrant shoe may not be plugged with the polyethylene or thrust block.

MERIDIAN

A drainage pit 3' in width and 3' deep shall be excavated below each hydrant and filled with ¾" crushed rock. Crushed rock shall be used around the shoe of each hydrant and to a level 6" above the top of the pipe lateral.

Upon completion of installation, each hydrant shall be tested for leaks by closing all nozzle caps and turning the operating nut to full open. There shall be no leaks visible from the caps, traffic flange, bonnet or surfacing from the weep holes upon completion of the leakage test, the operating nut shall be closed and a cap removed to allow the hydrant to drain. If the hydrant fails to drain properly, the hydrant shall be excavated to check the weep holes.

K. Installation of Blowoff Assemblies

Blowoff assemblies shall be installed to provide an outlet for flushing dead-end mains or for venting air during construction. All blowoffs shall be constructed of brass or copper. No galvanized or black iron materials are permitted.

Blowoffs shall be constructed of 2" copper and brass and shall conform to the Standard Details. A minimum separation of 18" (5'6" preferred) is required between the operating valve and the standpipe. A slip-type cover shall be placed over the stand pipe immediately upon installation in order to prevent debris from entering the pipe. Rods and clamps shall be used to restrain at least 40' of pipe.

Blowoff assembly valve boxes shall conform to the standard details.

Valves shall conform with these specifications.

L. Installation of Thrust Blocks

1. Installation

Thrust blocks shall be constructed at all blends and fittings which require support due to unbalanced line thrust. Outlets, bolts, nuts, clamps or other fittings shall not be blocked or made inaccessible. A bond breaker shall be placed between the pipe and the thrust block. If a large thrust block is to be poured, it shall be separated into sections by a suitable material. The sizes and shape of thrust blocks shall be in accordance with the standard details.

Bearing surface areas are minimum areas to bear against the undisturbed trench wall. If, in the opinion of the District Engineer, the soil bearing capacity is not sufficient to provide adequate restraint based on minimum bearing area shown on the standard details, then the minimum bearing area shall be increased to a size that will ensure adequate restraint. In every instance, the thrust block shall bear against undisturbed earth. When it is impossible, through over excavation or other cause, to pour a thrust block against undisturbed earth, harness rods shall be required to anchor the fittings to the main in accordance with the direction of the District Engineer.

Concrete for thrust blocks shall meet these these specifications. Before placing concrete, all equipment for mixing and transporting the concrete shall be clean. All debris, water or ice shall be removed from the excavation to be occupied by the concrete. Concrete shall not be placed on frozen sub-grade. Concrete shall be inspected by the District Engineer prior to backfill.

MERIDIAN

2. Form Work for Thrust Blocks

All forming for concrete thrust blocks and anchors will be done by bulk heading around the shape of the thrust block or anchor with wood, burlap, or reinforced paper sacks filled with sand or earth.

Sacks shall be of a size easily handled when full, and shall be left in place in the trench. Wood forms shall be removed before backfilling.

If the main must be placed immediately into service, harness rods may be used in lieu of thrust blocks or wood may be used to form up thrust blocks. Wood forms shall be of such design as to support the thrust until the concrete has set and shall not be considered a substitute for the concrete thrust block.

No horizontal struts or braces required for trench shoring shall remain in the concrete thrust blocks. Prior to placing concrete, The District Engineer shall inspect the forms.

When concrete is deposited against ground without the use of forms, the ground shall be thoroughly moistened or other provisions made to prevent the ground from drawing water from the concrete.

3. Minimum Curing Time

Newly placed concrete shall be allowed to cure for a minimum of 24 hours.

4. Compaction of Fill over Thrust Blocks

Backfill may be placed over thrust blocks once the surface has set. However, no tamping or compacting shall be allowed above or around the thrust block for a minimum of 24 hours after placement.

M. Protection of Water Lines near Sanitary and Storm Sewer Facilities

In the event that a water main must cross a sanitary sewer or storm sewer main, the following criteria shall apply:

1. Horizontal

Water mains shall be located a minimum of 10' horizontally from existing or proposed sanitary and storm sewer lines (measured edge to edge).

2. Vertical

Where water mains cross sewers, they shall, be installed to provide a vertical clearance above the sewer of at least 18" between the bottom of the water main and the top of the sewer. In exceptional circumstances, the District Engineer may pre-approve a crossing of less than 18" but only if the lower utility is bedded in accordance with these specifications and the water line shall be DIP for at least 10' on both sides of the crossing.

No water main shall pass through or come within 10' horizontally from any part of a sewer or sewer manhole (measured edge to edge).

N. Hydrostatic Testing of Water Mains

1. General

No hydrostatic tests shall be made on any portion of the pipeline until all field placed concrete has had adequate curing time and all compaction test results have been submitted to and approved by the District Engineer. All pressure and leakage tests shall be in accordance with AWWA C600 for ductile iron mains and AWWA Manual M23 for PVC mains. The District Engineer shall be notified 24 hours in advance of any testing and all testing shall be performed in the presence of the District Engineer. No service taps shall be permitted until the main has passed the required hydrostatic and disinfection testing. All discarded testing water shall be placed into the sanitary sewer system with District pre-approval.

METROPOLITAN DISTRICT

2. Standards

The specified test pressure shall be 1.25 times the operating pressure at the highest point along the test section or 150 psi, whichever is greater. Under no circumstances shall the test pressure exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.

Leakage shall be determined by the formula:

$L=(S)(D)(p^{0.5})/133,200$

Where S=Length of pipe in feet
D=Diameter in inches
p= Pressure in psi

3. Procedure

Each valved section of pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory to the District Engineer.

The pump, pipe connection, gauges, water meter and all other necessary equipment and personnel to complete the test shall be furnished by the contractor and shall be reviewed by the District Engineer prior to testing. Barrels and buckets shall not be acceptable to measure

water loss. An assembly that includes a clean vessel and a certified meter shall be used. If the material is found to be inadequate, testing shall be postponed until acceptable materials are provided. All corporation cocks and taps to the main line and all connection piping and valves required to make the test, whether or not specified or shown on the construction drawings shall be installed at the expense of the contractor.

Before applying the specified test pressure, all air shall be expelled from the pipe. In pipe sizes 6" and larger, hydrants can be used for venting if air valves have not been installed. All fire hydrant branch valves and all stub out isolation valves shall be opened for the pressure test. During the test, the pressure in the main shall not vary by more than ± 5 psi from the specified test pressure. If the pressure should drop below the 5 psi allowance during the test, the main shall be pumped back up to the specified pressure and the test repeated.

4. Acceptance

Any cracked or defective pipe, fittings, valves or hydrants discovered as a result of the pressure test shall be removed and replaced with sound materials and the test shall be repeated until the results meet the standard details set forth herein.

The pipe installation will not be accepted if the leakage exceeds the amount as defined in the formula in these specifications. If any test of pipe has a greater leakage as defined in the formula, the defective joints or pipes shall be located and repaired until the leakage test is acceptable. All visible leaks are to be repaired regardless of the amount of leakage.

O. Disinfection of Water Mains

1. General

Each section of water supply line shall be disinfected with chlorine and then flushed before acceptance for domestic service. Disinfection shall be in accordance with AWWA 601-81 and the requirements of the Colorado Department of Health. All discarded testing water shall be placed into the sanitary sewer system with District pre-approval.

MERIDIAN METROPOLITAN DISTRICT

2. Procedure

Disinfection shall be accomplished using tablet form hypochlorite (AWWA B300) or Liquid Chlorine (AWWA B301). Tablets shall be affixed to the inside top of each joint of pipe with an approved adhesive (Permatex #1 or equivalent). Dosage shall be calculated for an initial dosage of at least 50 ppm (see table below). After slowly filling the line, the chlorine solution shall remain in contact with the pipe for a minimum of 24 hours. At the conclusion of the 24-hour period, the solution shall be tested to determine if there is a residual chlorine level of at least 50 ppm. If such concentration exists, the line shall be flushed. If the residual concentration is below 50 ppm, the line shall be re-chlorinated.

Recommended Hypochlorite Table Dosage*					
Section (feet)	4" Pipe Diameter	6" Pipe Diameter	8" Pipe Diameter	10" Pipe Diameter	12" Pipe Diameter
18	1	2	4	6	8
20	1	2	4	6	8

*Number of tablets (5 grams) per length of pipe for dosage of 50 ppm

After the chlorine test has been passed, the line shall be flushed with potable water until the residual chlorine content does not exceed the distribution system levels.

Prior to discharge of the chlorinated water a reducing agent shall be added to the water in the tested section to neutralize the chlorine residual remaining **in** the water. Such reducing agents are identified in AWWA CM 6-1-81.

Twenty-four hours after flushing, personnel from the District shall take samples from the main to test for bacteriological contamination (clearwater test). Once the samples have been determined to be free from any bacteriological contamination, the District Engineer shall notify District Operations Personnel that the main may be opened to the system. Under no circumstances may the tested main be opened to the existing system by anyone other than authorized District personnel.

04 WATER SERVICE LINE DESIGN

A. Flow Design Criteria

Design flows shall be based on an analysis by the developer's Professional Engineer (PE). Flows shall be established in accordance with the recommendations set forth in the American Water Works Association's Manual No. M22, "Sizing Water Service Lines and Meters".

The developer's PE shall specify water conservation devices and fixtures for all facilities in accordance with the Rules and Regulations of the District.

B. Hydraulic Design

Water service lines shall be designed to deliver the maximum flow at an acceptable pressure within the building. Hydraulic losses shall be calculated for: the friction head within the pipe; losses due to valves, meters and other appurtenances; elevation head loss and any other parameters deemed significant by the developer's PE.

C. Sizing

Water service lines and meter shall be the same size. Exceptions may be granted if a letter requesting a variance is sent to the District Engineer prior to the approval of the drawings.

In the event that a water service stub was previously installed to the property line that is larger than is needed by the owner, an independent connection shall be made to the stub and the remainder of the service line shall be the same size as the meter.

Service lines that are intended to be used for two or more separate meter installations may be larger than the individual meters that the line is serving. This combined service arrangement is acceptable in the following applications: independent domestic and irrigation meters, commercial buildings with multiple meters and townhomes/condominiums with multiple meters.

Water service lines which exceed 100' in length may be increased by one pipe diameter larger than the water meter pending District pre-approval.

The developer's PE shall submit a detailed analysis of demands and the hydraulic calculations to support the sizing of the meters and/or service lines.

The minimum service line size shall be ¾”

D. Location and Alignment

Each single family residential detached and attached dwelling unit shall have a separate water service line and meter. Townhomes, condominiums and apartments which are designed to utilize common plumbing within the structure may have a single service line.

Service lines shall follow a straight horizontal alignment between the outlet of the building plumbing and the tap on the distribution main. The service line shall follow an alignment perpendicular to the main, with the exception of cul-de-sacs. At the end of cul-de-sacs, the distribution main shall not be more than 50' from the front property line of any lot.

Water service lines may be placed in a common trench with a sewer service line under the following conditions:

1. The water service line shall be 2" and smaller and type "K" copper.

2. The sub-grade bench for the water service line shall be undisturbed soil with a minimum width of 12".

3. The top of the sanitary sewer service line shall be located a minimum of 18" below the water service bench.

Water service lines shall be located in the center of the property. The shut off valve shall be located within the dedicated 5' easement at the front of the lot or in a public right-of-way. Service lines may not cross private property unless placed in an easement dedicated to the property owner being served by the service line.

