TABLE OF CONTENTS

CHAPTER 3
WATER SYSTEM

CHAPTER 3
WATER SYSTEM

3.00.00 INTRODUCTION

All water distribution systems constructed within the CITY of Westminster shall comply with the requirements of these STANDARDS AND SPECIFICATIONS and may include additional special criteria established by the CITY for overall hydraulics of the water utility system. Special criteria shall be outlined at pre-design meetings, as determined necessary by the CITY ENGINEER.

The DEVELOPER shall analyze any impacts to the existing off-site infrastructure. If there are any impacts, as determined by the CITY, additional analysis, such as hydraulic modeling, will be required at the DEVELOPER'S expense. If off-site PUBLIC IMPROVEMENTS are required for the proposed development to be successful, the CITY and the DEVELOPER will negotiate the scope of the improvements, any phasing, and payment by the developer to the CITY for these off-site PUBLIC IMPROVEMENTS.

All references to standards and manuals shall refer to the most current edition unless noted otherwise.

3.01.00 INTERRUPTION OF SERVICE

No valve or other control device on the existing public system will be operated for any purpose by anyone other than the Department of PWU (PWU).

The CITY PWU's Utilities Division shall operate all existing valves, hydrants, blow-offs and curb stops. Twenty-four hours prior to the interruption of service, the CONTRACTOR shall notify all users whose service will be interrupted in order for them to make provisions for necessary water storage. For water mains servicing commercial areas (e.g., restaurants) 48 hours prior notice shall be given, and work affecting the shut-down shall be coordinated with each business. No water line in service will be shut-down for more than a four-hour period at one time. Prior approval by the CITY ENGINEER is required for all shutdowns.

In certain situations, to lessen the impacts to adjacent customers (e.g. residences, businesses, schools, etc.), the WORK detailed in this section may require night or weekend construction at the direction of the CITY ENGINEER.

3.02.00 WATER BREAKS

If notification prior to shutdown is impossible, the CONTRACTOR shall notify all users within one (1) hour after the shutdown. Since prior notification was not possible, it will be the responsibility of the CONTRACTOR to supply potable water to the users affected. The CONTRACTOR shall also contact the PWU Utilities Division and the CITY's Fire Department in reference to this emergency shutdown within one (1) hour.

3.03.00 METER SET INSTALLATION REINSPECTION FEE

Water tap fees provide for the initial inspection of the meter set only. Where additional inspections are made necessary by incomplete or faulty work, a fee in accordance with CITY CODE will be charged for the second inspection and each subsequent inspection. This fee shall be charged to the holder of the permit and paid to the CITY before any additional inspections will be made.

TO SCHEDULE AN INSPECTION DURING REGULAR BUSINESS HOURS, CONTACT THE UTILITY OPERATIONS DIVISION METER SHOP AT 303-658-2519. FOR AFTER HOURS EMERGENCIES CALL POLICE DISPATCH AT 303-658-4360.

3.10.00 DESIGN CRITERIA

3.11.00 SCOPE

It is the intent of this section to provide sufficient detailed information to enable the DEVELOPER to correctly and efficiently design the overall water system for a particular development. If there is a question or a concern regarding the design of any portion of the water system that is not adequately answered within this chapter, the DEVELOPER shall contact the CITY to get all issues resolved prior to design. Any deviation from these STANDARDS AND SPECIFICATIONS must be approved in writing by the CITY ENGINEER.

3.12.00 GENERAL

The water system shall be designed by or under the direct supervision of a Professional Engineer registered in the State of Colorado utilizing the most current technical standards along with good, sound engineering judgment throughout the design process. The DEVELOPER shall have experience in the design and construction of municipal water distribution systems. The development approval process includes the submittal of a Preliminary Development Plan, an Official Development Plan, utility study and construction drawings for review and approval by the CITY ENGINEER.

For design of the water system, the CITY's Fire Department shall be contacted early in the design process in order to determine the required fire flows for proposed facilities. Fire flow requirements will likely dictate the sizing and layout of the water distribution system.

3.12.01 Water System Utility Study Requirements

The Utility Study shall include the following information and shall be bound in an 8 ½ x 11 inch folder:

B) **Certification statement** - shall be included at the beginning of the report and shall read as follows: "This Utility Report for the design of the _____ development was prepared by me or under my direct supervision in accordance with the CITY of Westminster's Standards and Specifications and acceptable professional practices of the industry. We acknowledge that the CITY of Westminster's review of this Utility Study is only for general conformance with submittal requirements, current design criteria and standard engineering principles and practices. We are also aware of the provisions of Section 11-6-5(B) of the CITY Code of the CITY of Westminster." The seal and signature of the Professional Engineer responsible for preparing the report shall follow this statement.

C) **Report text** for the water system design shall include the following at a minimum:

a) **Project location and Description** – a description of the boundary streets, project area and type of development proposed or anticipated use. Include a vicinity map.

b) **System layout** – a description of the existing and proposed water infrastructure in conformance with the CITY's latest master plan shall be provided and reference shall be made to a figure in the back of the report illustrating these improvements. The description shall include the sizes and types of existing and proposed pipes and the influence of the improvements on the project and surrounding area.

c) **Design flow requirements** – Complete design flow calculations and a discussion explaining the calculations and assumptions shall be provided. Items shall include types of facilities to be served, fire flow calculations based on building construction type and floor area, developed land area, number of units based on land use, and population densities. Calculations for Average Day, Max Day and Peak Hour demands shall be presented. Max Day plus Fire Flow and Peak Hour demand scenarios shall be evaluated for worst case and shall include domestic demands, building sprinkler flows and domestic irrigation flows. Data shall be presented in table format, if possible, for ease of reading. The report shall acknowledge that the Fire Department has provided the required fire flows and that they approve of the proposed fire hydrant locations.

d) **Off-site system requirements** – The report shall include a discussion of all PUBLIC IMPROVEMENTS needed to any off-site infrastructure, as determined by the CITY ENGINEER, to make the on-site infrastructure comply with CITY criteria including an analysis of water availability. If these PUBLIC IMPROVEMENTS to off-site infrastructure are anticipated then the off-site utility shall be included in the hydraulic modeling described in item e) that follows, at the DEVELOPER's expense. In addition to this analysis a cost estimate for these PUBLIC IMPROVEMENTS, as approved by the CITY ENGINEER, shall be included in the appendix of this report. For these PUBLIC IMPROVEMENTS, the CITY will inform the DEVELOPER if they will be allowed to construct these PUBLIC IMPROVEMENTS or if the CITY will construct these PUBLIC IMPROVEMENTS in accordance with item 3.00.00.

e) **Hydraulic Analysis** – A detailed description of modeling assumptions and rationale shall be provided in the report text such that the analysis is clear and can be confirmed. Results of the analysis at a minimum shall include: minimum and maximum system pressures for the various scenarios modeled, corresponding node locations, distribution of fire flows among hydrants, and maximum pipe velocities. Data should be presented in table format. Reference shall be made to modeling data in the appendix and a figure of the pipe and node network provided.

f) **Conclusions** – a description of the results and how they follow the CITY criteria shall be provided. Any deviations from the CITY criteria shall be described and applicable variances requested.

f) **Appendices** - Printed data output from the modeling results shall be provided in the appendix and shall correspond with a figure of the pipe and node network. The appendix shall also include hydrant flow test results, hand calculations and any other pertinent data. A large size figure (24" x 36") illustrating the existing and proposed utility improvements shall be provided and shall conform to the CITY's latest master plan. The drawing shall include pressure zone boundaries, building finished floor elevations, elevation contours and locations of proposed and existing utility easements and right-of-way.

In situations where a previous utility study was conducted and is still applicable, a utility conformance letter may be submitted in place of the Utility Study, at the discretion and with written authorization of the CITY ENGINEER.

3.13.0 DESIGN DEMAND

The domestic demands for a particular development vary depending on the type of development, land use density, irrigation demand and building fire sprinkler flow requirements. However, the demand used to design a water system is largely a function of the required fire flow for a particular development.

There are two general categories of development for which domestic flow rates are determined: residential and commercial/industrial. Domestic demands for these developments are determined from Tables 3.13.A, 3.13.B and 3.13.C below and then peaking factors are applied to develop the Maximum Day Demand and Peak Hour Demand as follows:

Maximum Day Demand = 2.5 x Average Day Demand
Peak Hour Demand = 4.0 x Average Day Demand

Domestic demands for a development shall be combined with peak irrigation demand, building fire sprinkler demand and the project fire flow. The peak irrigation demand shall be determined by the irrigation designer and the fire sprinkler demand shall be determined by the fire sprinkler Engineer. The fire flow for a project is determined from the International Fire Code (Edition currently approved by the CITY Building Department) and requires the approval of the CITY Fire Marshal. Factors such as building area and construction type are required to determine the fire flow for a structure.

The design of the water distribution system shall be based on the higher of the two demand scenarios:

Maximum Day Demand + project fire flow + building fire sprinkler flow + peak irrigation flow, or

Peak Hour Demand + peak irrigation flow.

The CITY shall be consulted for design criteria with regard to non-standard developments, design of municipal infrastructure such as transmission mains, pump stations, etc. and for developments with unusually high demands. The CITY ENGINEER shall have final input in these instances.

Residential Average Day Demand shall be based on density, and zoning as determined by the Preliminary Development Plan and Official Development Plan for the project and the proposed number of units. This estimate is to be used solely for the purposes of planning and design infrastructure. The CITY PWU's Water Resources Division shall be contacted to determine tap size and fees.

Table 3.13.A – Residential Average Day Demand Data.

Zoning	Type of Development	Units per Acre	People per Unit	Gallons per person per day
R-1 to R-5	Single Family Detached	Up to 5	2.90	89
R-8 to R-18 and District Center	Single Family Attached	Up to 18	2.00	90
R-36	Attached, Multi-family	Up to 36	1.80	72

Commercial and industrial Average Day Demands will vary widely depending on the type of development. The following criteria in Table 3.13.B is based on historic information from the CITY's water records and can be used to estimate the water usage for the various developments listed for the purposes of infrastructure design. The CITY PWU's Water Resources Division shall be contacted to determine tap size and fees.