It shall be the responsibility of the contractor to stake the location of the service line to ensure that the service line is correctly located on the property. All water service lines shall have a shutoff valve which can be accessed and operated from the outside of the building. Typically, this valve is considered to be a curb stop valve, wet tap valve or shutoff valve in a meter pit. Valves shall be the same size as the service line.

MERIDIAN

In the event that a fire sprinkler line is to be extended into a building, the water service line may be tapped only with the approval the District Engineer and South Metro Fire and Rescue. The determination of adequate sizing for both lines shall be the responsibility of the developer's PE. The water service line shall have a shutoff valve independent of the fire sprinkler line.

On commercial and multi-family projects the fire sprinkler line and water services shall be designed so that there is a minimum of a 5.0 foot horizontal separation between the lines when they enter the structure measured center to center of pipe.

E. Depth

All water service lines shall be designed so that a minimum of 4.5' of cover exists over the top of pipe after final grade has been established. This minimum shall apply from the distribution main, through the foundation and to a point where the pipe is located in a heated or insulated space.

F. Service Taps

All service lines shall be connected to the main by either a single strapped bronze saddle for PVC C-900 Class 150 and Class 200 water lines or by a machine tap into the main. Ductile iron water lines may be tapped by either the use of a double strapped bronze saddle or by machine tap into the main.

Machine taps shall be made by directly threading a corporation stop into the main or in combination with a service tapping saddle. Table IV-6 outlines the type of connection required.

Typically, water distribution mains 12" diameter and smaller are tapped for water service lines. In the event that a water transmission main 16" in diameter or larger must be tapped, the minimum size tap shall be 4". Such a connection shall be made by use of a wet tap saddle in accordance with these specifications. In order to reduce the service line to the appropriate size, a blind flange shall be installed on the tapping valve which has been drilled and tapped to the service line size.

All service line wet taps shall be made under full line pressure. Corporation taps shall be made in the upper half of the main at an angle of not more than 60° or less than 30° to the centerline of the pipe. Taps shall be made on the same side of the main as the water meter and shall have a "goose-neck" to provide a smooth curve into the trench. Service taps shall have a minimum separation of 18" and shall be no closer than 18" to a coupling or bell.

G. Materials

All materials for water service lines shall be in accordance with these specifications.

H. Valves

Valves to be used on water service lines shall comply with these specifications.

I. Pressure Reducing Valves (PRV)

All water service lines shall have a pressure reducing valve installed between the distribution main and the meter. The PRV shall be located such that the developer may have access for maintenance. Residential PRV's shall be adjusted by District personnel for a static pressure of 65 psi-70 psi and a residual pressure of 60 psi-65 psi. Commercial and irrigation PRV's may be adjusted by District personnel for pressures up to 90 psi at the request of the developer. Only District personnel may adjust PRV’s. A PRV is not required under 65 psi.

The requirement for PRV's on residential service lines if the pressure does not exceed 65 psi.

MERIDIAN METROPOLITAN DISTRICT

05 WATER SERVICE MATERIALS

A. "K" Copper Pipe

All water service lines ¾” through 2" in diameter shall be constructed of type "K" copper, in compliance with ASTM B88-81, either soft temper or hard drawn. The manufacturer's marking identifying the copper as type "K" shall be clearly visible on every segment of pipe to be installed. Lack of such markings shall be grounds for rejection.

B. Ductile Iron Pipe

Water service lines larger than 2" in diameter may be constructed of ductile iron pipe in compliance with these specifications. Only DIP shall be installed in meter vaults and backflow prevention vaults on lines larger than 2".

C. Polyvinyl Chloride Pipe - PVC

Water service lines larger than 2" in diameter may be constructed of polyvinyl chloride pipe in compliances with these specifications. PVC pipe shall not be installed in meter vaults or backflow prevention vaults.

D. Bedding Material

Pipe bedding for all types of water service lines shall comply with these specifications.

E. Water Service Fittings

1. Pipe fittings for DIP and PVC service lines shall be cast-iron, mechanical joint in compliance with these specifications.

2. Pipe fittings for "K" copper service lines shall be all brass construction in accordance with AWWA C-800. Fittings used inside a building or a meter vault (2" meter and larger) may be of the sweat copper type.

F. Valves

1. Valves on DIP and PVC service lines shall be gate valves in compliance with these specifications. Valves in meter vaults or backflow prevention vaults shall have cast iron hand wheel, supplied by the valve manufacturer, which has an arrow on the wheel indicating the direction to open the valve. All gate valves shall open by turning the nut or wheel clockwise.

2. Valves on "K" copper service lines shall be of the following types, depending on which is specified on the construction drawings. The contractor may not deviate from the type specified on the construction drawings.

a. Curb stop (ball valves grip tite compression connection)
Curb stops/ball valves shall be constructed of water works brass (85-5-5-5) with grip tite compression outlets. Styles for ¾", 1", 1 1/2" and 2" only Ford Model B44G; Mueller Model B25209; A. Y. McDonald Model #6100-Q or approved equal.

b. Gate Valve with Drain
Gate valves shall be constructed of water works brass (85-5-5-5) with drain valves. The drain shall be cast as part of the valve body. The body of the valve shall be constructed with sweat copper or NTP type ends. Valves shall have a wheel handle for operation of the valve and shall open by turning the handle clockwise. Styles shall be red and white #20134 or 201, Nebco #T22 or approved equal.

c. Valves that are 1-1 /2" or larger shall have a 2" square operating nut. In the case of service, irrigation, or blow-off assembly valves, a brass cotter key fastener shall secure a 2" brass nut.

G. Corporation Stops

Corporation stops shall be manufactured in accordance with AWWA C800-66, with AWWA taper thread (CC style) on the inlet side.

The outlet shall be compression for ¾", 1", 1-1/2" & 2". Styles shall be Ford #FB1000G for ¾" & 1"; Ford #FB1000G for 1-1/2" & 2"; Mueller #H15008 for ¾" & 1"; Mueller #H15013 for 1-1/2" & 2"; A. Y. McDonald 4701BQ for ¾" & 1"; A. Y. McDonald 4701BT for 1-1/2" & 2" or approved equal.

H. Tapping Saddles

1. Ductile Iron Pipe

Water service tapping saddles for service lines 2" diameter and smaller shall be bronze casting with double silicone bronze straps. No single strap saddles shall 'be permitted for ductile iron. Tapping saddles being used shall be Baker #183-0, Smith-Blair #323, Ford 202B, Mueller #16100 Series, Jones #J-979 or approved equal.

MERIDIAN METROPOLITAN DISTRICT

2. Polyvinyl Chloride Pipe

Water service tapping saddles for PVC pipe for service lines 2" diameter and smaller shall be a bronze casting with either a hinged silicon bronze pin with a single silicon bronze bolt or a type using two silicon bronze bolts. Styles shall be Ford S90 or Jones #J-995, A. Y. McDonald #3895 or approved equal.

Water service tapping saddles for service lines 3" diameter and larger shall conform to these specifications.

I. Copper Setters

Copper setters shall be of an all copper and brass construction and shall have a positive 1/4 turn shut-off valve on the inlet side of the copper setter with padlock wings. Vertical meter setters for inside-house installation shall be Ford No. #3 Copperhorn or approved equal. Horizontal meter setters for outside-house (meter pit) installation shall be Ford Series 70 Tandem Coppersetter (to accommodate PRV) or approved equal.

J. Meter Pits

Meter pits shall be constructed of HDPE rings with an internal diameter of 24" and in segments of 12" high. The top section shall be tapered to accommodate a 20" LD. meter pit dome.

Meter pits installed in landscaped areas may require that a 2-inch hole be provided in the center of the manhole cover at the contractor's expense for the installation of a remote reading-sensing unit. Contractor required to confirm with District prior to construction.

MERIDIAN

K. Pre-Cast Concrete Vaults and Manholes

Pre-cast concrete vaults and manholes required for meter sizes 2" and greater shall comply with these specifications.

L. Manhole Rings and Covers

Manhole rings and covers for meter vaults and manholes shall comply with these specifications. Outside meter pits installed parking areas or roadways shall have a ¾" PVC conduit extended from the meter pit to the exterior face of the building. The end of the conduit shall be placed at an elevation of 48" +/- 3" above finished grade.

Meter pits installed in landscaped areas may require that a 2-inch hole be provided in the center of the manhole cover at the owner's expense for the installation of a remote reading-sensing unit. Contractor required to confirm with District prior to construction.

M. Meter Pit Domes

The meter pit dome assembly shall consist of dome, top cover and frost lid (inner lid). All parts shall be constructed of aluminum or cast iron and shall be Ford Model W3 or W3H or approved equal. Only cast iron dome assemblies shall be permitted in driveways.

Meter pits installed in landscaped areas may require that a 2-inch hole be provided in the center of the manhole cover for the installation of a remote reading-sensing unit. Contractor required to confirm with District prior to construction.

N. Meters

All meters shall be provided by the District upon payment of the meter fee as outlined in the Rules and Regulations. No substitutions shall be permitted.

O. Curb Boxes

Curb boxes shall be arch pattern base which does not permit the transfer of loading onto the curb stop valve. Curb boxes shall be constructed of cast iron, Model 6500 series, Size 95E as manufactured by the Tyler Manufacturing Company, or approved equal. All extensions to a curb box shall be coal tar coated, and wrapped in 8-mill polyethylene plastic.

P. Bell Restraints

1. Ductile Iron Pipe Restraint

Restrain devices for bell and spigot joints of ductile iron pipe shall consist of split restraint rings, one installed on the spigot, connected to one installed on the pipe barrel behind the bell. The restraint devices shall incorporate a series of machined serrations (not "as cast") on the inside diameter to provide positive restraint, exact fit, 360^{o} contact and support of the pipe wall. Restraint devices shall be manufactured of ductile iron, ASTM A536, Grade 65-45-12 and connecting bolts shall be of high strength, low alloy material in accordance with ANSI/AWWA C111/A21.11.

Restrain devices shall carry water working pressure rating of 350 psi for sizes 4"-6", 250 psi for 8" and 200 psi for 10"-12". Restrain devices for ductile iron pipe bell and spigot assemblies shall be Ford/Uni-Flange Series 139-0 or approved equal.

2. Ductile Iron Pipe Restraint -Wedge Action Devices

Restraint devices for bell and spigot joints of ductile iron pipe shall consist of a ductile iron restraining gland conforming to ASTM A536, Grade 65-45-12 and when installed on the spigot pipe, impairs multiple wedging action against the pipe, increasing its resistance as the pressure increases. Wedging mechanisms shall be manufactured of ductile iron, heat treated to a hardness of 370 BHM minimum. A standard ductile iron mechanical follower gland, conforming to ASTM A536, Grade 65-45-12, shall be provided and installed behind the ductile iron pipe bell. Using connecting bolts of high strength, low alloy material in accordance with ANSI/AWWA C111/A21.22, the wedge-action restrainer assembled on the spigot pipe and follower gland seated behind the pipe bell shall be secured.

Restraint devices shall carry water working pressure rating of 350 psi for 4"-12" sizes and all components must be supplied as a recognized restraint harness assembly by the manufacturer. Restraint devices for ductile iron pipe bell and spigot assemblies shall be Ford/Uni-Flange Series 1450 or approved equal.

06 WATER SERVICE INSTALLATION

A. Excavation

Excavation for water service lines shall be in accordance with these specifications with the exception that a minimum clearance of 6" between the sides of the pipe to the trench wall is not required for "K" copper service lines.

In the event that a common trench is specified for a "K" copper service line together with a sanitary sewer service line, the sub-grade bench for the water service lines shall have a minimum width of 12". This bench shall be excavated from undisturbed soil at an elevation no less than 18" above the top of the sanitary sewer service. Common trench construction is only permitted for "K" copper water service line installations.

B. Pipe Foundation and Bedding

1. DIP and PVC Service Lines

Pipe foundation and bedding for DIP and PVC service lines shall be in accordance with these specifications.

2. "K" Copper Service Lines
Pipe foundation and bedding for "K" copper service lines shall consist of placing squeegee bedding to a depth of at least 3" below and 3" around the copper service line for a minimum thickness of 6 ¾" of bedding material.

C. Trench Backfilling and Compaction
Trench backfilling and compaction of water service lines shall be in conformance with these specifications.

D. Installation of Water Service Lines
1. DIP and PVC Service Lines
Installation of DIP and PVC service lines shall be in accordance with these specifications.

2. "K" Copper Service Lines
The location of the service line shall be staked by the contractor to ensure that the service is correctly located on the respective property. Copper service lines shall be installed in a straight horizontal alignment from the main to the curb stop valve. No fittings shall be allowed between the main and the curb stop valve. Water services shall be radial to the center line (or center point in cul-de-sacs) from the main to the back of sidewalk.

In the event that the distance between the curb stop and house exceeds 100', a brass fitting in accordance with these specifications shall be required.

MERIDIAN
METROPOLITAN DISTRICT

E. Installation of Polyethylene Wrapping
Polyethylene wrapping shall be installed on all DIP water service lines and cast iron fittings in accordance with these specifications.

F. Installation of Valves and Valve Boxes
1. DIP and PVC Service Lines
Valves and valve boxes installed on DIP and PVC service lines shall be cast iron gate valves installed in accordance with these specifications.

Valves shall be installed on all service lines at the property line except wet taps that have an isolation valve at the tapping saddle.

2. "K" Copper Service Lines
Valves installed on copper service lines shall be brass curb stop valves in accordance with these specifications. The size of the curb stop valve shall be the same size as the service line. Location of the curb stop valve shall be noted on the construction drawings. All curb stop valves shall be placed on a 12" diameter (or square), 1" thick concrete pad upon which the base of the curb stop service box shall rest. Under no circumstances shall the service box rest on the curb stop valve or service line.

G. Installation of Fittings
1. DIP and PVC Service Lines
Pipe fittings for DIP and PVC service lines shall be installed in accordance with these specifications.

2. "K" Copper Service Lines

All underground pipe fittings for "K" copper service lines shall be all brass construction with compression end connections.

No fittings shall be permitted between the main and curb stop valve.

Pipe fittings that are located inside a building or inside of a meter vault for line 2" and larger may have sweat copper or compression connections. Solder used in sweat copper connections shall not contain lead.

Solder used in pipe and pipe fittings shall not contain lead.

H. Installation of Gate Valves with Drains

Gate valves with drains shall be installed inside the residence in accordance with the standard details of these specifications. Gate valves of this type shall conform to these specifications.

I. Installation of Service Taps

All service lines shall be connected to the main by the use of a double strap bronze saddle for DIP water mains and single strap bronze saddles for PVC water mains or by a machine tap into the main. Fittings shall be installed in accordance with these specifications. Machine taps shall be made by directly threading a corporation stop into the main or in combination with a service tapping saddle. Table IV-6 outlines the type of connection required for given service line and main line sizes.

Corporation stops and tapping saddles shall conform to these specifications. The District Engineer shall approve the tapping machine and shall be limited to the uses recommended by the manufacturer. Teflon tape, or equal, shall be used on all corporation stops.

MERIDIAN

Drill bits and shell cutters for PVC C900 Class 150 and Class 200 pipe shall have multiple cutting teeth or double fluted design. Anderson combination, cutter and tap or the Mueller tap and shank #581502-3/4”, 581503-1" with power seal double fluted bit #M9075-T ¾”, M9100-T1" with washer or an approved equal shall be used. Single tooth cutters and twist drills are prohibited for PVC pipe.

No taps shall be permitted on a water main until the line has passed a pressure test and clear water test.

All service lines taps shall be made under full line pressure. Taps shall be made in the upper half of the main at an angle of not more than 60° or less than 30° to the centerline of the pipe. Tap shall be made on the same side of the main as the water meter and shall have a "goose-neck" to provide a smooth curve into the trench.

Service taps shall have a minimum separation of 18" and shall be no closer than 18" to a coupling or bell. Taps that are placed less than 18" from other taps, valves, fittings, the beginning of the bell of a pipe or the end of the pipe, the entire pipe shall be removed and replaced. After the tap has been completed, any damaged wrap and bedding shall be repaired or replaced by the contractor in such a manner as to protect both the service and the main. Upon completion of all service taps, a visual inspection shall be made by the District Engineer to check for leakage. If any leakage exists and it cannot be corrected by tightening the corporation stop, a repair saddle may be used upon approval by the District Engineer. If any evidence exists of damage to the water main, then the defective segment shall be removed and replaced.

J. Abandonment of Water Service Lines

When a service line is abandoned, the service shall be excavated at the point of connection to the water main. The corporation cock shall be shut off and the remainder of the service shall be removed. A tapped flare nut (C.O. 133) with ¾" brass pipe plug shall be placed on the end of the corporation to insure that the corporation cock does not allow water to leak past the seat. All taps 1 1/2" and larger shall be removed and replaced by a solid sleeve with meg-a-lug restraints.

K. Installation of Meter Pits

In the event that meters may not be located within buildings in accordance with these specifications, meter pits may be used. All meters shall be installed in an approved pit in accordance with the standard details for the specific meter size. Meter pits shall be located in a non traffic area readily accessible by District personnel. Meter pits may be located in traffic areas with approved lids, however, all pits shall be located within the boundaries of the property being served. Meter pits may not be located under sidewalks.

The general dimensions for meter pits and vaults are intended to be minimum dimensions and the enclosures have been sized for metering appurtenances only.

The maintenance of meter pits shall be the sole responsibility of the Owner. The Owner shall promptly repair any deficiencies in a meter pit. Failure to comply with any District notice of deficiency may result in the water service being shut down. Maintenance of the meter pit shall include the adjustment of the meter pit dome or manhole cover to raise it above landscape improvements.

Meter pits and curb stop valve boxes in landscaped areas, tracts and open space shall have a concrete collar that extends 6" outside the diameter of the valves or meter pit ring.

L. Installation of Water Meter and Back Flow Prevention Assemblies for Commercial Development

The assembly shall be installed at an elevation that is no less than 24" or more than 48" above the finished floor. The assembly shall be placed 12" away from the adjacent wall to the center of the device with a minimum of 24" of clear space in front of the device from floor to ceiling. If the water meter and back flow prevention assembly are to be installed in series, there shall be a minimum of 24" clearance between the devices. (See backflow preventer detail drawings for specific location requirements.)

07 WATER METER DESIGN CRITERIA

A. General

All water service lines shall have a meter purchased from the District and set at a location in accordance with these specifications.

B. Sizing

Meters shall be sized by the developer's architect or engineer in accordance with the hydraulic analysis of the service line as outlined these specifications. Meter size shall be reviewed and approved by the District Engineer. All nonresidential users shall submit a detailed fixture unit count, including the calculations for any irrigation demands including sprinkler systems and hose bibs. All residential installations in which more than one unit is to be served from one meter, shall submit a detailed fixture unit count, including any irrigation demands, along with a service line hydraulic analysis to the District Engineer. All commercial installations and residential installations in which more than one unit is to be served from one meter, shall submit

a detailed fixture unit count along with a service line hydraulic analysis including any irrigation demands to the District Engineer. The water service line between the main and the meter shall be the same size as the meter.

Although the developer's architect or engineer shall evaluate the hydraulic characteristics of each service line the flows identified in Table IV-7 may be used as a general guideline for selecting a meter size.

C. Meters

Meters shall be one of three types, iPERL (Electromagnetic Flow Measurement for all ¾" & 1" meters), compound meters and turbine meters according to the following guidelines:

iPERL meters are to be used for all ¾" and 1" single family residential, multifamily residential for less than eight units; commercial buildings; small food preparation facilities and drip irrigation systems.

Compound meters are required for multi-family residential with more than eight units; commercial/office buildings with water cooled HVAC; large restaurants; schools; hospitals; manufacturing plants; laundries; hotels and motels; clubhouses and athletic facilities with pools and showers.

Turbine meters are required for irrigation systems and manufacturing plants.

D. Meter Locations

All water service lines shall have a meter which may be located either inside a structure or in an approved pit or vault. Installations within a structure shall be at locations noted on the architectural plans for the structure. Meters located outside of the structure shall be noted on the site plan. All installations shall be in accordance with the standard details of these specifications as well as the requirements outlined below:

MERIDIAN METROPOLITAN DISTRICT

1. Meters Located Inside Structures

a. General

Meters located within structures shall be installed in such a manner that District personnel may have free access and sufficient working room to maintain and inspect the meter. All meters shall be in a horizontal position and shall be placed in a heated or insulated area which has sufficient provisions for drainage to the building sewer. Each meter shall also have a shutoff valve accessible to District personnel.

b. Basements

Meter installations in basements shall be in accordance with the standard detail drawing utilizing a vertical meter setter located 48" above the slab elevation in the basement. The meter shall not protrude from the basement wall more than 18" and shall have a clear working space of 24" directly in front of the meter. Access to the meter must be maintained at all times and any finishing of the basement must include provisions to provide **full** access to the meter. All such plans must be submitted and approved by the District Engineer.

c. Crawl Spaces

In the event that a home or building does not have a basement, the meter may be placed in a crawl space that meets the following criteria. The minimum height of the crawl space shall be 36" and a moisture barrier such as 6-mil plastic shall be installed throughout the crawl space. The crawl space shall be a "warm crawl space" with full insulation on all exterior walls and the floor. Access to the crawl space shall be by means of an opening of a

minimum dimension of 36" on all sides and a permanently constructed ladder shall be installed, if necessary, to provide access into the area. The meter assembly shall be within 36" of the access opening and a minimum of 24" from any outside vent which allows air to enter into the crawl space. Any valves or fixtures such as gate valves, PRV's, or meter setters shall have a minimum clearance from the dirt floor of 18". All proposed locations of meters in crawl spaces shall be submitted and approved by the District Engineer prior to construction.

d. Mechanical Rooms

Meters may be installed in mechanical rooms for commercial and other non-residential buildings. Meters shall be constructed in accordance with the Standard Details for the appropriate meter and shall be located in a heated or insulated room that has an adequate drain connected to the building sewer. The minimum clearances for the installation of the water meter and backflow assemblies shall be in compliance with these standards. Access to the mechanical room shall be provided at any reasonable time upon request by the District. Water meters shall not be located directly beneath any electrical panels or breakers and shall be installed in accordance with the NEC and UPC.

e. Garages

Meters may be located inside garages for commercial or other nonresidential buildings provided that no other suitable location is available. The garage shall be fully insulated and heated and the meter shall be further protected by means of an enclosure, if necessary, from damage by any vehicles or tools. The minimum clear space requirements for mechanical rooms shall apply to garage installations.

f. Outside of Structures

In the event that meters cannot be located within structures in accordance with these specifications, the owner may install the meter outside of the structure in an approved pit in accordance with the standard detail drawing for the specific meter size. Meter pits may not be located under sidewalks.

Remote readout wire will be supplied and shall be installed by the contractor at the same time the conduit is being installed. Splicing is not permitted.

The general dimensions shown on the standard details for meter pits and vaults are intended to be minimum dimensions and the enclosure has been sized for metering appurtenances only.