Table 3.13.B – Commercial/Industrial Average Day Demand Data

Type of Development	Unit	Indoor Design Demand (gallons/unit-day)
Auto Service and Repair	sf	0.12
Car Wash	bay	528
Childcare	sf	0.32
Church	sf	0.18
Grocery Store	sf	0.22
Gas Station with Car Wash	sf	8
Gas Station without Car Wash	sf	1.32
Hospital	sf	0.32
Hotel/Motel	room	130
Medical Office	sf	0.2
General Offices	sf	0.04
Restaurant	sf	1.1
Retail/Shopping Center	sf	0.16
School	sf	0.06
Warehouse/Industrial	sf	0.04

For commercial and industrial planning purpose, where specific densities and building uses are not yet known, average day demands can be calculated on an acreage basis as specified in Table 3.13.C.

Table 3.13.C – Commercial/Industrial Average Day Demand Data (Based on Acreage)

Type of Development	Gallons per Acre-Day
Retail Commercial	1430
Office	1430
Office – High density	2480
Mixed-Use	4100
Industrial	1430
School/Church	1260

If the developer has specific information for their proposal that is different from the above, and the developer wishes to design using the different information, the developer must contact PWU to discuss and obtain approval.

3.14.00 HYDRAULIC DESIGN

A computer generated hydraulic analysis of the proposed infrastructure, or "model", shall be developed using standard industry software such as WaterCAD or CITY approved equal. In order for the model to properly correlate with the CITY's distribution system, a hydrant flow test needs to be performed on nearby hydrants and static and residual pressures obtained as a function of flow rate. This data shall be used in the model to develop a water source curve, represented by a reservoir and pump, and this will

allow modeled pressures to vary over a range of imposed demands. The water source curve functions as a boundary condition in the model where proposed piping interfaces with the existing distribution system at this boundary.

For purposes of hydraulic modeling, Hagen Williams C coefficient shall be 130 for PVC pipe, lined ductile iron pipe, and lined steel pipe. For any other condition, coordination with the PWU is required.

The objective during hydrant flow testing is to obtain a flow rate similar to the design demand required for the proposed development. The hydrants to be tested shall be determined by the PWU and data obtained during this test shall be valid for up to one-year, unless otherwise approved in writing by the PWU. Distribution system factors may require that a fire flow be increased for a particular area of the system, as determined by PWU. A hydrant flow test shall be requested by the DEVELOPER from the CITY's Fire Department.

Special analysis may be required by the CITY ENGINEER for developments requiring large flow demands and shall be discussed with the Utilities Division. Future changes in zone pressures, in conformance with the CITY's latest master plan, shall be considered in the hydraulic analysis.

Upon approval by the CITY ENGINEER, the requirement for a computer generated hydraulic analysis may be waived for the following:

- Developments requiring low domestic demands (less than 600 gpm) and with no fire flow requirement; or

- Developments proposing less than 200 feet of water main and no required fire hydrants.

For the above cases, hydraulic calculations should be provided as part of the Utility Study and shall demonstrate acceptable system pressures and velocities as a result of required flows.

3.15.00 OPERATING PRESSURES WITHIN THE DISTRIBUTION SYSTEM

Minimum recommended pressure within the distribution system shall be 50 pounds per square inch during the Peak Hour Demand and the maximum recommended pressure during the Average Day Demand shall be 100 pounds per square inch.

The maximum pressure fluctuation at any location in the distribution system between Peak Hour Demand and Average Day Demand shall not exceed 30 pounds per square inch.

The minimum pressure at the ground surface (i.e., hydrant nozzle) shall be 20 pounds per square inch under all scenarios, including fire flow. The Utility Study shall discuss the pressure at the highest occupied space in all buildings and provide a recommendation on the need for a domestic booster pump and/or the need for a fire pump to supply fire sprinkler systems.

3.16.00 PRESSURE REGULATING STATIONS

Pressure reducing valve (PRV) installations should be avoided. In areas where a main extension may cause pressures to be greater than the existing zone pressure, the DEVELOPER must discuss alternatives with PWU. Detailed design of any PRV installations shall be performed by the DEVELOPER with input from PWU.

For individual water services to buildings, water pressure regulators will be required if system pressures exceed 80 psi or at the discretion of the CITY's Building Division.

3.17.00 SIZING OF MAINS

3.17.01 Distribution Mains

All water mains shall be sized large enough to provide for domestic, irrigation, and fire protection flows to the area serviced. The maximum acceptable head loss for six, eight, ten and twelve inch mains is two feet per thousand feet of main for the Peak Hour Demand scenario. This acceptable head loss rate shall not apply for fire flow scenarios. The maximum pipe velocity for non-fire flow scenarios shall be 5 feet per second and for fire flow scenarios shall be 7 feet per second. Final size of distribution mains shall be approved in writing by the CITY ENGINEER. Over sizing of mains may be required by the CITY ENGINEER, and the recovery of the costs of such over sizing shall be in accordance with Section 11-6-7 of CITY CODE.

The minimum diameter for water mains that have fire hydrants is 8 inches. All waterlines shall be looped. Mains in residential areas that do not have fire hydrants may be 6 inches, with written approval of the CITY ENGINEER. No dead-end mains, except lines extending into cul-de-sacs serving not less than 3 and not more than 6 single-family residential units, nor mains extending more than 150 feet from the lateral connection, will be permitted. All stubs and dead end mains shall have a blow-off installed. With the exception of fire hydrant laterals, only polyvinyl chloride (PVC) pipe is approved for water main installations 12 inches in diameter and smaller. Any other material proposed must be approved in writing by the CITY ENGINEER prior to construction. A Hazen-Williams “C” coefficient of 130 shall be used when modeling PVC and DIP pipe.

3.17.02 Transmission Mains

All transmission mains shall be sized in compliance with the CITY's "Water Distribution System Study," latest edition, or as otherwise approved in writing by the CITY ENGINEER. See section 3.22.00 for further details.

3.18.00 SYSTEM LAYOUT – CONSTRUCTION PLAN CRITERIA

3.18.01 General

All water mains shall be installed in dedicated RIGHT-OF-WAY or utility easement dedicated to the CITY. Water main installation in easements between single-family residential lots will only be allowed for the purpose of looping a water main at the end of a cul-de-sac. Waterlines should NOT be installed parallel to and directly below any concrete such as sidewalks, curbs, or gutters. Lines shall normally be located 5 feet north or west of street centerline, or 5 feet north or west of a curbed median, unless otherwise approved in writing by the CITY ENGINEER.

The minimum depth of cover for water mains from the final approved grade of the surface to the top of the water main shall be 5 feet. Where final grades have not been established, mains shall be installed to a depth great enough to insure 5 feet of cover below the approved future grade but in no event less than 5 feet of cover from the temporary grade. The maximum depth of cover for water mains shall be 8 feet below the final approved grade of the surface unless approved otherwise, in writing, by the CITY ENGINEER.

Plan and profile shall be required for all water main designs. Utility crossings shall be identified in the profile views for all known or planned utilities. The vertical alignment of water

mains shall be designed such that unnecessary high points are avoided. If a high point in the main cannot be avoided, a controlled high point shall be located at a fire hydrant tee where trapped air in the system can be bled. High points at a water main lowering should be avoided by deflecting the main on both sides of the lowering such that positive pipe grades are maintained to controlled high points in the system. To maintain positive pipe grades to controlled high points, the maximum depth of cover to the main can increase to 8 feet, if approved in writing by the CITY ENGINEER. Refer to Sections 3.18.02 through 3.18.06 for the alignment of water lines with sewer lines. Refer to Section 3.18.07 for the design of combination air valves.

Water mains shall be laid a minimum of ten feet, horizontally and edge to edge, from any existing or proposed utility. Upon written approval by the CITY ENGINEER, a water main may be laid closer than ten feet to a parallel sewer main if it is laid in a separate trench and if the elevation of the invert of the water main is at least 18 inches above the crown of the sewer main and, in addition, PVC C-900 is used for the sewer main.

Water mains shall be designed such that they extend the entire frontage of the property to be served or as otherwise approved in writing by the CITY ENGINEER.

When the water main passes under a highway, railroad, or waterway, there shall be a minimum of five feet of cover and a steel casing shall be installed in accordance with the standard drawing in the Appendix of this chapter. The steel casing shall extend the entire width of the RIGHT-OF-WAY or easement of the crossing structure or as directed by the CITY ENGINEER. In all cases, valves shall be located such that the water main at such crossings can be completely isolated without interruption of any services.

3.18.02 Waterline Crossing Over a Sanitary Sewer Line

When there is less than 18 inches of vertical clearance between the water main and the sanitary sewer pipe, or water main pipe joints extend less than 10 feet each side of the sewer pipe, one of the following secondary containments shall be required for the water or sewer pipe:

1. Utilize Pressure Pipe AWWA C900.

2. Concrete or flowable fill encasement, extending to any joints within 10 feet of the crossing.

Note that if joint-less pipe, such as fusible PVC or welded steel, is used for the water or sanitary sewer pipe then secondary containment will not be required. However, structural support of the water or sewer main using flowable fill may be required to prevent settlement and permit maintenance of both utilities.

Minimum criteria is presented in this section, and applies to both public mains and private service lines.

3.18.03 Waterline Crossing Over a Storm Sewer Line

When there is less than 18 inches of vertical clearance between the water main and the storm sewer, the water line shall be cased. Alternately, with written approval by the CITY ENGINEER, each joint of the storm sewer within nine feet of the centerline of the crossing shall be encased in concrete.

Freeze potential of a water main shall be evaluated when crossing storm sewers or other exposures to the elements. If a water main crosses a storm sewer with 3 feet or less of vertical clearance, a 12" thick layer of extruded polystyrene insulating foam, also referred to as "XPS" shall be provided all around the water main for a minimum of 5 feet on each side of the storm sewer. The sheets of "XPS" shall be thick enough to allow shaping of the material so it fits snugly around all sides of the pipe leaving a minimum 12" thickness around all sides of the pipe. Bonding of individual sheets of "XPS" shall be in accordance with section 3.61.03 of these Standards and Specifications. Crossings of dead end water mains and storm sewer with less than 18 inches of vertical clearance shall be prohibited.

3.18.04 Sanitary Sewer Line Crossing Over a Waterline

When there is less than 18 inches of vertical clearance between the water main and the sanitary sewer pipe, or water main pipe joints extend less than 10 feet each side of the sewer pipe, one of the following secondary containments shall be required for the water or sewer pipe:

1. Utilize Pressure Pipe AWWA C900.

2. Concrete or flowable fill encasement, extending to any joints within 10 feet of the crossing.

Note that if joint-less pipe, such as fusible PVC or welded steel, is used for the water or sanitary sewer pipe then secondary containment will not be required. However, structural support of the water or sewer main using flowable fill may be required to prevent settlement and permit maintenance of both utilities.