08 CROSS CONNECTION CONTROL CRITERIA

A. General

Cross-connections of any type that may permit a backflow of water from a supply other than that of the District into the District's potable water system are strictly prohibited.

All cross connection control devices shall be of a model and size approved by the District Engineer. **All devices shall be installed in a horizontal position.** The term "Approved Cross Connection Control Device" shall mean a device that has been manufactured in full conformance with the standards established by the American Water Works Association Standard C506-78 "Standards for Reduced Pressure Principle and Double Check Valve Backflow Prevention Devices" and has met the laboratory and field performance specifications of the Foundation for Cross Connection Control and Hydraulic Research of the University of Southern California.

MERIDIAN METROPOLITAN DISTRICT

The Foundation for Cross-Connection Control frequently revises its standards for backflow prevention and cross connection devices. It shall be the responsibility of the contractor to insure that the correct device is utilized. A current list of devices is available from the District Engineer.

B. Types of Cross-Connection Control Devices

The design, installation and maintenances of all cross-connection control devices shall be the sole responsibility of the contractor. The following standards shall apply to cross-connection control devices:

1. Air Gap (AG)

An air gap is the unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture or other device and the flood level rim of said vessel. The air gap shall be at least double the diameter of the supply pipe, measured vertically above the top of the rim of the vessel, and in no case less than 2". When an air gap is used at the service connection to prevent the contamination or pollution of the public potable water system, if an emergency bypass is installed around the air-gap system and an approved reduced pressure principle assembly shall be installed in the bypass system. All air gaps shall be permanently constructed with rigid piping. Flexible hose or tubing shall not be acceptable for an air gap.

2. Double Check Valve Assembly (DCVA)

Double check valve assemblies shall consist of an assembly of two independently operating check valves with tightly closing shut-off valves on each side of the check valves, plus properly located test cocks for the testing of each check valve. The entire assembly shall meet the design and performance specifications and approval of a recognized and approved testing agency for backflow prevention devices. These devices shall be readily accessible for in-line maintenance and testing.

Double check valve assemblies shall be placed in a location that is protected from freezing.

3. Pressure Vacuum Breaker with Internal Check Valve (PVB)

Pressure vacuum breaker assemblies shall consist of at least one check valve, vacuum relief, inlet and discharge shutoff and properly installed test cocks. The pressure vacuum breaker shall have a vacuum relief valve which is internally loaded, normally by means of a spring. The PVB shall be installed a minimum of 12" above the highest outlet and/or overflow level on the non-potable system. Pressure vacuum breakers shall not be installed more than 5' above the ground. Adequate room shall be made available for maintenance and testing.

4. Atmospheric Vacuum Breaker (AVB)

An atmospheric vacuum breaker is a device that allows air to enter the water line when the line pressure is reduced to a gauge pressure of zero or below. The atmospheric vacuum breaker is designed to prevent back-siphonage only. It is not effective against backflow due to back pressure and shall not be installed where it will be under continuous operating pressure for more than 12 hours in any 24-hour period. Poppets of all atmospheric vacuum breakers shall be precision fitted to insure Positive closure. An A VB shall be installed downstream of the last shutoff valve and a minimum of 6" above the highest outlet and/or overflow level on the non-potable system. Atmospheric breakers shall not be installed more than 5' above the ground.

5. Reduced Pressure Principle Device (RPPD)

A reduced pressure principle device is an assembly of two independently operating approved check valves with automatically operating differential relief valves between the two check

MERIDIAN METROPOLITAN DISTRICT

valves, tightly closing shut-off valves on either side of the check valves, plus properly located test cocks for the testing of the check and relief valves. The entire assembly shall meet the design and performance specifications and approval of a recognized and approved testing agency for backflow prevention assemblies. The device shall operate, to maintain the pressure in the zone between the two check valves at a level less than the pressure on the public water supply side of the device. In case of leakage of either of the check valves the differential relief valve shall operate to maintain the reduced pressure in the zone between the check valves I by discharging to the atmosphere. When the inlet pressure is two pounds per square inch or less, the relief valve shall open to the atmosphere. These devices must be readily accessible for in-line maintenance and testing and must be installed in a location where no part of the device will be submerged. Under no circumstances shall a RPPD device be placed underground in a pit.

The device shall not be installed where the pressure can be maintained above the device's rated capacity. When the RPPD is located within a structure, it is recommended that a drain pipe be provided under the relief valve port of the device. An approved air gap between the port and the drain is required. All manufactures' recommendations for the device shall be followed.

6. Hose Bibs

Hose bibs shall be directional with built in backflow preventer. Hose bibs will also have a drain down feature built into the unit.

C. Application of Devices

The type and complexity of the cross connection control device shall be determined by the developer's Engineer in accordance with the Colorado Department of Health Cross Connection Control Manual. All applications shall be submitted to the District Engineer for review and approval. The determination of the type of device required shall be based on the degree of hazard caused to the public from contamination.

MERIDIAN
METROPOLITAN DISTRICT

All devices shall be installed in a horizontal position.

The applications listed below may be used as a guideline but are not to be construed as the sole determining factor in selecting a device:

1. Residential irrigation systems (3/4" to 1") shall have: a single pressure vacuum breaker prior to all valves within a system (including solenoid valves; or an atmospheric vacuum breaker with a single check valve downstream (or after) every valve, including solenoid valves and gate valves for each zone.

2. Commercial irrigation systems shall have an approved reduced pressure principle device. The backflow preventer shall be located a minimum of 5' or a maximum of 8' from the edge of the meter pit.

3. Fire protection sprinklers for buildings shall have an approved reduced pressure principle device.

4. Soda dispensers shall have an approved stainless steel reduced pressure principal device. The piping downstream of the device shall be woven pvc, cpvc or stainless steel.

5. Swimming pools have the option of using a reduced pressure principal device, or an air gap. However, any system which has a booster pump or chlorine feed system which is dependent on a booster pump shall have a reduced pressure principle device.

6. Stock tanks require a reduced pressure principle device or an air gap.

7. Two-fluid solar systems, whether utilized for space heat or domestic hot water preheat, shall be protected against the possible backflow of substances into the potable water distribution system as follows:

   a. In the case of a domestic hot water heating application where a primary circulation fluid is used to absorb heat from the solar collectors and is deemed to have an inherent toxicity, the exchange of heat from the circulation fluid to the potable water shall be done by way of an approved double-walled exchanger.

   b. In the case of a two-fluid space heating application with or without domestic hot water preheat capabilities, there shall not be any connection, direct or indirect, between the primary circulation medium and the potable system. The exchange of heat between the storage medium and potable water shall be done through the use of an approved double-walled exchanger.

   c. In the case of a single-fluid solar domestic hot water heating system which utilizes drain-down design for freeze protection, drain lines from the system shall be extended to an approved, properly trapped and vented receptor with a visible air gap of at least three times the diameter of the drain line with a fixed minimum air gap of 2" above the flood level of the receptor.

   d. In the case of a solar air heating system, which utilizes a fan coil unit to exchange heat from the hot air to preheat water for domestic uses, no backflow preventers will be required at the potable connection. However, if the fan coil unit utilizes drain-down freeze protection, the drain from the exchange coil shall conform to the requirements of the single-fluid drain solar domestic hot water systems.

8. Boilers shall have an air gap or a reduced pressure principle device.

9. Hospitals, mortuaries and medical buildings shall have a reduced pressure principle device.

10. Structures larger than 40' in height measured from the water main to the highest fixture within the structure shall have a Reduced Pressure Principle Device.

11. Sewage treatment plants shall have a reduced pressure principle device.

12, Lift stations and recreational vehicle sewage dumps shall have a reduced pressure principle device.

13. The required cross-connection of backflow prevention device for industrial and commercial buildings shall be determined by the District Engineer. The type and location of the device shall be shown on the construction drawings.

MERIDIAN

D. Water Conservation Devices

All devices shall conform to MMD conservation guidelines for water devices. It shall be the responsibility of the contractor to insure that the correct water conservation devices are utilized.

The following water conservation devices shall be required.

1. Toilets shall not use more than 1.6 gallons per flush.

2. Urinals shall not use more than 1.0 gallon per flush.

3. Kitchen and lavatory faucets shall have aerators, laminar flow devices, or other fixtures that restrict flow to a maximum of 3 gallons per minute. No inline flow control washers, orifices or other such fittings are permitted.

4. Shower heads shall be constructed so as to limit flow to a maximum of 3 gallons per minute. No inline flow controls, washers, orifices or other such fittings are permitted.

5. All parks, median strips, landscaped public areas and landscaping surrounding condominiums, townhomes, apartments, commercial establishments, developed open space areas and industrial parks shall utilize an automatic irrigation system operated by electric time control stations.

TABLE IV-I

DOMESTIC DEMANDS - UNIT FLOW FACTORS

Type of Use	Unit Flow (Average Daily Flow)	Peaking Factor (Maximum Day vs. Average Day)
Single Family	465 gpd/DU	2.1
Multi-Family	260 gpd/DU	2.1
Commercial	56 gpd/ksf	2.1
Warehouse/Industrial	28 gpd/ksf	2.1

Any use not addressed above shall conform to the fixture unit count table of the current edition of the AWWA M-22 and District pre-approval.

Definitions: Single-Family: Any detached residential home (District determination)
Multi-Family: Any attached/detached residential home (District determination)
DU: Dwelling Unit
Gpd: Gallons per day
ksf: 1,000 square feet

MERIDIAN METROPOLITAN DISTRICT

TABLE IV-2		
FIRE FLOW REQUIREMENTS		
Type of Use	Needed Fire Flow	Number of Hydrants Totaling
Single Family Detached/Attached	Contact South Metro Fire	TBD
Multi-Family	Contact South Metro Fire	TBD
Commercial	Contact South Metro Fire	TBD
Schools	Contact South Metro Fire	TBD
Industrial	Contact South Metro Fire	TBD

NOTE: The above criteria are minimum guidelines, the developer shall be responsible for determining the needed fire flow for each building.

TABLE IV-3				
MAXIMUM PERMISSIBLE DEFLECTION IN LAYING PUSH-ON JOINT PIPE DUCTILE IRON PIPE				
	Maximum Permissible Deflection per Length		Approximate Radius of Curve Produced by Succession of Joints	
Size of Pipe	18 Foot Lengths	20 Foot Lengths	18 Foot Lengths	20 Foot Lengths
4"	19"	21"	205'	230'
6"	19"	21"	205'	230'
8"	19"	21"	205'	230'
10"	19"	21"	205'	230'
12"	19"	21"	205'	230'

MERIDIAN METROPOLITAN DISTRICT

NOTE: In no case shall the deflection exceed the manufacturers recommended maximums. Calculations are based on 5° of deflection in the bell of the pipe.

TABLE IV-4		
MAXIMUM PERMISSIBLE DEFLECTION IN PAYING PUSH-ON JOINT PIPE -HIGH DEFLECTION ("HD") COUPLING ONLY - POLYVINYL CHLORIDE PIPE		
Size of Pipe	Maximum Permissible Deflection per 20' Length	Approximately Radius of Curve Produced by Succession of Joints
4"	21”	229’
6”	21”	229’
8”	21”	229’
10”	21”	229’
12”	21”	229’

NOTE: Calculations are based on 5° of deflection in the bell of the pipe.

TABLE IV-5		
MAXIMUM PERMISSIBLE DEFLECTION IN PAYING PUSH-ON JOINT PIPE INTEGRAL BELL ("IB") ONLY POLYVINYL CHLORIDE PIPE		
Size of Pipe	Maximum Permissible Deflection per ,20' Length	Approximately Radius of Curve Produced by Succession of Joints
4"	6"	764'
6"	6"	764'
8"	6"	764'
10"	6"	764'
12"	6"	764"

NOTE: Calculations are based on 1°30 minutes of deflection in the bell of the pipe.

TABLE IV-6								
TAPPING REQUIREMENTS FOR SERVICE CONNECTIONS								
Size of Pipe	Ductile Iron Tap Size				Polyvinyl Chloride Tap Size			
4"	DT	S	NO	NO	S	S	NO	NO
6"	DT	S	S	S	DT	S	S	S
8"	DT	DT	S	S	DT	DT	S	S
10"	DT	DT	S	S	DT	DT	S	S
12"	DT	DT	S	S	DT	DT	S	S
16"	WT	WT	WI	WT	WT	WT	WT	WT

Definitions: S: Tapping saddle required. All saddles shall have the A WW A taper on its threads.
DT: Direct tap permitted.
NO: No tap permitted with or without a saddle, a tee connection may be permitted if specifically authorized by the District.
WT: Wet tap required. Wet tap shall be full circle fabricated steel saddle with stainless steel bolts. Minimum size available for wet taps 4" diameter.

TABLE IV-7			
METER SIZING GUIDELINES - RECOMMENDED DESIGN FLOW			
Size of Meter	Displacement Type Meter	Compound Type Meter	Turbine Type Meter
¾"	24 gpm	N/A	N/A
1"	40 gpm	N/A	N/A
1 ½"	80 gpm	N/A	N/A
2"	N/A	128 gpm	128 gpm
3"	N/A	250 gpm	280 gpm
4"	N/A	400 gpm	480 gpm
6"	N/A	800 gpm	1,000 gpm
8"	N/A	1,280 gpm	N/A

AWWA Manual M22.

TABLE IV-8					
ALLOWABLE LEAKAGE FOR MECHANICAL JOINT OR PUSH-ON JOINT PIPE IN 18 FOOT NOMINAL LENGTHS					
Test Pressure	4" Pipe Diameter	6" Pipe Diameter	8" Pipe Diameter	10" Pipe Diameter	12" Pipe Diameter
250	0.47	0.71	0.95	1.19	1.42
235	0.45	0.68	0.90	1.13	1.35
200	0.42	0.64	0.85	1.06	1.27
175	0.40	0.60	0.79	0.99	1.19
150	0.37	0.55	0.75	0.92	1.10

Hydrant Paint Color Specification

Waterous Hydrant Color Meridian Tan #4168 or MMD pre-approved equal. Pre-approved is defined as MMD review and approval prior to the acceptance of the final signed and sealed construction plans or drawings.

MERIDIAN
METROPOLITAN DISTRICT

MERIDIAN METROPOLITAN DISTRICT
SANITARY SEWER COLLECTION SYSTEM

TABLE OF CONTENTS

MERIDIAN METROPOLITAN DISTRICT

MERIDIAN
METROPOLITAN DISTRICT

SANITARY SEWER COLLECTION SYSTEM

01 SANITARY SEWER MAIN DESIGN CRITERIA

A. Flow Design Criteria

Sanitary sewer mains designed to transport domestic sewage shall comply with the criteria established in these Standard Specifications. Roof drains, foundation drains, sump pumps or storm water drains shall not be connected to the sanitary sewer system.

B. Hydraulic Design

Sanitary sewers shall be designed to carry the peak discharge and to transport suspended material such that deposits in the sewer are prevented. The sewer shall have capacity for the peak annual sewage flow with adequate velocity at minimum sewage flows.

Sewer mains shall be designed to provide velocities at peak flow of not less than 2' per second no more than 10' per second based on Manning's formula:

$V=1.486(R^{0.667}\ S^{0.5})/n$

Where: V = mean velocity; R = hydraulic radius; S = slope of energy grade line; n = Manning's "n" ("n" = 0.011 for PVC pipe)

The maximum depth of flow in the pipe at peak flow shall be 75% of the diameter for lines 12" diameter and smaller and 80% of the diameter for lines 15" and 18" or larger in diameter.

MERIDIAN
METROPOLITAN DISTRICT

The hydraulic characteristics shall be calculated for each portion of a sanitary sewer main. The following slopes are generally permissible for sewer mains:

Size of Sewer (in)	Minimum Slope (ft/ft)	Maximum Slope (ft/ft)
8	0.006	0.082
10	0.005	0.061
12	0.005	0.050

Sanitary sewer main sizing shall be determined by the minimum line size on the lowest portion of the system. Line sizing may only be decreased going uphill. An "upsize" main may not be used to accommodate a flat slope unless all the main line downstream is of equal size or larger.

The minimum diameter for a sanitary sewer main shall be 8".

C. Location and Alignment

1. Streets

Sanitary sewer mains shall be located at the centerline of the street or 6' from flowline. Manholes shall be on centerline or 6' from flowline. Sewer service lines shall be located at the center of the lot it services. If not located in the centerline,

the sanitary sewer line in streets running north and south shall be on the west side of the street, and in streets running east and west, on the south side of the street. In roadways which meander, the sanitary sewer line shall not "zig-zag" and its location shall be approved by the District Engineer.

2. Easements

Sanitary sewer mains shall be located within dedicated streets. When such an alignment is not feasible, sanitary sewer mains may be located within a dedicated easement of a minimum width of 20'. In some instances additional width may be required in accordance with these Standard Specifications. The maximum change in direction of a sanitary sewer main through a manhole located within an easement is 45°. Curvilinear sanitary sewer mains are not permitted within easements. The type of pipe used in restricted easements will be C 900 Class 150. The sanitary sewer main shall be placed along the centerline of the easement with a minimum depth of cover of 4'. Neither manholes nor jogs in sanitary sewer main are permitted in easement in the back of a lot.

Manholes shall be placed at each end of the easement at a location that permits access by large, tandem wheel maintenance vehicles. Jogs in sanitary sewer mains and manholes that are located in the back of lots are not permitted. Manholes may be located in dedicated open space or common areas, provided that access is available.

Grading within a District easement is permissible; however the side slope may not exceed a 4:1. The grade along the length of the easement may not exceed 5% unless otherwise approved by the District Engineer.

MERIDIAN
METROPOLITAN DISTRICT

3. Dedicated Open Space and Drainageways

When a sanitary sewer line is located in dedicated open space, the line shall run straight from manhole to manhole. When a sanitary sewer line crosses an existing or future drainageway, the line shall cross perpendicular to the drainageway or as close to perpendicular "as feasible. If the slope of the drainageway downstream from the crossing exceeds a grade of 0.5 percent within 200' of the crossing, a cutoff wall, a minimum of 5' deep, shall be constructed 10' to 15' downstream from the crossing.

4. Alignment with Other Utilities

Sanitary sewer mains shall be located at least 10' horizontally from any water main or appurtenance. This distance shall be measured edge to edge. Sanitary Sewer must have a vertical clearance of at least 18" - absolutely no variance will be approved for less than 6". Variances between 6" and 18" MUST be approved by the District Engineer.

In the event that a sanitary sewer main must cross a water main, the following criteria shall apply:

a. Sanitary Sewer Main Crossing below a Water Main: If the vertical clearance exceeds 18", no special provisions apply. If the vertical clearance is less than 18", the sanitary sewer main shall be encased in concrete for 1' (12”) on each

side of the crossing.

b. Sanitary Sewer Main Crossing over a Water Main: If the vertical clearance exceeds 18", no special provisions apply. If the vertical clearance is less than 18", the sewer main shall be encased in concrete for to 10' each side of the crossing.

In the event that a sanitary sewer main must cross a storm sewer line, the following criteria shall apply:

c. Sanitary Sewer Line Crossing over a Storm Sewer Line: If the vertical clearance is less than 18", the storm sewer joints shall be encased in concrete for 10' on each side of the crossing.

d. Sanitary Sewer Line Crossing below a Storm Sewer Line: If the vertical clearance is less than 18", the sanitary sewer line shall be encased in concrete for 1' (12”) each side of the crossing.

5. Curvilinear Mains

Sanitary sewer mains shall follow horizontally straight alignments between manholes whenever possible. In the event that such an alignment results in a substantial increase in the number of manholes, curvilinear sewers may be permitted with prior written District approval. Curvilinear sewers shall parallel the street centerline from manhole to manhole with the following minimum curvature:

MERIDIAN METROPOLITAN DISTRICT

Pipe Diameter	Minimum Radius of Curvature
8	200'
10"	250'
12"	300'

The curvature of the sewer main shall be achieved by a uniform deflection of the pipe joints. Angle fittings are not permitted. Curvilinear sewers may either be a continuous curve from manhole to manhole or a single transition from "tangent to curve" or "curve to tangent". Complex curves or segmented "tangent to curve to tangent" alignments are not permitted.

D. Depth

All sanitary sewer mains shall have a minimum of 4.0' of cover over the top of pipe after final grade has been established.

Sanitary sewer mains shall be bedded with Class B Bedding (3/4” crushed rock) with the bedding being consistent from manhole to manhole. Sanitary sewer mains shall require the use of SDR 35 PVC pipe, in accordance with these specifications. The color of the pipe shall be green.

E. Manholes

1. Spacing

Manholes shall be installed at the end of each line, at all changes in grade, size, or alignment, and at all junctions or intersections of sewer mains. Manholes shall be spaced at distances not greater than 400' for 8" through 15" sewers with a straight horizontal alignment. Curvilinear sewers shall have manholes at distances not greater than 300'.

2. Type and Sizing

Manholes shall be constructed of a “cast-in-place” base, precast concrete barrel sections and an eccentric cone section. The inside dimension of the manhole shall not be less than 48" for sewer mains 8" to 18" in diameter and 60" for sewer mains larger than 18" in diameter. Manholes which have a 48" inside diameter shall have a 24" diameter ring and cover. Manholes which have a 60" inside diameter shall have a 30" ring and cover. Manholes on sanitary sewer mains 18" diameter and smaller shall have steps in accordance with standard details and notes.

3. Hydraulic Design

Manholes shall have a minimum drop across the manhole of 0.2' (0.3’ for 90º connections) along the flow channel and a maximum drop of 0.5'. At manholes where there is a change in pipe diameter, the crown elevation of the pipes shall match. Head losses through manholes shall not exceed 0.1' loss for a "straight run" or intersection greater than 90° to the outlet line; and 0.2’ loss for 90° intersections to the outlet main.

MERIDIAN
METROPOLITAN DISTRICT

4. Drop Manholes

Drop manholes shall have cleanout assemblies in accordance with the standard details. The interior of the manhole shall be completely lined with a coating in accordance with the standard details and notes.

5. Waste Metering Manholes

Waste metering manholes must have prior Meridian Metropolitan District approval before final design.

6. Sampling Manhole

Sampling manholes must have prior Meridian Metropolitan District approval before final design.

7. Service Connections to Manholes

Residential sewer service lines shall not be connected directly to a manhole. A maximum of two services may be connected behind a manhole at the end of a sewer line to an 8' stub of 8" main connected to the manhole.

8. Grade Adjustments

Manholes shall be constructed to permit grade adjustments by use of HDPE (precast concrete with prior MMD approval) adjusting rings not to exceed a total height of 18". In dedicated open space or landscape areas, manhole rims shall be set 6" above grade to prevent infiltration from surface runoff. A concrete collar shall be placed around the ring and cover in all landscaped tracts and dedicated open space areas. The collar shall be a minimum of 12" in width.