Minimum criteria is presented in this section, and applies to both public mains and private service lines.

3.18.05 Storm Sewer Line Crossing Over A Waterline

In all cases, regardless of vertical clearance, the water line shall be cased. Alternately, with written approval by the CITY ENGINEER, the joints of the storm sewer shall be encased in concrete a minimum of nine feet on each side of the centerline of the crossing.

Freeze potential of a water main shall be evaluated when crossing storm sewers or other exposures to the elements. If a water main crosses a storm sewer with 3 feet or less of vertical clearance, a 12" thick layer of extruded polystyrene insulating foam, also referred to as "XPS" shall be provided all around the water main for a minimum of 5 feet on each side of the storm sewer. The sheets of "XPS" shall be thick enough to allow shaping of the material so it fits snugly around all sides of the pipe leaving a minimum 12" thickness around all sides of the pipe. Bonding of individual sheets of "XPS" shall be in accordance with section 3.61.03 of these Standards and Specifications. Crossings of dead end water mains and storm sewer with less than 18 inches of vertical clearance shall be prohibited.

3.18.06 Limits on Vertical Separation

Under no circumstances shall the vertical clearance between any waterline and sanitary sewer or storm sewer be less than 18 inches without written approval from the CITY ENGINEER.

3.18.07 Combination Air Valves

Combination air valves are necessary to serve several functions: they exhaust large volumes of air from the system during start-up, they open during draining or if a negative pressure occurs and they release accumulated air from the system during operation. The vertical alignment of water mains shall be designed such that unnecessary high points are avoided as described in section 3.18.01 of these STANDARDS AND SPECIFICATIONS. If a high point in a distribution water main cannot be avoided, a controlled high point shall desirably be located at a fire hydrant tee where trapped air in the system can be bled through the fire hydrant. If this is not possible due to legitimate design constraints, an air valve shall be located at the high point and within a manhole.

Combination air valves for distribution mains and transmission mains shall be sized by the design engineer in accordance with the manufacturer's recommendations and approved by the CITY ENGINEER.

3.19.00 EASEMENTS

All water mains shall be in an easement which has a horizontal width of at least two times the depth to the pipe invert. The minimum easement shall be 20 feet in width for one utility, 30 feet in width for two utilities, and 40 feet in width for three utilities. Site-specific circumstances may dictate the need for wider easements. For normal depths, the main shall be located a minimum of 10 feet from and parallel to the edge of the easement. Meters and fire hydrants not installed within the right-of-way will require an easement dedication ten feet wide and extending five feet behind the meter or fire hydrant. If a fire hydrant lateral or water meter extends behind the curb more than ten feet, then the width of the easement shall be a minimum of 15 feet. All easements shall be for the exclusive use of the CITY. Neither landscaping (except grass and private irrigation systems) nor permanent structures (sheds, buildings, etc.) shall be placed in the easement.

The easement agreement, provided by the CITY, shall state that any temporary structures (including paving and fencing) placed in the easement shall be removed and replaced by the owner of the land when requested by the CITY so that maintenance can be performed. The OWNER shall agree to hold the CITY harmless for any replacement of structures removed from the easement.

The following statement shall appear on all Official Development Plans and all Final Plats**.**

UTILITY MAINTENANCE STATEMENT

All public water, storm sewer and sanitary sewer mains and appurtenances located in public right-of-way shall be maintained by the CITY of Westminster Public Works Department. All public water, storm sewer, sanitary sewer mains and appurtenances under private drives are located in utility easements. CITY is responsible for maintenance of these water, storm and sanitary sewer facilities. CITY is not responsible for repair or replacement of private drive, curb and gutter or landscaping damaged during utility repair or maintenance.

3.20.00 FUTURE CONNECTIONS

A blow-off is required at the end of any water main which terminates and is anticipated to be extended in the future. Refer to the detail drawing in the Appendix of this chapter. When a future main extension is anticipated, the main shall include valves so that only one valve will have to be closed when the main is extended. The valve shall be restrained so when the one valve is closed and the line to be extended is exposed, the valve will not blow off. Restraint shall be made by the use of a mechanical joint anchoring tee (swivel tee), swivel cross, and by installing a minimum of two full lengths of pipe on the extension side of the valve (8 inch pipe and smaller). No service taps shall be allowed on a main which can be extended in the future between the single valve to be closed and the dead end.

3.21.00 SERVICES

Calculations for meter and service line sizes shall be prepared using the "Plumbing Data Sheet" available from Public Works. The applicant shall prepare building plans and calculations and submit them to the Building Division for review and approval. The CITY's Building Division must approve all meter and service line sizes (before and after the meter) prior to beginning construction. The service lines, tap and meter shall be the same size, unless otherwise approved and/or required by the CITY ENGINEER. If the tap and meter are of different sizes, the fee shall be paid based on the larger size, unless a larger tap is approved and/or required by the CITY ENGINEER in which case the fee for the meter size shall be paid.

Each separated structure shall be served by a separate service line and meter. All non-residential developments with any irrigated areas are required to have separate irrigation taps and meters from the water main in accordance with Section 8-7-3(D) of CITY CODE. Utility easements shall be required for service lines up to and including the meter pit.

No pressure booster facility of any kind shall be allowed on any service line between the public main and the meter. All service line pressure booster facilities shall be privately owned and maintained.

Water service lines shall be located a minimum of 10 feet away from all sewer services and a minimum of 5 feet away from all fire protection service lines (measured horizontally). All service lines shall be constructed perpendicular to the front property line of the property they are going to serve and not less than 5 feet from the side of a front property line. Service lines through private property to serve a separate property are prohibited.

Size changes, if allowed between the service line and the meter, shall be accomplished by providing a full sized meter vault and setter for the line size installed and using industry standard adapters to install a reduced size meter in the full size line.

Water taps cannot be issued prior to a building and/or tap entitlement approval. Exceptions must be approved by the CITY MANAGER; for example, conversion from well water to the CITY water system.

All service lines 3/4-inch through 2-inch shall be copper and shall be installed continuous without joints between the corporation stop at the water main and the meter or curb stop. ¾" to 1" Services shall be tapped at the main with a 45 degree angle from horizontal and all taps 3/4"-2" shall have a minimum of 5 feet of cover and be laid as shown on the detail drawing in the Appendix of this chapter. The minor exception to this is allowed for the "slack" section in the service line near the tap which may have slightly less than 5 feet of cover.

Service connections requiring a flow greater than can be delivered through a 2-inch corporation and service line shall be 4-inch, 6-inch, or 8-inch connections and shall be polyvinyl chloride pipe in accordance with section 3.52.02 of these STANDARDS AND SPECIFICATIONS. Service connections (4-inch, 6-inch, or 8-inch) to new lines shall be made with mechanical joint anchoring tees (swivel tees) or reducing mechanical joint anchoring tees (swivel tees) if installed at the time of main line construction. Later connections, if installed, may also be made with tapping sleeves and tapping valves and at the developer's expense.

3.22.00 TRANSMISSION MAINS

All water mains larger than 12 inch in diameter shall be classified as "transmission mains."

All transmission mains shall have combination air valves installed at all high points on the line and on each side of butterfly valves in accordance with the detail drawing in the Appendix of this chapter.

All transmission mains shall have blow-off assemblies installed at all low points on the line and constructed in accordance with the detail drawing in the Appendix of this chapter.

The design of ductile iron and steel transmission mains and other critical direct bury appurtenances such as valves, shall require cathodic protection. Cathodic protection shall be designed by a qualified cathodic protection engineer, registered in the State of Colorado and shall conform to NACE Standard RP-01-69, latest revision. As a minimum, the cathodic protection system shall include magnesium anodes; test station thermal board and shunts; exothermic weld caps and coating; conductor, test stations, joint bond wires; wire splice kits; exothermic weld equipment and materials; wire and cable marker tags; and one-piece insulating sleeves and washers, all in conformance with section 3.62.00 of these STANDARDS AND SPECIFICATIONS. All of the data for these materials shall be submitted to the CITY for approval prior to installation. Test stations shall be shown on design drawings and as-built drawings. Cathodically protected pipe, except steel casing pipe, shall also require polyethylene wrap as described in section 3.61.02.

No service line taps or any taps less than six inches in diameter shall be made to transmission mains. Exceptions to this will be for combination air valves only.

Valves on transmission mains shall be placed no more than 1,200 feet apart. Where there are connections to transmission mains, all connecting mains shall include valves at the connection. There shall be a minimum of two valves at a tee connection and three valves at a cross connection.

3.23.0 UNLAWFUL CONNECTION

No installation of potable water supply piping or part thereof shall be made in such a manner that it will be possible for used, unclean, polluted, or contaminated water, mixtures, or substances to enter any portion of such piping from any tank, receptacle, equipment, or plumbing fixture by reason of back siphonage, suction, back pressure, or any other cause, either during normal use and operation or when any such tank receptacle, equipment, or plumbing fixture is flooded, or subject to pressure in excess of the main line operating pressure. No person shall make a connection or allow one to exist between pipes or conduits carrying domestic water supplied by the CITY and any pipes, conduits, or fixtures containing or carrying water, chemicals, liquids, gases, or any other substances from any other source. Refer to Section 3.24.08, Backflow Prevention Assemblies for further requirements.

3.24.00 APPURTENANCES

3.24.01 Valves

Residential distribution systems shall include valves to ensure that no more than 600 feet of main or 18 residential units and 1 fire hydrant will be out of service in the event of a single water main break. Valve placement shall be such that there are at least two valves at every tee and three valves at every cross.

Valves 16 inch or larger shall be butterfly valves. Main line valves shall be located at a tee, cross or elbow if possible. Under no circumstances shall a valve be located in concrete areas, such as sidewalks, crosspans, aprons, curbs, or gutters. Butterfly valve operators shall be located on the north or east side of the water main. Any valve located in a greenbelt area shall have an 18-inch-wide by 6-inch thick concrete collar around the valve box. All 16” and larger butterfly valves will be accessible in a vault.

3.24.02 Fire Hydrants

The maximum distance, as measured along the centerline of the street, between fire hydrants shall be 500 feet in residential areas and 300 feet in business and other high-value areas unless otherwise approved in writing by the CITY ENGINEER. One fire hydrant will be allowed on dead-end line provided that the line is an 8" line. The number and location of fire hydrants in a given area shall be approved in writing by the Fire Department. If hydrants are to be installed at locations other than street intersections, they shall be located on the extension of property side lot lines. In no case shall a hydrant be located closer than 5 feet to obstructions, driveways, etc. The fire hydrant shall be located within the right-of-way or pocket Utility Easement and on the same side of the street as the water main unless otherwise approved in writing by the CITY ENGINEER. Fences, landscaping, etc., shall in no way hinder the operation of the fire hydrant. In addition, clear distances to the fire hydrant shall be in accordance with Section 3.19.00 of these STANDARDS AND SPECIFICATIONS.

The fire hydrant lateral lines shall be set at 90 degrees to mains. The length of the fire hydrant lateral line shall be minimized and shall be no more than 50 feet long unless approved by CITY ENGINEER. No horizontal bends or offsets shall be used in fire hydrant lateral lines. Under no circumstances shall any tap be made on a fire hydrant lateral line.

3.24.03 Thrust Blocks and Joint Restraint Devices

All bends, tees, plugs, dead-ends, wet taps (in certain cases), hydrants, and blow-offs shall be designed and constructed with concrete thrust blocks. If the soil-bearing strength is unknown, the soil-bearing capacity used in design shall be 2,000 pounds/square foot. Refer to the detail drawings in the Appendix of this chapter.

Joint restraint devices shall be used on both sides of valves and fittings for pipe sizes 12 inches in diameter and smaller and in addition to thrust blocks. Vertical bends in all pipe sizes shall be restrained using joint restraint devices and shall be restrained for a specified distance as recommended using the latest edition of AWWA Manual M23 and M41, as appropriate.

Harness rods, or "rodding", are not an acceptable means for restraining pipe and fittings unless it is specified inside vaults as shown on the detail drawings in the Appendix of this chapter. Under no circumstance shall steel harness rods be allowed to be in contact with soils.

3.24.04 Meters

Calculations for meter and service line sizes (before and after the meter) shall be prepared using the "Plumbing Data Sheet" available from PWU. The applicant shall prepare building plans for review and approval by the Building Division. Concurrently, water demand calculations shall conform to the building plans and shall be submitted to PWU to determine meter size, water tap fees, and sewer tap fees. The service lines, tap and meter shall be the same size, unless otherwise approved and/or required by the CITY ENGINEER. If the tap and meter are of different sizes, the fee shall be paid for the larger, unless a larger tap is approved and/or required by the CITY ENGINEER in which case the fee for the meter size shall be paid.

Water taps cannot be issued prior to a building and/or tap entitlement approval. Exceptions must be approved by the CITY MANAGER; for example, conversion from well water to the CITY water system.

Public water meter installations inside any buildings are prohibited in all areas of the service area except Downtown Westminster and near Westminster Station unless otherwise approved,

in writing, by the CITY ENGINEER. The urban areas of downtown and Westminster Station shall have indoor meters, unless otherwise approved, in writing, by the CITY ENGINEER. Meters shall be located within publicly-owned rights-of-way or easements. Meter pits shall not be located within concrete areas or areas exposed to vehicle traffic, unless otherwise approved in writing by the CITY ENGINEER. If the CITY ENGINEER approves of locating a meter pit in a concrete area or an area exposed to light vehicle traffic, then a heavy duty meter pit design shall be used in accordance with the design detail in the Appendix of this chapter.

All water meters connected to the CITY's utility system shall be the property of the CITY. Under no circumstances shall anyone other than CITY PWU personnel remove a water meter once the pit or vault has been inspected and approved. No connections shall be made in the meter pit, for irrigation or otherwise, by anyone other than authorized CITY PWU personnel. Irrigation system connections shall be made downstream from the meter and a minimum of five feet from the meter pit or vault.

For any installation where special or unusual conditions might exist, detailed drawings, accompanied by a letter of explanation, shall be submitted to the CITY ENGINEER for review and approval.

For any water meter installation over 2 inches in size, detailed drawings of the proposed installation shall be submitted to the CITY ENGINEER for review and approval prior to construction.

There shall be no electrical wiring allowed in any water meter pit or vault unless authorized, in writing, by the CITY ENGINEER.

Inspections of all residential pits and commercial pits or vaults shall be conducted by the CITY. Locations and details for commercial pits or vaults shall be reviewed and approved in writing by the CITY ENGINEER.

3.24.05 Fire Protection Service Line

All Buildings except single-family residential: Valves on newly constructed fire lines shall be located on the tee at the main line. The owner shall maintain all private fire lines beginning at and including this valve. All fire sprinkler taps shall be installed with an approved backflow prevention device as defined in Section 8-7-27 of CITY CODE, and a flow switch which will indicate when water has flowed through the line. A property requiring a domestic service line and a fire protection service line will have separate taps for each. Fire protection service lines shall be constructed of PVC from the fire line valve to the 90 degree bend for the building standpipe. The 90 degree bend and standpipe shall be ductile iron pipe in conformance with the International Fire Code as adopted by the Building Division. Fire line valves shall have a flange connection and shall bolt directly to a mechanical joint anchoring tee (swivel tee) at the main.

Single family residential (including townhome): Fire protection systems are required for all residential spaces. Fire protection systems that are not passive purge are required to have a backflow preventer installed in the meter pit. A 1" meter is required, at no additional cost.

3.24.06 Valve Vaults

All valves larger than 12 inches shall be installed in a vault in accordance with the detail drawings in the Appendix of this chapter. All valve vaults shall be capable of withstanding AASHTO H-20 highway loading. The vault shall also have lift hooks in the roof for valve removal inside the vault.

Vaults shall be made water proof after construction by use of sealants, epoxies or other approved methods. All vaults shall be designed with wall sleeves and link seal and be capable of handling thrusts caused by removing valves. All vent pipes for vaults shall be installed in conformance with the detail drawings in the Appendix of this chapter.

3.24.07 Manholes

Manholes shall be installed on all pressure regulating valves, all butterfly valves, permanent blow-off installations, and air release valves in accordance with the detail drawing in the Appendix of this chapter.

3.24.08 Backflow Prevention Assemblies

To prevent backflow contamination of the CITY's potable water system, a reduced pressure zone (RPZ) backflow prevention device shall be installed inside the structure after the main shut off valve on all non-single-family residential water service lines or where any condition might exist that would result in a higher pressure downstream of the water meter than exists in the main line and that could allow backflow or back siphonage of polluted or contaminated water or other substances from the water user's system. The assembly shall be installed per CDPHE guidelines and Section 8-7-27 of CITY CODE to allow for proper operation and easy access for annual testing and maintenance.

A reduced pressure zone backflow prevention device shall be used for all non-residential irrigation services. This shall be required for both domestic and reclaimed water sources. The assembly shall be located a minimum of five feet downstream of the water meter and installed per CDPHE guidelines and Section 8-7-27 of CITY CODE to allow for proper operation and easy access for annual testing and maintenance.

3.30.00 CONSTRUCTION SPECIFICATIONS

3.31.00 TRENCHING, BACKFILLING AND COMPACTION

Trenching, backfilling and compaction shall be done in accordance with Chapter 9 of these STANDARDS AND SPECIFICATIONS.

3.32.00 BEDDING

In the event unstable trench conditions are found at pipeline grade, a minimum of one and one-half inch uniformly graded, washed rock shall be used for trench stabilization. Depth of the stabilization shall be as approved in writing by the CITY ENGINEER.

Granular bedding material shall meet the requirements of Chapter 9 of these STANDARDS AND SPECIFICATIONS. Bedding shall be placed to six inches below the bottom of the pipe and shall be placed around the sides of the pipe and to a minimum of 12 inches above the top of the pipe and in accordance with the detail drawing in the Appendix of this chapter.

3.33.00 PIPELINE INSTALLATION

3.33.01 General

The CITY shall be notified at least 48 hours in advance of any pipe installation. No pipes shall be backfilled until they have been inspected by the CITY INSPECTOR. Alignment and grade of the pipe and the location of fittings, valves, and hydrants shall be staked in accordance with the approved construction plans under the supervision of a Professional Land Surveyor registered in the State of Colorado.

Proper implements, tools, and facilities shall be provided and used by the CONTRACTOR for the safe and convenient execution of the work. All pipe fittings, valves, and hydrants shall be carefully lowered into the trench by means of a derrick, ropes, or other suitable tools or equipment to prevent damage to water main materials and protective coatings and linings. Chains or cables shall not be used for handling pipe with protective coatings. Under no circumstances shall water main materials be dropped or dumped into the trench.

All pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. The groove in the bells of the pipe shall be full and continuous or the pipe will be rejected. Defective pipe or fittings shall be removed from the job site within 24 hours of notification by the CITY ENGINEER. All foreign matter or dirt shall be removed from the interior and ends of pipe and accessories before they are lowered into position in the trench and prior to connection.

Every precaution shall be taken to prevent foreign material and trench water from entering the pipe and fittings. During construction, the CONTRACTOR shall provide and maintain adequate equipment to properly remove and dispose of all water entering the trench and any other part of the work.

3.33.02 Pipe

Immediately before joining two lengths of pipe, the inside of the bell and the outside of the spigot end and the gasket shall be thoroughly cleaned. Caution shall be exercised to ensure that the correct type of gasket is used. A thin film of gasket lubricant shall be applied to the inside face of the gasket and the spigot end of the pipe. The spigot end of the pipe shall be placed in the bell with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home with a slow steady pressure, without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to ensure insertion to the Full depth of the joint. The pipe shall then be properly set and brought to correct line and grade. After installation of the polyethylene protective wrap, if required, the pipe shall be secured in place by installation of bedding material and backfill, in accordance with Chapter 9 and the detailed drawings in the Appendix of this chapter. All pipe laying shall be in accordance with AWWA C600 and AWWA C605.

Deflection from a straight line or grade, as required by horizontal or vertical alignments or offsets, shall not exceed fifty percent (50%) of the maximum allowable limits set by the manufacturer's specifications. If the alignment requires deflection in excess of the allowable deflection per joint, special bends, or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limits set forth, as approved, in writing, by the CITY ENGINEER.

All fittings, appurtenances, and ductile iron pipe shall be protected with minimum 8 mil polyethylene film wrap in accordance with Section 3.61.02 of these STANDARDS AND SPECIFICATIONS. Additionally, approved wax taping and zinc caps shall be placed on all bolted fittings. Miscellaneous steel or other ferrous pipe for temporary blow-offs, etc., shall be similarly protected. Methods for applying the wrap shall conform to the detail drawing in the Appendix of this chapter.