F. Materials

All materials for the sanitary sewer collection system shall be in accordance with standard details, notes and specifications. Color of sanitary pipe is green (non-potable, irrigation & reclaim pipe is purple; potable pipe is blue).

G. Underdrain Systems

Underdrains, roof drains and other surface water collection systems shall not discharge into the sanitary sewer system.

Underdrains shall not be considered part of the sanitary sewer system and are not required by the District nor are the responsibility of the District.

MERIDIAN
METROPOLITAN DISTRICT

H. Sewer Main Cleanouts

The use of sewer main cleanouts shall not be permitted. In the event a sewer main is to be extended beyond a manhole, the extension cannot have sewer services more than 50' upstream of the manhole.

I. Special Applications

Special applications or designs of sanitary sewer systems, such as lift stations, siphons, elevated pipelines, etc. are generally not permitted. Any situations which dictate the need for such an application shall be presented as a variance to the District prior to final design approval.

J. Limits of Accuracy (Allowable Error)

Limits of accuracy shall refer to the horizontal and vertical deviation that is permissible during the laying of sewer mains. The allowable error shall be a maximum of plus or minus 0.05' for lines designed at 1% or less in a vertical direction. Lines designed at greater than 1% shall be a maximum of plus or minus 0.10' in a vertical direction. In a horizontal direction the allowable error shall be a maximum of 0.30'. Any line that does not meet these criteria shall be removed and re-laid. On curvilinear mains the maximum horizontal deviation shall not exceed plus or minus 0.30'.

02 SANITARY SEWER MAIN MATERIALS

All pipe materials used in the construction of the sanitary sewer system shall conform to the requirements specified herein. Any other material proposed as an equal must be approved by the District Engineer in writing prior to construction. All materials furnished

shall be new and undamaged. Everything necessary to complete all installations in accordance with these specifications shall be furnished and installed whether shown on approved drawings, standard details, notes or not. All installations shall be completed as fully operable.

A. Polyvinyl Chloride Pipe - SDR 35

All PVC pipe 15" diameter and smaller furnished under this specification shall be manufactured in strict accordance with ASTM D 3034 and ASTM D 1784.

All PVC plastic shall have a minimum cell classification of 12354-B in accordance with ASTM D 1784.

Joints shall be made using a molded or extruded synthetic elastomeric joint in accordance with ASTM F-477.

Pipe furnished under this specification shall have a DR ratio of 35.

Pipe shall have a normal laying length of 13', 18' or 20'.

B. Polyvinyl Chloride Pipe - Ribbed Gravity Sewer Pipe (requires prior written District approval before construction).

1. All ribbed PVC gravity sewer pipe shall be seamless open profile and meet the requirements of ASTM F 794 and Uni-Bell B-9. The pipe shall have a smooth interior with a solid cross-sectional rib exterior. Exterior ribs shall be perpendicular to the axis of the pipe to allow placement of the sealing gasket without additional cutting or machining. The pipe stiffness shall be a minimum of 46 psi when tested at five percent deflection in accordance with ASTM D 2412.

2. The PVC materials shall meet a cell classification of 12454 B, 12454 C or 13364 B as determined in ASTM C 1784.

3. Elastomeric gaskets shall comply with ASTM F 477.

4. Laying lengths shall be a nominal 18’ and 20’.

5. The minimum wall thickness of the waterway of pipe and fittings fabricated from pipe sections shall be the requirements below. The wall thickness of fittings fabricated sections shall meet the requirements given below. The wall thickness of fittings fabricated from pipes meeting the requirements of ASTM D 3034, SDR 35 and ASTM F 679 are also acceptable. Open profile molded fittings shall conform to the minimum wall thickness requirements given below:

Nominal Pipe Size	8"
Minimum Inside Diameter	7.867"
Tolerance on Inside Diameter	+0.048
Minimum Pipe Stiffness, Series 46	lbf/in^2 46
Waterway Minimum Wall, Series 46	0.060"

6. The thickness of the bell shall be considered satisfactory if it was formed from pipe meeting the requirements above.

7. Fittings

a. Molded fittings shall conform to the requirements of ASTM F 794, paragraph 7.2.4.1.

b. Fabricated fittings shall be made from pipe meeting the requirements of this specification, ASTM D 3034, SDR 35, or ASTM F 679. Fabricated joints shall be adequately lapped or fusion butt welded and, when needed, additionally reinforced.

8. Installation

a. This pipe material may not be used in situations where the bury depth exceeds 15 feet from finished grade to top of pipe.

C. Polyvinyl Chloride Pipe - C-900 (requires prior written District approval before construction)

All polyvinyl chloride pipe furnished under this specification shall be manufactured in strict accordance with AWWA Standard C900-75.

Joints shall use a standard elastomeric joint.

Pipe furnished under this specification shall have a DR ratio of 18, Class 150 or DR ratio of 14, Class 200.

MERIDIAN

D. Polyvinyl Chloride Fittings

PVC fittings shall only be permitted for service connections such as tees and wyes. PVC fittings shall be manufactured in strict accordance with ASTM D-1784, ASTM D-3034, ASTM F-477 and ASTM F-679. Joint type shall be identical to that of the pipe. Solvent weld fittings are allowed only for sand and grease interceptors.

E. Precast Concrete Vaults and Manholes

See MMD Utility Detail Drawings and Standard Notes.

F. Pipe Encasement

See MMD Utility Detail Drawings and Standard Notes.

G. Concrete

See MMD Utility Detail Drawings and Standard Notes.

H. Concrete Reinforcement

See MMD Utility Detail Drawings and Standard Notes.

I. Manhole Rings and Covers

See MMD Utility Detail Drawings and Standard Notes.

J. Bedding Materials

See MMD Utility Detail Drawings, Standard Notes (3/4" Crushed Rock) and Water Specifications - 02 Water Main Materials X. Bedding Materials.

K. Manhole Steps

Manhole steps shall be polypropylene and conform with the standard details. All steps shall have adequate treads. Polypropylene steps shall be constructed of a copolymer polypropylene shell reinforced with a ½" diameter steel rod (grade 60). Polypropylene step shall be manufactured by M.A. Industries, or approved equal. The step shall have impact strength of 300 foot-pounds and, when installed, shall resist pullout forces of 600 pounds. The step may be installed in a preformed hole or cast in place as part of the manhole or vault

L. Grout

Grout shall be non-shrink consisting of Portland cement, sand and admixtures required to meet the site conditions.

M. Flexible Plastic Joint Sealing Compound

See MMD Utility Detail Drawings and Standard Notes.

MERIDIAN

N. O-Ring Joint for Precast Concrete (Requires written District approval before construction)

In lieu of a flexible plastic joint sealant, an "O-Ring" joint may be used for sealing two sections of precast concrete. O-Rings shall meet ASTM C-361 with a minimum diameter of ¾". Lubricant shall be used as recommended by the O-Ring manufacturer.

O. Coal Tar Epoxy Lining (requires prior written District approval before construction)

The coal tar epoxy used for coating the interior of manholes shall be a two (2) component polyamine coating having the following physical characteristics:

Color: Black –Glossy
Mil thickness: 50 mil minimum (average)
45 mil absolute (minimum)
Touch Dry: 10 hours (will vary with temperature)
Heat resistance (wet): 160^{o} Fahrenheit

The coating shall be so formulated that the percentage by weight of the coal tar pitch shall not exceed the percentage by weight of the epoxy resin. The coating shall be satisfactory to produce a hard, glossy surface free from runs, sags, cracks and blisters and shall meet the following formulation:

Volatile	Maximum 20% by weight
Coal Tar	Maximum 30% by weight
Epoxy Resin	Minimum 30% by weight
Film Forming Solids	Minimum 80% by weight

P. Spectra Shield (Requires written District approval before construction)

Contractor shall provide the manufacture specifications.

03 SANITARY SEWER MAIN INSTALLATION

A. Excavation

1. Limit of Excavation

   See MMD Utility Detail Drawings and Standard Notes.

2. Trench Width.

   See MMD Utility Detail Drawings and Standard Notes.

3. Tunneling and Boring

   See MMD Utility Detail Drawings and Standard Notes.

4. Trench Support

   See MMD Utility Detail Drawings and Standard Notes.

5. Grading and Stockpiling

   See MMD Utility Detail Drawings and Standard Notes.

6. Dewatering

   See MMD Utility Detail Drawings and Standard Notes. Contractor is responsible for any and/or all permitting.

7. Blasting

   See MMD Utility Detail Drawings and Standard Notes.

B. Pipe Foundations and Bedding

1. Pipe Foundation

   See MMD Utility Detail Drawings and Standard Notes.

2. Pipe Bedding

   See MMD Utility Detail Drawings and Standard Notes.

C. Trench Backfilling and Compaction.

See MMD Utility Detail Drawings and Standard Notes.

MERIDIAN METROPOLITAN DISTRICT

1. Procedure within the Pipe Zone

   See MMD Utility Detail Drawings and Standard Notes.

2. Compaction Above the Pipe Zone

   See MMD Utility Detail Drawings and Standard Notes.

3. Compaction Tests

   See MMD Utility Detail Drawings and Standard Notes.

4. Final Clean up

   See MMD Utility Detail Drawings and Standard Notes.

D. Installation of Sanitary Sewer Main

1. General

   Pipe shall be laid without break, upgrade from structure to structure, with the bell ends of pipe upgrade. Pipe shall be laid to the line and grade given so as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the flow line. The interior of the sewer pipe shall be cleaned of all dirt and superfluous materials as the work progresses.

   If service fitting areas of development are not installed when the main is installed, the main shall be SDR 35 to allow the use of tapping saddles for future service connections.

   At all times when pipe laying is not in progress, the open end of the pipe shall be closed with a tight fitting cap or plug to prevent the entrance of foreign matter into the pipe. This provision shall apply during all work breaks, including the noon hour, as well as overnight. Under no circumstances shall sewers be used as drains for removing water which has accumulated into the construction trenches. At the beginning of a construction project, a watertight plug shall be installed in the connection manhole, or first manhole upstream, in order to prevent any inflow into the existing sewer system. This plug shall be removed by the Contractor only in the presence of the District Representative. All related costs shall be borne by the contractor.

   All sewer lines shall have a minimum of 4' of cover from finished grade. All pipe and fittings shall be carefully examined for cracks and other defects before installation. All lumps, blisters and excessive coating shall be removed from the bell or coupling and spigot ends of each pipe. Defective pipe or fittings shall be set aside for inspection by the District Engineer who may require repairs or reject the pipe.

   Polyvinyl chloride pipe shall be installed in accordance with ASTM D-2321, Uni-Bell Standard UNI B-5, the manufacturer's recommendation and these specifications. All pipe and fittings shall be carefully lowered into the trench in such a manner as to prevent damage to the materials. Under no circumstances shall sewer main materials be dropped or dumped into the trench. PVC pipe stored outside and exposed to sunlight for more than 30 days shall be covered with an opaque material. Clear plastic sheets shall not be used to cover pipe. Both ends of the pipe shall be clear to allow for

MERIDIAN METROPOLITAN DISTRICT

air circulation under the covering.

Immediately before joining two lengths of sanitary sewer pipe, the inside of the bell or coupling, the outside of the spigot and the gasket shall be thoroughly cleaned to remove all foreign material. Lubrication of the joint and rubber gasket shall be done in accordance with the pipe manufacturer's specifications.

Care shall be taken that only the correct gasket, compatible with the annular groove of the bell, is used. Insertion of the gasket in the annular groove of the bell or coupling must be in accordance with the manufacturer's recommendations. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint. The spigot and bell or coupling shall be aligned and pushed until the reference line on the spigot is flush with the end of the bell or coupling. Pushing shall be done in a smooth, steady motion.

Pipe stored outside which will not be laid within 10 days shall be covered with an opaque material to prevent exposure to sunlight. Clear plastic sheets shall not be used. Both ends of the pipe shall be clear to allow for air circulation under the covering.

Immediately before joining two lengths of PVC pipe, the inside of the bell or coupling, the outside of the spigot and the elastomeric gasket shall be thoroughly cleaned. Lubrication of the joint and rubber gasket shall be done in accordance with the manufacturer's specifications.

MERIDIAN

E. Installation of Manholes

METROPOLITAN DISTRICT

1. Excavation and Backfill
   See MMD Utility Detail Drawings and Standard Notes.

2. Manhole Base
   The manhole base shall be “cast-in-place”. The manhole stubs and sewer main shall be set with water stop gasket before the concrete is placed and shall be rechecked for alignment and grade before the concrete has set. The various sized inlets and outlets to the manhole shall be located as shown in the standard details. The base shall be extended 8" minimum below the bottom of the lowest pipe. Invert elevations of connecting sewers may vary depending upon sizes. The crown elevation of all pipes shall be the same as the crown elevation of the largest pipe.

   All transitions shall be pumice stoned smooth and of the proper radius to give an uninterrupted transition of flow. The concrete shall be per MMD Utility Detail Drawings and Standard Notes with 3/4" maximum size aggregate and shall have a slump not greater than 2". The concrete base shall be shaped with a wood float and shall receive a hard steel trowel finish before the concrete sets. In the event additional mortar is required after initial set has taken place, the surface to receive the mortar shall be primed, and the mortar mixed with "Willhold Concrete Adhesive" or approved equal, in the amounts and proportions recommended by the manufacturer and as directed by the District Engineer in order to secure as "chip-proof” a result as possible. The base shall set a minimum of 24 hours before the manhole construction is continued.

   The accumulation of water on the surface of the concrete due to water gain, segregation, or other causes during placement and compacting shall be prevented as

much as possible by adjustments in the mixture. Provisions shall be made for the removal of such accumulated water so that under no circumstances will new concrete be placed in such accumulations.

When concrete is placed, the temperature of the concrete mix shall not be lower than 50° Fahrenheit or higher than 90° Fahrenheit.

When concrete is deposited against ground without the use of forms, the ground shall be thoroughly moistened or other provisions made to prevent the ground from drawing water from the concrete.

3. Precast Manhole Sections

Each manhole section shall be placed in accordance with the manufacturer's recommendations in a perfectly plumb position. Each joint between the manhole sections shall either be an "O-ring" type joint (with prior approval from the District) or shall have a layer of flexible plastic joint sealing compound on both the tongue and groove part of the joint. The eccentric cone and steps shall be located over the downstream side of the manhole centered over the pipe. Coal tar epoxy lining shall be placed in accordance with these specifications.

4. Manhole Frames and Covers

Manhole frames and covers shall be set to the proper elevations and shall match final grades. Manhole frames shall be set ¼" to ½" below the final grade of the asphalt or concrete roadway and shall be securely attached to the manhole shaft unit with ram-neck or MMD approved adhesive. After the frames are securely set, the frames and covers shall be cleaned and scraped to ensure a satisfactory fit. In the event the manholes are placed in open space areas the ring and cover shall be placed a minimum of 6" above final grade in a 12" wide and deep collar of concrete the depth of the ring and cover.

5. Watertightness of Manholes

Manholes and appurtenances shall be watertight and free from infiltration. The District Engineer shall determine the adequacy of manholes and appurtenances as to watertightness. If testing of the manholes is requested, the test may be made at the same time as the leakage test of the sanitary sewer main. Any leakage shall be repaired at the sole expense of the contractor.

6. Connection to Existing Manholes

New connections to existing manholes wherein stubs have not been provided shall be made by core drilling through the base or as approved by the District Engineer.

7. Installation of Grout

Grout shall be applied to all surfaces in accordance with the manufacturer's recommendations. Grout shall have a troweled finish and shall be protected from a rapid loss of moisture with a covering of wet rags or polyethylene sheets. The temperature of the grout and the surfaces receiving the grout shall be maintained between 65 degrees Fahrenheit and 85 degrees Fahrenheit until after setting.

MILLBRAE
METROPOLITAN DISTRICT

8. Installation of Coal Tar Epoxy Lining

Where coal tar epoxy coated structures are specified, the inner surface of the structure shall be coated with coal tar epoxy with a minimum film thickness of 45 mils. Immediately prior to installation of each section of manhole, a permanently non-drying one-component mastic coal tar fabricated joint compound shall be applied around the inside corner of the joint. The joint compound shall be applied liberally with a trowel, brush or similar device so that when the joint is properly made up, the joint compound will completely fill and seal the void and the excess will be extended out of the inside of the joint.

The excess joint compound shall then be troweled smooth with the lining in the manhole. The mastic coal tar joint compound shall be supplied by or approved by the coal tar epoxy coating manufacturer.

F. Protection of Water Lines Near Sanitary Sewer Facilities

Water mains shall be located a minimum of 10' horizontally from existing or proposed sanitary sewer lines (measured edge to edge). Where water mains cross sewers, they shall be installed to provide a vertical clearance above the sewer of at least 18" between the bottom of the water main and the top of the sewer. When a water main crosses a sanitary sewer at a point less than 18" above the sewer, the sewer main shall be encased in concrete for a distance of 1' (12") on each side of the crossing. Stability of the water and sewer lines at a point of crossing is critical and care must be taken to ensure proper bedding and compaction of both water and sewer lines.

Where it is not feasible to install a water main above an existing or proposed sewer line, the water main shall be laid to provide a vertical clearance distance of at least 18" between the bottom of the sewer and the top of the water main. The sewer main shall be encased in concrete for a distance of 10' on each side of the water main.

G. Alignment and Deflection Testing

After the sewer main and all appurtenances have been installed and have passed the compaction test, the line shall be inspected for alignment and deflection. Prior to any testing of the sewer mains, the lines shall be thoroughly flushed and balled to remove debris and dirt. The lowest manhole (or manholes) within the project shall be plugged with an approved water tight plug (pollard or approved equal) on the downstream outlet of the manhole and all water, silt and debris shall be pumped from this manhole and disposed of properly. The plug shall be installed once the base for the lowest manhole has been constructed and shall not be removed at any time without the consent of the District Engineer.

All mains shall be mandrel tested and all curvilinear lines and "straight-run" sewers that have been specified by the District Engineer shall also be TV inspected.

1. Mandrel Testing

The contractor shall supply all necessary equipment and personnel to perform the testing. Testing consists of pulling an approved calibrated mandrel equal to 95% of the inside diameter, through the pipe from manhole to manhole.

If excessive deflection does not allow the mandrel to pass though the line, the defective section shall be removed and replaced.

2. TV Inspection

The contractor shall provide the TV equipment and give 24 hours notice prior to such inspection. The District Engineer may request pictures or videotape copies of any area. The Contractor shall correct any defective portions. All costs for the TV inspection and any repairs shall be borne by the contractor.

H. Leakage Testing

Once the pipe has passed the alignment and deflection tests, the pipe shall be tested for leakage and infiltration. All materials and associated costs for such tests shall be at the Contractor's expense.

1. Leakage Tests

a. Water Test

The water exfiltration test may be conducted if excessive amounts of groundwater were not encountered during installation and the invert of the lower manhole is not greater than 25' below the invert of the upper manhole. Such testing shall be conducted by plugging the inlet of the lower manhole and the inlet(s) of the upper manhole with an approved water tight sewer plug. The segment shall then be filled with water to a point 2' above the crown of the open sewer in the upper manhole. The segment shall remain filled for at least two hours. The leakage shall not exceed the amounts shown on Table V-3. The length of service connection shall not be used in computing the length of sewer main being tested.

METROPOLITAN DISTRICT

If the leakage is greater than allowed, further inspection shall be conducted by a TV inspection. The defective area shall be repaired and the process shall be repeated until the test section meets the allowable limits. All costs for the testing and repair shall be borne by the Contractor.

b. Air Tests

Each section of sanitary sewer between two successive manholes shall be tested by plugging all pipe outlets with suitable test plugs. Air shall be slowly added until the internal pressure is raised to 4.0 psi. The compressor used to add air to the pipe shall have a blow-off valve set at 5.0 psi to assure that at no time the internal pressure in the pipe exceeds 5.0 psi. The internal pressure of 4.0 psi shall be maintained for at least two minutes to allow the air temperature to stabilize after which the air supply valve shall be closed and the pressure allowed to decrease to 3.5 psi. The time that is required for the internal air pressure to drop from 3.5 psi to 3.0 psi shall be measured. Allowable time is calculated from the following equation:

$A=0.000183d^2L$

A = allowable time.

d = nominal pipe diameter in inches,
L = length of section tested in feet.

An air pressure correction is necessary when the prevailing groundwater is above the sewer line being tested. Under this condition, the air test pressure shall be increased 0.433 psi for each foot the groundwater level is above the invert of the pipe. If the prevailing groundwater is more than 2' above the invert of the pipe, the infiltration test shall be used. Internal air pressure shall never exceed 5.0 psi.

The pressure drop shall not exceed the amounts shown in Table V-4.

If the leakage is greater than allowed, further inspection shall be conducted by a TV inspection. The defective area shall be repaired and the process shall be repeated until the test section meets the allowable limits. All costs for the testing and repair shall be borne by the contractor.

2. Infiltration and Inflow Test

If groundwater is present the end of the sewer at the upper manhole shall be plugged with an approved watertight plug and the section shall be tested for infiltration. The infiltration shall not exceed the amounts shown in Table V-5. The length of house laterals entering that section are not to be used in computing the length of sewer main being tested.

MERIDIAN

The amount of infiltration shall be measured through the use of a pipe weir, flume or other approved apparatus in the presence of the District Engineer.

If the leakage is greater ·than allowed, further inspection shall be conducted by a TV inspection. The defective area shall be repaired and the process shall be repeated until the test section meets the allowable limits. All costs for the testing and repair shall be borne by the contractor.

04 SANITARY SEWER SERVICE DESIGN CRITERIA

A. Flow Design Criteria

Flow design criteria for residential and non-residential sanitary sewer service lines shall be based on the estimated flow determined by the Contractor's architect, engineer or mechanical engineer and shall comply with the most current UPC.

B Hydraulic Design

Service lines shall be designed to carry the peak discharge and transport suspended materials from the building sewer to the collection main. Service lines shall be laid to a constant grade between the collection main and the outlet of the building sewer. In situations where the collection main is deeper than 20', the service line may be laid at a constant slope to a point where an angle fitting is installed to make a relatively steep (45º) connection to the collection main.

Although the hydraulic characteristics of each sanitary sewer service line shall be calculated by the Contractor's engineer, the following slopes are generally permissible for service lines

Diameter	Minimum Slope (Foot/Foot)	Minimum Fall (Foot/Foot)
4”	0.02	1/4
6”	0.01	1/8

The minimum diameter for a sanitary sewer service line shall be 4".

C. Location and Alignment

Each single family residential detached or attached dwelling unit shall have a separate sanitary sewer service line and tap. Townhomes, condominiums and apartments that are designed to utilize common plumbing within the structure, may have a service line that serves more than one dwelling unit.

Service lines shall follow a straight horizontal alignment between the outlet of the building sewer and the connection to the collection main. In the event that a horizontal deflection is necessary, a cleanout will be required in accordance with the standard details.