At times when installation is not in progress, the open ends of the pipe shall be closed with a watertight plug. Pipe should be kept clean, dry, and supported off the surface of the ground. Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining, leaving a smooth end at right angles to the axis of the pipe. Pipe ends shall be smooth and beveled with a file or other tools according to the pipe manufacturer's recommendations.

Extra care should be used in handling PVC pipe during cold weather due to the reduced flexibility and impact resistance as temperatures approach and drop below freezing. PVC pipe to be stored outside and exposed to sunlight for more than 30 days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover the pipe. Air circulation shall be provided under the covering. Any over-exposed pipe, as determined by the CITY ENGINEER, will not be permitted for installation.

All PVC waterline installations shall include the installation of a single, 12-gauge, insulated copper tracing wire taped to the top of the pipe. The tracing wire shall be installed in a continuous run between fire hydrants and the ends of the tracer wire shall be brought to the surface in a cathodic protection box next to the fire hydrant in accordance with the detail drawing in the Appendix of this chapter. Wire splices shall be accomplished in accordance with the detail in the appendix of this chapter. Tracer wire shall be tested by the CITY INSPECTOR, or by the CONTRACTOR and observed by the CITY INSPECTOR, for continuity prior to acceptance.

During the backfilling of all PVC waterline trenches, a continuous 2-inch-wide metallic-coated, detectable tape labeled "Waterline Buried Below" shall be placed in the trench backfill 2 feet above and directly over the pipe. Detectable tape shall be manufactured by Pro-Line, or CITY approved equal.

Following backfill and compaction of the water mains, cathodic protection test stations, shall be tested for effectiveness by the CONTRACTOR and the results of the continuity test shall be submitted to the CITY ENGINEER. If cathodic protection of the pipe is determined not to meet industry standards, then corrections shall be made until it meets industry standards and is accepted by the CITY ENGINEER.

3.33.03 Fittings

Pipes shall be connected to valves and fittings by mechanical joints unless specified differently in the approved drawings. For approved slip-on joints, the joint shall be assembled with a ratchet jack or other approved method in a manner that does not cause any damage to the pipe. Both the spigot and bell must be thoroughly clean and free from tar or other coatings and rust.

For mechanical joint pipe, the last 8 inches of the outside of the spigot end of the pipe and the inside of the bell of all fittings and gate valves shall be thoroughly cleaned to remove oil, grit, tar (other than standard coating), and other foreign matter from the joint and then a thin film of gasket lubricant shall be applied. The cast iron gland shall then be slipped on the spigot end of the pipe with the lip extension of the gland toward the bell of the fitting. Gasket lubricant shall be applied to the rubber gasket and placed on the spigot end of the pipe with the thick edge towards the gland.

After the spigot end of the pipe is placed into the bell and fully inserted the gasket shall be pressed into place within the bell so it is even around the entire joint. After the gland is positioned behind the gasket, the CONTRACTOR shall install all bolts and nuts and tighten

them with a torque wrench in accordance with manufacturer's recommendations. Nuts spaced 180 degrees apart shall be tightened alternately to produce equal pressure on all parts of the gland. All fittings must have approved zinc caps and wax tape.

Jointing shall be done in accordance with AWWA Specification C-111, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings, for all mechanical joint fittings.

3.34.00 VALVE AND VALVE BOX INSTALLATIONS

In addition to the jointing requirements mentioned in Section 3.33.03 of these STANDARDS AND SPECIFICATIONS, the additional requirements of this section shall apply. Valves and valve boxes shall be installed where shown on the approved drawings and as directed by the CITY ENGINEER. Valve boxes shall be firmly supported, centered, and plumbed over the operating nut of the valve with the box cover at or minus 1/4-inch within the surface of the finished pavement or at such other elevation as may be directed by the CITY ENGINEER. Extensions to within 4 feet of the finished grade shall be provided for valves installed with more than 5 feet of cover. All extensions shall be pinned to the valve operating nut. Earth fill shall be carefully tamped around each valve box to a minimum distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Valves shall have the interiors cleaned of all foreign matter before and after installation. For valve box installations in flow fill, pipe wrap must be used on the exterior of the valve box.

Gear cases shall be tightened and the valve shall be inspected in opened and closed positions to insure that all parts are in working condition prior to installation. The cases shall be supported by concrete blocks to prevent any shock or stress being transmitted to the valve.

3.35.00 THRUST BLOCKS

The CONTRACTOR shall excavate as required to ensure that the thrust blocks are placed against undisturbed soil and shall form the sides of the thrust block to provide the size and shape as required in the detail drawing in the Appendix of these Standards and Specifications. When it is impossible, because of over excavation or other causes, to pour a thrust block against undisturbed earth, harness rods shall be used to anchor the fittings to the main in addition to the thrust block and as required by the CITY ENGINEER. After the concrete has been placed and has set, the CONTRACTOR shall remove all forming materials prior to backfilling around the thrust block. Concrete for the thrust blocks shall comply with provisions set forth in Chapter 7 of these STANDARDS AND SPECIFICATIONS

The blocking shall be placed so that the pipe and fitting joints will be accessible for repair. A bond breaker shall be placed between the fittings and the thrust block. Backfill may be placed over the thrust blocks once the surface has set sufficiently to resist the weight of the backfill. However, no tamping or compacting shall be allowed above the thrust block for a minimum of 24 hours after placement. Concrete must set a minimum of 48 hours prior to the initial filling of the line.

3.36.00 CONNECTION TO EXISTING MAINS

At locations where connections to existing water mains are to be installed, the CONTRACTOR shall locate the existing mains, both vertically and horizontally, and shall verify their exact size in advance of the time scheduled for making the connections. The CONTRACTOR shall notify and schedule the connection with the CITY ENGINEER.

Prior to connecting to existing water mains, the CONTRACTOR shall have all personnel, materials, and equipment ready to connect the fitting to the existing main to keep the shut-off time to a minimum. As soon as possible after making the connections, the CONTRACTOR shall flush the connection to prevent any contamination of the existing facilities. The CONTRACTOR shall take every precaution

necessary to prevent dirt or debris from entering the main. The CONTRACTOR must use AWWA standards C651 and C655 for disinfection and flushing for all new water mains. Refer to PWU's current approved service rules for detail on disinfection, flushing, testing, and connections.

3.37.00 FIRE HYDRANT INSTALLATION

Before installation of a hydrant, the following operations shall be performed:

(A) The hydrant shall be thoroughly inspected for any defects or damage.

(B) The hydrant interior shall be thoroughly cleaned.

(C) The hydrant shall be opened and closed as many times as necessary to determine that all parts are in proper working order, valves are seating properly and the drain valve is operating freely.

(D) The hydrant shall be aligned so that the nozzles are rotated to face the accessible route by the Fire Department.

(E) The hydrant bury depth from the shoe to the finished grade shall be verified and the appropriate hydrant installed (see below). Extension kits will not be allowed on new hydrant installations without the prior written approval of the CITY ENGINEER.

(F) When approved, height adjustments must be made by utilizing a grade lock at the hydrant shoe.

Following the installation of fire hydrants and before inspection by the CITY ENGINEER, the CONTRACTOR shall ensure the following:

(A) The nozzle caps are removed, cleaned and greased with a food grade anti-seize compound such as those manufactured by Loctite, CRC, Assured Flow or USA Bluebook, or equal as approved in writing by the CITY ENGINEER.

(B) Reservoir oil is checked and filled as required.

(C) The operating nut is in new condition.

(D) The hydrant is re-painted in accordance with the requirements of Section 3.55.00.

Hydrants shall be set so that a minimum of 5 feet of cover is provided for the lateral line and the nozzles are a minimum of 18 inches above finished grade. Each hydrant shall be set on a concrete foundation at least 18 inches by 18-inches and 6 inches thick. Each hydrant shall be blocked against the end of the trench with a concrete thrust block and shall be mechanically restrained from the tee at the mainline to the hydrant.

Hydrants shall have weep drain holes in the hydrant shoe and shall be surrounded with 1-1/2-inch washed rock. A sheet of 8-mil polyethylene shall be placed over the washed rock to prevent dirt from filling the rock. All hydrants shall stand plumb and shall be connected to the street main by a minimum 6-inch ductile iron lateral line. The lateral line, hydrant and fittings shall be wrapped in polyethylene. For new construction, the hydrant barrel from the flange to the shoe shall be ordered to meet the required field dimension so that the proper depth is achieved without the use of extensions. The fire hydrant traffic flange shall be adjusted to no less than 2 inches and not more than 8 inches above the approved finished grade.

Depending upon hydrant location, the use of steel posts filled with concrete may be required for protection, as required by the CITY ENGINEER. Hydrant gate valves shall have a restrained connection directly to the tee at the main (swivel tee). In areas where the hydrant bottom is installed below ground water, the drain shall be plugged and the hydrant marked with a metal tag to indicate the requirements to pump the hydrant after use. All other requirements shall be as shown on the detail drawing in the Appendix of this chapter.

3.38.00 TAPS

The size of tap and the tapping method for a given type and size of waterline shall be as follows. Transmission mains (16 inch pipes and larger) should not be tapped unless otherwise approved in writing by the CITY ENGINEER.

Host Pipe Size	Tap Size (DIP or PVC)			
	¾"	1"	1-1/2"	2"
6"	DT/S	DT/S	S	S
8"	DT/S	DT/S	S	S
10"	DT/S	DT/S	S	S
12"	DT/S	DT/S	S	S

S -- Tapping saddle required. All saddles shall have the AWWA taper on its threads.
DT -- Direct tap permitted.
DT /S -- Either a tapping saddle or a direct tap may be permitted depending on the situation.

All existing AC waterlines shall be tapped using a saddle.

All ¾" and 1" taps into the water main shall be at an angle of 45 degrees from the horizontal, and corporation stops shall be installed. For 1" and smaller, continuous type K copper shall be used from the main with no joints or valves between the corp stop and meter yoke. 1 1/2" and 2" taps into the water main shall be at the 3 and 9 O'clock position, and corporation stops installed.

Taps shall not be made on a water main until the main has passed the pressure tests and clear water tests and a "Release For Service" letter has been issued by the CITY ENGINEER. Care shall be taken to properly install water service lines so that a minimum of 12 inches of slack is in the service line at the main to protect against pull-out. Tapping mains may require digging out bedding material and cutting or removing part of the corrosion protective wrapping. After the taps are made, the wrap shall be repaired or replaced by the CONTRACTOR to protect both the service line and the main.

Service taps shall have a minimum separation of 24 inches and be no closer than 24 inches to a main line joint. There shall be no more than 4 taps per 20' section of pipe.

All service taps shall be performed by the CONTRACTOR. All necessary materials for said taps, including corporations stops, copper line, meter pits, copper setters, curb stops, etc., shall be supplied by the CONTRACTOR. Said materials shall conform to these STANDARDS AND SPECIFICATIONS. The CITY ENGINEER will inspect each tap prior to backfilling.

Taps to PVC mains shall be accomplished with the mainline valves either side of the tap in the closed position.

Taps to PVC mains shall only be made when the air temperature is 32^{o}F or higher.

3.39.00 METER INSTALLATION

All meter installations shall be in accordance with the detail drawings in the Appendix of this chapter.

No connections shall be made in the meter pit other than those related to the meter and bypass. Sprinkler system or backflow preventer connections shall be made no closer than five (5) feet from the meter pit or vault on the downstream side of the meter. The CITY will own and maintain the service line and fittings up to, and including the meter.

Residential single family meters with transponders shall be provided and installed by the CITY upon the CONTRACTOR'S request for a final meter inspection. All other meters and associated transponders shall be purchased by the CONTRACTOR and then provided to the CITY for testing prior to installation. The CONTRACTOR shall contact the CITY's Meter Shop prior to purchasing meters and transponders to verify the type and brands that are required. The CONTRACTOR shall also contact the CITY's Meter Shop to make an appointment for delivery of said meter(s) to the Shop for testing. The location of installation and manufacturers information shall accompany the meter when delivered by the CONTRACTOR to the CITY's Meter Shop. The meter will be tested and CONTRACTOR must call to schedule the meter pit/vault inspection. In addition, the following specific criteria shall apply:

3.39.01 3/4-Inch and 1-Inch Meter Installations

The ¾" and 1" meter sets shall be installed in accordance with these STANDARDS AND SPECIFICATIONS and the detail drawing in the Appendix of this chapter. The meter shall be located a minimum of 18 inches from the back of walk to the edge of the meter lid. Where no sidewalk exists, the meter shall be placed a maximum of 6 feet behind the back edge of the curb. In detached walk areas the meter shall be placed 6 feet behind the back edge of curb but no closer than 18 inches from the front edge of the walk to the edge of the meter lid. In all cases, the meter shall be installed within rights-of-way or public easements. In some situations, the meter set location may be modified as directed by the CITY ENGINEER.

The dome or meter lid shall be level and 2 inches above the approved final grade. The copper setter shall be a minimum of 15 inches and a maximum of 17 inches below the meter pit lid. A variance of more than 2 inches vertically in installing the copper setter will not be accepted.

No meters shall be set in streets, sidewalks, driveway alignments, or concrete areas without specific design and prior approval of the CITY ENGINEER. Meter pits shall be constructed of modified hi-density polyethylene. The size shall be as specified in the detail drawing in the appendix of this chapter. Grade adjustment shall be made at the top of the pit using concrete rings. The trench floor under the concrete rings shall be compacted earth. The concrete pit shall not bear on the service pipe.

Final inspections of the meter pit will be made at the time the meter is actually set. The building permit applicant is responsible for any required adjustments to the copper setter or meter lid at that time.

3.39.02 1-1/2-Inch and 2-Inch Meter Installations

The 1 ½" and 2" meter sets shall be installed in accordance with these STANDARDS AND SPECIFICATIONS and the detail drawing in the Appendix of this chapter. Meter manhole lids shall be a maximum of 2 inches above the approved final grade.

The meter manhole shall be located a minimum of 3 feet behind sidewalk and in no case shall the manhole lid be located more than 10 feet from the back edge of curb. Where no sidewalk exists, the meter shall be placed a maximum of 6 feet behind the back of curb. In detached walk

areas the meter shall be placed 6 feet behind the back edge of curb but no closer than 18 inches from the front edge of the walk to the edge of the meter lid. A curb stop is required on the service line behind the back of curb and outside of the manhole. In all cases, the meter manhole shall be installed within the right-of-way or public Utility Easements. No meter manholes shall be set in streets, concrete areas, driveway alignments, or other traffic area without specific design and prior approval of the CITY ENGINEER.

Meter manholes shall use a 24 inch aluminum ring and cover and the outside of the aluminum ring shall have 8 mils of tar applied. Once the tar is set then a 12" wide by 6" thick concrete collar shall be placed around the manhole ring. The manhole cover shall have a 2 inch diameter recessed hole in the center of the cover for the transponder and the cover shall have the lettering "Water Meter" cast into the lid. Meter manholes in traffic areas are only allowed at the discretion of the CITY ENGINEER. If allowed, the manhole shall use a 24 inch aluminum ring and cover and shall be designed to accommodate and protect the transponder. Approval by the CITY ENGINEER of this design will be on a project specific basis.

3.39.03 3-Inch and Larger Meter Installations

The 3" and larger meter sets shall be installed in accordance with these STANDARDS AND SPECIFICATIONS and the detail drawing in the Appendix of this chapter. The entry hole through the roof of the vault shall be aligned perpendicular to the service line and adjacent to the water meter. Vaults shall be sealed at all joints and made watertight. Meter vault lids shall be a maximum of 2 inches above the approved final grade.

The meter vault shall be located a minimum of 5 feet behind sidewalk or back of curb and no more than 10 feet from the back of curb. Where no sidewalk exists, the meter shall be placed a maximum of 6 feet behind the back of curb. In detached walk areas the meter shall be placed 6 feet behind the back edge of curb but no closer than 18 inches from the front edge of the walk to the edge of the meter lid. A curb stop is required on the service line behind the back of curb and outside of the vault. In all cases, the meter vault shall be installed within the right-of-way or public Utility Easements. No meter vaults shall be set in streets, concrete areas, driveway alignments, or other traffic area without prior approval of the CITY ENGINEER.

Meter vaults shall use a 24 inch aluminum cover and shall have the lettering "Water Meter" cast into the lid. A 24" x 36" aluminum cover adaptor and ring shall be used to enlarge the access opening and the adaptor shall have a 2 inch diameter hole for the transponder.

The outside of the aluminum ring shall have 8 mils of tar applied. Once the tar is set then a 12" wide by 6" thick concrete collar shall be placed around the manhole ring. Meter manholes in traffic areas are only allowed at the discretion of the CITY ENGINEER.. Approval by the CITY ENGINEER of the design for traffic areas will be on a project-specific basis.

PVC pipe shall be used on the service line outside the vault, except where the pipe stubs through the vault walls. DIP shall be used inside the vault. For all 3 inch and 4 inch meter settings, 4 inch service pipe will be required on the CITY side of the meter. A reducer will be required before the meter and on the bypass for 3 inch settings. Insulators shall be provided between connections of dissimilar metals. Meter installations 3" and larger shall require shop drawing submittals for approval.

Final inspections of the meter manhole will be made at the time the meter is set. Meter will be set by the CONTRACTOR if the meter manhole passes inspection. CONTRACTOR must call 303-658-2549 to schedule final inspection. CONTRACTOR will warranty meter manhole and appurtances for a period of 2 years after final inspection has passed.

3.40.00 TESTS

3.40.01 General

The CONTRACTOR shall disinfect and test all mains and fire lines regardless of existing conditions. This may include repairing existing facilities that must be included in the test and are not capable of holding test pressures. All thrust blocks or other bracing facilities shall be in place at least 48 hours before the initial filling of the line. All tests will be observed by the CITY INSPECTOR.

3.40.02 Filling and Venting Lines

All valves will be operated by the PWU. The line shall be slowly filled with water and all air expelled from the pipe. Care shall be taken so that all available hydrants (including hydrant gate valves), air valves, and other vents are open during the filling of the line. Where hydrants or other vents are not available in the line, the CONTRACTOR shall make whatever taps are required for venting purposes. These taps shall be abandoned after pressure and disinfection tests have passed and the line has been completely flushed as required by the PWU. Following testing, the taps shall be removed back to the main and the main repaired by the use of a stainless steel repair clamp. The rate of filling the line shall not exceed the venting capacity of the vent.

3.40.03 Disinfection

The CONTRACTOR will be required to disinfect all new water piping (mains, services, hydrant laterals, etc.), connections to the existing water system and water main breaks in accordance with AWWA standards C651 and C655. Disinfection of the water system shall be performed after all field placed concrete has fully cured, in accordance with Section 3.35.00 of these STANDARDS AND SPECIFICATIONS, and following backfill of the water system. The CITY ENGINEER shall be notified at least 48 hours prior to disinfection or flushing is performed. All new water piping must be disinfected and receive approval by the CITY prior to connection to the existing system, unless written approval is provided by the CITY ENGINEER.

Any exceptions to the AWWA standards will be outlined in the PWU Department Service Rules or must be approved in writing by PWU.

If a connection or repair is made to an existing water main with an equivalent length equal to or less than 18 feet of pipe, the new pipe, fittings and valves required for the connection shall be spray-disinfected or swabbed with a minimum 1 percent solution of chlorine just prior to being installed in accordance with AWWA C651-, Section 10. If possible, flushing from both directions toward the work area shall be performed immediately following repairs.

3.40.04 Flushing the Main

The CONTRACTOR shall dechlorinate the water prior to flushing the line.

The entire line shall be flushed after the specified disinfection time as required in Section 3.40.03. Such flushing shall continue until the water is clear and meets the chlorine content of the existing line. The entire line, including hydrant leads, branch lines, and dead-end mains shall be flushed. The discharge of flushed water shall be accomplished such that no erosion

will occur and with no harm to fish, animals, or plants in accordance with Federal and State regulatory agencies. The Water Quality Control Division of the CDPHE requires all CONTRACTORS to possess a current Discharge Permit for discharges of chlorinated and process waters associated with the installation of new mains or conduits. Contact CDPHE Water Quality Control Division at 303-692-3539 for information on obtaining the required permit. Procedures for discharge will be subject to the review of the CITY ENGINEER.