Sanitary sewer service lines may be placed in a common trench with a water service line only under the following conditions:

1. The water service line shall be "K" copper.
2. The subgrade bench for the water service line shall be undisturbed soil with a minimum width of 12".
3. The top of the sanitary sewer service line shall be located a minimum of 18" below the water service bench.

Sanitary sewer service lines shall be located at the center of the lot.

In the event that two service lines are located at the same station on the main line, the service wye for the lot on the long side of the street shall be placed a minimum of 2' downstream of the adjacent service wye. When the service lines are the same length the service wye for the service lines on the east or north side of the street shall be placed a minimum of 2' downstream of the adjacent service. The service line shall extend from the main to the lot in a manner that is parallel with the lot line or perpendicular with the main. Services in cul-de-sacs shall be radial to the center of the lot provided that the angle of connectors does not exceed 90°. When the service to a lot is at the end of the sanitary sewer main, the manhole shall be located at the center of the lot and the service shall connect to the main 5' down from the manhole and shall enter the lot at the center of the lot.

It is the responsibility of the contractor to stake the location of the service to ensure that it is correctly located.

A service that is connected to a sanitary sewer main that runs between two lots in a dedicated easement shall be placed 15' from the rear property line. If the adjacent service connects to the same main, it shall be 20' from the rear property line.

D. Depth

All sanitary sewer service lines shall be designed so that a minimum of 4.0' of cover exists over the top of pipe after final grade has been established. No variance will be considered which proposes the use of PVC ASTM D2321 SDR 35 pipe with less than 4.0' of cover.

Sanitary sewer service lines may be bedded with squeegee bedding in accordance with the Water Specifications.

E. Manholes

Manholes for sanitary sewer service lines 8" diameter and larger shall comply with these standard specifications. Manholes for sanitary sewer service lines shall be required for the purposes of monitoring or sampling in accordance with District Standards.

F. Materials

All materials for sanitary sewer service lines shall be in accordance with standard specifications.

G. Underdrain Systems

MERIDIAN

Underdrain systems shall not be considered part of the sanitary sewer system and are not required by nor are the responsibility of the District.

H. Sewer Service Cleanouts

Cleanouts shall be installed on sewer service lines at all points of horizontal deflection or on service lines which exceed 100' in length. The cleanout diameter shall match the nominal diameter of the service line and shall be constructed in accordance with the standard details. Cleanouts shall be located so that surface water does not accumulate. When cleanouts are located in existing or future landscape areas, the cleanout cover shall be 4" to 6" above finished grade.

I. Sand/Oil and Grease Interceptors

All restaurants, cafeterias or other food preparation facilities shall have a grease interceptor installed on the sewer service line. The sizing of the grease interceptor shall be determined by the contractor/design engineer and submitted to the District Engineer for approval. The grease interceptor shall be owned and maintained by the property owner. Bypasses around grease traps shall not be permitted.

Services which discharge any quantities of sand, oil or other inert debris into the sanitary sewer system shall have a sand/oil interceptor installed. Examples of such services include, but are not limited to: automobile service stations, mechanical repair shops, car washes, garden nurseries, warehouses and garages with floor drains. The sizing of the sand/oil interceptor shall be determined by the contractor/design engineer and submitted to the District Engineer for approval. The sand/oil interceptor shall be owned and maintained by the property owner. Bypasses around sand/oil interceptors shall not be permitted.

Although a facility may not have been originally constructed with a sand/oil or grease interceptor, the District may require that one be installed in the event of a change in the type of use of the facility. All costs shall be borne by the contractor/design engineer.

J. Lift Stations (requires prior written District approval before construction)

Lift stations shall be permitted to provide service to individual facilities in the event that gravity service is not possible. Lift stations shall not be used as an alternative to extending a gravity service line, which may be longer or deeper than "normal".

Lift stations shall be designed by the Developer/Owner's Engineer and shall include a commutator or grinder for all solids. The force main shall be sized for the maximum discharge flow and the pump.

All lift station designs shall be submitted to the District Engineer for approval. The use and design of the lift station shall also be approved by the Douglas County Building Department.

All costs, maintenance and operation of the lift station, force main and gravity service line shall be the sole responsibility of the property owner.

05 SANITARY SEWER SERVICE MATERIALS

MERIDIAN METROPOLITAN DISTRICT

A. Polyvinyl Chloride Pipe - PVC

Sanitary sewer service lines may be constructed of polyvinyl chloride pipe in compliance with the standard specifications.

B. Bedding Material

Pipe bedding for all types of sanitary sewer service lines shall comply with standard specifications.

C. Sanitary Sewer Service Fittings

Pipe fittings for PVC service lines shall be PVC, bell and spigot joint in compliance with standard specifications. No solvent weld fittings may be used except for sand and grease interceptors.

D. Tapping Saddles

Sanitary sewer service tapping saddles shall be constructed of PVC manufactured in strict accordance with ASTM D-1784, ASTM D-3034, ASTM F-477 and ASTM F679. Tapping saddles shall consist of: a rubber gasket attached to the "flange" of the saddle which will seal against the outside wall of the main, a bell and spigot gasket in the bell of the service outlet and two stainless steel straps which secure the saddle to the main line. Solvent welded saddles shall not be used.

E. Pre-Cast Concrete Sand/Oil and Grease Interceptors

Pre-cast sand/oil and grease interceptors shall be constructed in the same manner as

Precast Concrete Vaults, See standard details. All piping within these interceptors shall be solvent weld PVC. Interceptor installed in a parking lot or roadway shall be raised to grade by using precast concrete riser rings that are a minimum of 6” wide.

F. Manhole Rings and Covers

Manhole rings and covers for sand/oil and grease interceptors shall comply with standard specifications.

G. Pipe Adaptors/Couplings

Pipe adaptors, couplings or bushings shall be used to connect pipes of different materials or dimensions. Adaptors, couplings and bushings shall provide a secure, leak proof joint that shall meet or exceed the leak testing requirements of the pipe. Adaptors, couplings and bushings shall be secured to the pipe by means of a mechanical connection such as stainless steel clamps or a positive bell and spigot gasketed joint. The nominal diameter of the adaptor, coupling or bushing shall match the nominal diameter of the pipes being connected. Field modifications of these items shall not be permitted. Pipe adaptors, couplings or bushings shall be manufactured by Joints, Inc. (Calder Coupling): Fernco, Inc.; GPK Industries or an approved equal. Concrete collars with “diapers” shall not be permitted.

H. Lamphole/Cleanout Ring and Cover

Lamphole/cleanout rings and covers shall be cast iron, heavy duty with an ability to withstand traffic loading. Rings and covers shall be Tyler or approved equal. Lamphole covers shall be a Tyler series 6855 slip type section with locking lid or an approved equal.

MERIDIAN
METROPOLITAN DISTRICT

06 SANITARY SEWER SERVICE INSTALLATION

A. Excavation

Excavation for sanitary sewer service lines shall be in accordance with standard specifications.

In the event that a common trench is specified for a sewer service line and a water service line, the subgrade bench for the water service line shall have a minimum width of 12". This bench shall be excavated from undisturbed soil at an elevation no less than 18" above the top of the sanitary sewer service.

B. Pipe Foundation and Bedding

Pipe foundation and bedding for service lines shall be in accordance with standard specifications; however, ¾” crushed rock bedding shall not be required unless PVC sewer service lines exceed a depth of cover of 15'.

C. Trench Backfilling and Compaction

Trench backfilling and compaction of sewer service lines shall be in conformance with standard specifications.

D. Installation of Sanitary Sewer Service Lines

Installation of service lines shall be in accordance with standard specifications.

Sewer services shall be connected to the main by means of a wye fitting or tapping saddle entering the main at an angle of 45° vertically above the spring line of the main. Service lines shall be extended from the main using a combination of no more than three "eighth bends" (45°) or "sixteenth bends" (22 ½^{0}). All service lines shall be plugged at the end of the line with a watertight plug manufactured for use with the service line material.

End plugs must be able to withstand the internal pressure of leakage testing required by these specifications.

E. Installation of Service Line Taps

All service lines shall be connected to the main by means of either a PVC molded wye installed in conjunction with the main line or a PVC saddle in accordance with standard specifications. Allowable combinations of service line connections are outlined in Table V-2.

The sewer main shall be scored to the shape of the wye using a template approved by the saddle manufacturer. The hole shall be cut with a hole cutter or keyhole saw and cleanly machined by hand to remove all burrs, rough edges and debris. The exterior of the main shall be wiped clean and prepared with an approved cleaning solvent prior to the installation of the saddle. The saddle shall be drawn tight by means of stainless steel straps.

Upon completion of the tap, the main, the tapping saddle and the service line shall be squeegee bedded for depth 0 to 15', or ¾” crushed rock bedding for depths of 15' and over, and hand tamped prior to backfilling. Saddle taps may be tested for leakage in accordance with standard specifications.

F. Installation of Sand/Oil and Grease Interceptors

When required, sand/oil and grease interceptors shall be installed in accordance with standard specifications. All pipe and fitting installed as part of the interceptor shall be a minimum of Schedule 40 PVC solvent weld. Interceptors installed in a parking lot or a roadway shall be raised to grade by using HDPE riser rings that are a minimum of 6" wide.

MERIDIAN

TABLE V-1 QUANTITIES OF WASTEWATER - UNIT FLOW FACTORS		
Type of Use	Unit Flow (Average Daily Flow)	Peaking Factor (Peak Flow = Avg Day * PF)
Single Family	175/DU	5.0
Multi-Family	125 gpd/DU	5.0
Commercial	53.4 gpd/ksf	5.0
Warehouse/Industrial	26.7 gpd/ksf	5.0

Definitions: Single Family: Any detached residential home
Multi-Family: Any attached residential home
gpd: Gallons per day
ksf: 1,000 square feet.
DU: Dwelling Unit

TABLE V-2 TAPPING REQUIREMENTS FOR SERVICE CONNECTIONS				
Size of Main	Polyvinyl Chloride Sewer Main - Material and Tap Size			
	4"	6"	8"	10" & over
8"	S/F	F	M	-
10"	S/F	S/F	M	M
12"	S/F	S/F	M	M

"S/F" Tapping Saddle or Fitting (Wye) Required
"F" Fitting Required
"M" Manhole Required
"-" Not Applicable

Limits include exfiltration of manholes.

TABLE V-3 ALLOWABLE LIMITED OF EXFILTRATION (Leakage) 50 GALLON/INCH/DIAMETER/MINIMUM DAY	
Pipe Diameter	Maximum Allowable Loss in gallons per hour per 100 Feet of Pipe
8"	0.31
10"	0.39
12"	0.47

MERIDIAN
METROPOLITAN DISTRICT

TABLE V-4			
ALLOW ABLE TIME (min:sec) FOR PRESSURE DROP FOR LENGTH BELOW			
Pipe Diameters			
	8"	10"	12"
100 feet	1:10	1:50	2:38
200 feet	2:20	3:39	5:16
250 feet	2:55	4:57	6:35
300 feet	3:30	5:29	7:54
350 feet	4:06	6:24	9:22
400 feet	4:41	7:32	10:54
450 feet	5:43	8:14	11:51
500 feet	6:43	9:09	13:10

TABLE V-5	
ALLOWABLE LIMITED OF INFILTRATION	
50 GALLON/INCH/DIAMETER/MINIMUM DAY	
Pipe Diameter	Maximum Allowable Infiltration in gallons per hour per 100 Feet of Pipe
8"	0.31
10"	0.39
12"	0.47

MERIDIAN
METROPOLITAN DISTRICT