3.40.05 Pressure Test

After the pipe and appurtenances have been laid, the line has been backfilled, and all field-place concrete has cured in accordance with Section 3.35.00 of these STANDARDS AND SPECIFICATIONS each valved section, unless otherwise directed by the CITY ENGINEER, shall be subjected to a hydrostatic pressure of not less than 150 psi. However, in all cases the test pressure shall be 50 percent over existing main pressure in the test area as measured at the lowest elevation of the water main. The test duration shall be a minimum of one hour. If the test pressure drops more than 5 p.s.i. during the test, measured water shall be added to the test section to bring the section up to the specified test pressure. Water added to maintain the pressure shall be per AWWA C600 and AWWA C605. Allowable leakage shall be calculated according to the following formula:

Ductile Iron and PVC Pipe:

$$L = \frac{N \times D \times SQRT(P)}{148{,}000}$$

L = Allowable Leakage in gallons per hour
N = Total length of pipe being tested in feet
D = Nominal diameter of pipe in inches
P = The average test pressure in psi

Each test section of pipe shall be slowly filled with water and the specified test pressure (measured at the lowest point of elevation) shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges, and all necessary apparatus and labor shall be furnished by the CONTRACTOR. Gauges and measuring devices shall be approved by the CITY ENGINEER. Before applying the specified test pressure all air shall be expelled from the pipe. Any cracked or defective pipes, fittings, valves, or hydrants discovered in the pressure test shall be removed and replaced by the CONTRACTOR with sound material including any existing pipe or appurtenances that are leaking and were included in the test section. After all visible leaks have been repaired; the pressure test shall be conducted again. Should testing show a leakage rate in excess of the rates calculated from the formula above, the pipeline shall not be accepted. The pipeline shall be repaired, rechlorinated to meet the criteria in Section 3.40.03 of these STANDARDS AND SPECIFICATIONS and retested as described in this section until it meets the test requirements and is accepted by the CITY ENGINEER.

3.40.06 Bacteriological and Turbidity Test

Water from all new water mains and appurtenances must successfully pass a bacteriological and turbidity test before the main is placed in service. After final flushing, an acceptable sample shall be collected from the new mains and appurtenances. A sample shall be collected for every 1200ft of new pipe.

All sampling shall be performed by the PWUPWU. A minimum 24 hours is required to receive bacteriological test results and may take as long as 72 hours. No bacteriological tests will be taken on Thursdays or Fridays.

If unsatisfactory results are obtained from bacteriological tests, the water system shall be rechlorinated by the continuous-feed or slug method of chlorination in accordance with AWWA C651 current revision, Section 8, until satisfactory results are obtained. Rechlorination shall be done by the CONTRACTOR, at their expense and under the CITY ENGINEER's supervision. If coliform is present in the results, the CONTRACTOR is required to pass two (2) successive tests.

3.40.07 Cathodic Protection System Testing

Following construction of water mains and other appurtenances requiring cathodic protection, the following tests shall be performed:

1. Test the pipe-to-soil voltage potential by comparing to a copper sulfate half-cell. One lead of the volt meter is connected to the pipe lead and the other is connected to the copper sulfate half cell buried in moist in-situ soil near the pipe installation. The potential shall read 0.85 volt or higher. A value of 0.80 volts or less means the pipe is corroding.

2. Check the continuity of the pipe. Prior to completely backfilling the pipe an ohmmeter shall be connected between each end of the installed pipe to measure an ohm reading. Next, test between the test box lead wire and the pipe. A reading of 3 ohms or less shall be achieved for both tests.

3. Test the voltage output of the anode. As in test one above, connect the voltmeter to the anode lead wire and the other lead to the copper sulfate half cell. The voltage reading shall be between 1.4 and 1.6 volts.

4. Measure the current flow from the anode to the pipe. The volt meter is connected to the anode test lead and the other voltmeter lead is connected to the pipe test lead in the test box. The reading shall be between 0.005 amp and 0.3 amp. If the current is more than 1.3 times the design needs, a resistance shall be added to the circuit to extend the life of the anodes.

3.41.00 WORKING WITH ASBESTOS CEMENT PIPE

Approximately one-third of the CITY's distribution system is asbestos-cement (AC) pipe, commonly known as "Transite." When working with AC pipe by tapping, removing portions of the pipe, attaching fittings or disposing of the pipe, certain precautions need to be taken. The CONTRACTOR shall pothole to determine the AC pipe outside diameter. It will be the responsibility of the CONTRACTOR working within the CITY of Westminster to follow State and Federal regulations (such as CDPHE, Regulation 8 Part B) as they apply to asbestos materials.

3.42.00 ABANDONMENT PROCEDURES

Abandonment of CITY water facilities shall follow these procedures. The CITY ENGINEER shall approve of facilities to be abandoned and the method and materials used for the abandonment.

Water Services:

- Expose the tap at the main line connection.
- Disconnect the service line from the corporation stop and pull the service line away from the main.
- Remove the corporation stop and install an approved repair clamp on the main.
- Rewrap Cast Iron or Ductile Iron Pipe with polyethylene and tape.
- After inspection, backfill and compact the excavation.
- Remove the meter and yoke from the meter pit and return the meter to the CITY's Meter Shop.
- Remove the meter pit cover, and contact the CITY'S Meter Shop to return cover.
- Backfill the meter pit and compact the excavation to finished grade
- Meter pit removal may be required*

Water Lines:

- Shut down the main and remove a section of pipe.
- Any main and fittings that will remain in service shall be disinfected in accordance with Section 3.40.03.
- Plug the pipe or fitting and rewrap Cast Iron or Ductile Iron Pipe with polyethylene and tape.
- Install required thrust block.
- Pressure grout the abandoned water line, or other methods approved by the CITY ENGINEER.
- If removing water line at active tee, remove tee and replace existing water line with new pipe section.

Water Valve Boxes:

- Water valves to be abandoned shall be removed in their entirety with a blind flange installed at the fitting.

3.50.00 MATERIALS

3.51.00 GENERAL

With the exception of fire hydrant laterals, only polyvinyl chloride (PVC) pipe is approved for water distribution main installations. Any other material proposed must be approved by the CITY ENGINEER in writing, prior to construction. All materials furnished shall be new and undamaged.

Acceptance of materials or the waiving of inspection thereof shall in no way relieve the Developer of the responsibility for furnishing materials meeting the requirements of these STANDARDS AND SPECIFICATIONS. The CITY reserves the right to direct or deny the use of certain types of materials in specific circumstances. All materials delivered to the job site shall be adequately housed and protected to ensure the preservation of their quality for the work. The presence of any defects in any materials may constitute sufficient cause for rejection of the pipe or appurtenances. Rejected materials shall be removed from the work site unless otherwise permitted by the CITY ENGINEER.

3.52.00 PIPE

3.52.01 Ductile Iron Pipe (DIP)

All ductile iron pipe shall be manufactured in accordance with AWWA Standard C-151 current standard (include zinc coated pipe), Ductile Iron Pipe Centrifugally Cast for Water. Pipe furnished under this specification shall conform to pressure class 350.

Ductile iron pipe shall be approved for fire hydrant laterals, pipe stubs through walls (as required) and other applications as approved by the CITY ENGINEER in writing.

The joint type shall be "push-on, single-gasket" type conforming with applicable requirements of AWWA Standard C-111 current standard, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings. Joint types other than "push-on, single-gasket" are acceptable only if specifically approved by the CITY ENGINEER in writing.

Pipe shall have normal laying length of either 18 feet or 20 feet. Random lengths are not acceptable.

Grade of Iron used in the manufacture of pipe shall have 60/42/10 physicals in accordance with AWWA C-151.

Pipe shall have standard thickness cement mortar linings in accordance with AWWA Standard C-104-13, Cement Mortar Lining for Ductile Iron Pipe and Fittings. Pipe shall have a standard asphaltic coating on the exterior

The weight, pressure class or nominal thickness, and casting period shall be shown on each pipe. The manufacturer's mark, the year in which the pipe was produced, and the letters "DI" or

"Ductile" shall be cast or stamped on the pipe. IAW AWWA C-151 current standard.

3.52.02 Polyvinyl Chloride Pipe (PVC)

All PVC pipe shall meet the requirements of AWWA Specification C-900 current standard, Polyvinyl Chloride Pressure Pipe and Fabricated Fittings (4” - 12”), and shall be Pressure Class 305 psi (DR 14), or AWWA C-905 current standard, Polyvinyl Chloride Pressure Pipe and Fabricated Fittings (14” - 48”), and shall be Pressure Class 235 psi (DR 18).

All pipe shall be suitable for use as a pressure conduit. Provisions must be made for expansion and contraction at each joint with a rubber ring. The bell shall consist of an integral wall section with a solid cross-section rubber ring which meets the requirements of AWWA Specification C-900 current standard.

Standard laying lengths shall be twenty feet (20') for all sizes. Random lengths shall not be acceptable.

Each length of pipe shall bear the date manufactured, type, grade, length, manufacturer's name, and NSF seal of approval.

Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type joint.

Solvent cement joints are strictly prohibited.

The manufacturer shall furnish a certified statement that all of the specified tests and inspections have been made and the results thereof comply with the requirements of the applicable standard(s) herein specified. A copy of the certification shall be sent to the CITY ENGINEER upon request.

The following test station box has been approved by the CITY for use with tracer wire installations:

Valvco, Terminal Box #NM (5" ID) without locking lid
Others as approved in writing.

3.52.03 <u>Steel Pipe</u>

Upon approval by the CITY ENGINEER, the use of steel pipe may be allowed for transmission mains 16 inches in diameter or larger. The pipe shall meet Standard AWWA C-200 current standard, Steel Water Pipe 6 inch and Larger, and installed accordingly. Detailed specifications shall be as approved by the CITY ENGINEER on a case-by-case basis.

All new steel mains shall require cathodic protection and shall be designed by a qualified cathodic protection engineer, registered in the State of Colorado. Cathodically protected pipe shall also require polyethylene wrap as described in Section 3.61.02.

3.53.00 FITTINGS

All mechanical joint fittings shall be manufactured in accordance with AWWA C110 current standard, Ductile Iron and Gray Iron Fittings, or AWWA C153 current standard, Ductile Iron Compact Fittings. Fittings shall be furnished with rubber gasket joints in accordance with AWWA C111 current standard, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

All fittings shall be 350 PSI pressure rating and shall conform to the dimensions and weights shown in the tables of the above referenced AWWA Standards. All fittings shall be made from gray iron or ductile iron. The manufacturer shall prepare a certified statement that the inspection and all of the specified tests have been made and the results thereof comply with the requirements of the applicable Standard(s) herein specified. A copy of the certification shall be sent to the CITY ENGINEER upon request.

All ductile iron flanged fittings shall be manufactured in accordance with AWWA C110 current standard for integrally cast flange fittings or AWWA C115 current standard, Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges, for threaded flange fittings. Typical ductile iron flanged fittings shall be rated for 250 psi working pressure. A working pressure of 350 psi may be achieved with the use of special gaskets.

The following are additional requirements or exceptions to the standards mentioned above:

All fittings 4" through 16" shall be furnished with a fusion bonded epoxy inside and out, with a standard thickness as defined in AWWA C116 current standard , Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings. The requirement for fusion bonded epoxy on fittings may be waived by the CITY ENGINEER if specific fittings are not available.

All fittings shall be furnished complete with tee-head mechanical joint bolts and hexagon nuts and shall be fabricated from a high strength, low alloy steel known in the industry as "Cor-Ten" or approved equal.

Mechanical joint anchoring fittings (swivel) as approved by the CITY ENGINEER, in writing, may also be used.

3.54.00 VALVES

3.54.01 General

All valves shall open left (counterclockwise). Valves shall have a 2-inch-square operating nut. Extension stems shall be pinned to the operating nut for a secure connection. Set screw type connections will not be allowed.

All buried valves shall be installed with a valve box meeting the material specifications of Section 3.54.04 of these STANDARDS AND SPECIFICATIONS.

3.54.02 Gate Valves

Gate valves shall be required for 4 inch through 12 inch valve sizes, unless approved otherwise by the CITY ENGINEER in writing. Gate valves shall be iron body, resilient-seated gate valves with non-rising bronze stems with design, construction, and pressure ratings conforming to AWWA Specifications C-509 current standard, Resilient Seated Gate Valves, or C515 current standard, Reduced Wall Resilient
Seated Gate Valves, and with modifications specified herein. Stem seals shall be triple "O" ring seals designed so that the seals above the stem collar can be replaced with the valve under pressure and in full open position.

Gate valves approved by the CITY shall be one of the following types:

American Flow Control, Series 2500 (C515 only)
Mueller, Series 2361, 2362
American AVK, Series 25, 45, 65
CLOW Valves, Models 2639 and 2640

With the exception of tapping valves and valves in vaults, gate valves shall have mechanical joint ends.

Gate valves requiring flanged ends shall have dimensions and drilled holes that conform to ANSI B16.1, Class 125. Flange faces shall be machined to a flat surface with a serrated finish in accordance with AWWA C207 current standard, Steel Pipe Flanges (4 in. through 144 in). Tapping valves and valves in water vaults for 3” and larger meters shall have a flange connection on one side of the valve and a mechanical joint on the other side (refer to Section 3.60.04 for approved tapping valves).

All ferrous internal and external surfaces of the valves shall be epoxy coated in conformance with AWWA C116 current standard, Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings, and C550 current standard, Protective Interior Coatings for Valves and Hydrants. The coating shall be a two-part thermosetting epoxy suitable for field over coating and for touch-up with the same coating material without special surface preparation. The supplier shall furnish detailed performance tests of adhesion, hardness and abrasion resistance of the furnished coatings when requested by the CITY ENGINEER. The coating shall have a successful record of performance in valves, pipe or other fittings for a minimum of ten years.

The resilient seat gate valve stem shall have external break-off capabilities for over-torquing and positive stop to prevent over compression.

All external bolts, nuts and washers used in conjunction with valves shall be stainless steel and tee-bolts shall be "Cor-Ten" with zinc caps with wax tape coating. Valves shall be delivered complete with bolts, glands and rubber gaskets in conformance with AWWA C111 current standard, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

3.54.03 Butterfly Valves

Butterfly valves shall be required for 16 inch and larger valves, unless approved otherwise by the CITY ENGINEER in writing. All butterfly valves shall be installed in a vault in accordance with the detail drawings in the Appendix of this chapter. Butterfly valves shall have a combination air and vacuum valve installed on both sides of the valve.

Butterfly valves approved by the CITY shall be one of the following types:

Mueller, Lineseal III and XPII (sizes up to 48")
Pratt, Triton XR-70 (sizes 24" to 72"),
K-Flo, 500 Series (sizes up to 20")

Butterfly valves shall be geared and designed for underground service and shall conform to current AWWA Specification, Rubber Seated Butterfly Valves, Class 150-B. Valves shall be tight closing rubber seat type with the rubber seats bonded to the valve body. No metal to metal sealing surfaces will be permitted. Valves shall be bubble tight to 150 PSI minimum rated pressure with flow in either direction. Valve discs shall rotate 90 degrees from the full open position to the shut-tight position. Valve bearings shall be sleeve-type corrosion-resistant, and self-lubricating with the load not to exceed 2,500 PSI.

All butterfly valves shall be furnished with flanged ends. Dimensions and drilling shall conform to ANSI B16.1, Class 125. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207 current standard, Steel Pipe Flanges (4 in through 144 in). The flanges shall have full-sized bolt holes through the flanges, except that drilled and tapped holes will be acceptable only in the areas where the shaft passes through the body. Flanges with all holes tapped will not be allowed.

All ferrous internal and external surfaces of the valves shall be epoxy coated in conformance with AWWA C116 current standard, Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings, and C550 current standard, Protective Interior Coatings for Valves and Hydrants.

All external bolts, nuts and washers used in conjunction with valves shall be stainless steel and tee-bolts shall be "Cor-Ten".

3.54.04 Valve Boxes

Valve box risers for standard bury depths shall be two-piece with a 5-1/4-inch diameter screw-type shaft that is adjustable from 45 inches to 60 inches in height. Extensions shall be required for pipes with greater bury depth and the number of extensions shall be minimized. Valve boxes shall be made of gray cast-iron with a large oval base and conform with ASTM A48 Class 30A. Valve boxes shall be considered integral units and shall have at least 6 inches adjustment above and below the specified depth of cover over the pipe. Valve box lids 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.

Valve boxes for buried gate valves shall be one of the following types as approved by the CITY:

Tyler, series 6860 (with No. 160 base)
Olympic Foundry Inc., Model No. 450VB
Castings Inc., Series 6850
East Jordan Iron Works, Series 8560

3.55.00 FIRE HYDRANTS

Hydrants will be Waterous, Pacer Model WB-67-250 with the following options:

-- Bronze to bronze seating.
-- Oil cup reservoir.
-- Bronze "safety sleeve" stem coupling.
-- Bronze operating nut.
-- Epoxy-coated upper and lower washer assembly.
-- Fire hydrants shall open left (counterclockwise).

Hydrants shall have a 5-1/4-inch main opening with a 6-inch mechanical joint end. Each hydrant shall be equipped with one 4-1/2-inch pumper nozzle and two 2-1/2-inch hose nozzles with national standard threads. A traffic break-away feature shall be incorporated into the barrel of the hydrant at the ground line.

Hydrants shall be thoroughly cleaned at the factory and then painted with a prime coat of synthetic red primer, Type IV-TTP-86f, followed by one shop coat of fire engine red industrial enamel (Rust-oleum 7407 masstone tint base #1210, or approved equal). Fire hydrant paint shall not be lead based. Care shall be taken when handling hydrants to protect the paint. The installation CONTRACTOR shall repaint all hydrants after installation with Rustoleum brand High Performance Protective Enamel (7564 Safety Red), as determined by the CITY ENGINEER.

The operating nut shall be National Standard pentagon measuring 1-1/2 inches from point to opposite flat. Nozzle covers shall have the same size and shape nut as the operating nut and shall be attached by chain to the hydrant body.

Any product that must be modified to meet these STANDARDS AND SPECIFICATIONS shall be accompanied by a certification signed by a company officer that states that these changes have been incorporated into the product furnished and, in addition, the hydrant shall be tagged by the manufacturer to assure that all the above options were included.

3.56.00 BLOW-OFFS

For host pipes less than 16” in diameter, blow-offs shall consist of a 2” tap, a 2” blow-off pipe and a blow-off assembly approved by the CITY. Refer to the detail drawing in the appendix of this chapter. The main tap shall consist of a corporation stop and the blow-off pipe shall have a curb stop installed between the tap and blow-off assembly and shall have a 2-inch square operating nut with a valve box. The freeze-proof blow-off assembly shall empty through a drain hole into drain rock below the valve box.

The standard required blow-off for 16-inch and larger mains shall be a 6-inch or larger pipe with a gate valve meeting the material requirements of Section 3.54.02 of these STANDARDS AND SPECIFICATION and a manhole meeting the material requirements of Section 3.57.00 of these

STANDARDS AND SPECIFICATIONS. This blow-off shall also conform to the detail drawing in the Appendix of these STANDARDS AND SPECIFICATIONS.

3.57.00 MANHOLES AND VAULTS

3.57.01 General

Manholes, Vaults and associated components (i.e. manhole sections, lids, walls and base slabs) shall be designed in accordance with ASTM C 857 and ASTM C 858 to handle applicable loads, including earth, thrust and live loads. Concrete shall have a minimum 28 day mix design of 5,000 psi. All concrete structures shall be designed for HS-20 loading in accordance with AASHTO Standards. Concrete structures shall be manufactured by facilities certified by the National Precast Concrete

Association (NPCA). Concentric reducing sections for manholes shall not be used.

Vaults shall be cast with a separate roof slab for removal and shall be 8 inches minimum thickness. Vault walls shall be cast in one continuous placement and corners shall have added reinforcement as shown in the standard detail in the appendix of these Standards and Specifications. Minimum wall thickness shall be 6 inches and reinforcement shall be at least one inch from the face of the vault. Shop drawings for vault designs shall be submitted to the CITY ENGINEER and shall be signed and sealed by a Registered Professional Engineer in the State of Colorado.

Steps shall be ½" minimum diameter steel reinforcing bar with a polypropylene plastic covering. Steps shall be placed 12 inches on center and 18 inches maximum from the top of the ring to the first step. Steps shall align with one another in a straight vertical line. Steps shall be PS2-PF manufactured by M.A. Industries, Inc., or CITY approved equal.

3.57.02 Rings and Covers

All gray iron manhole rings and covers shall conform to the requirements of AASHTO M 105 Class 35B or ASTM A48 Class 35B. Ductile Iron castings shall conform to the requirements of ASTM A536 Grade 80-55-06. Aluminum castings shall conform to the requirements of ASTM B 26 Alloy 356 or 319. All castings shall conform to Federal Specification RR-F-621E, for shape and dimension required and shall have a minimum traffic load rating of AASHTO H20-44.

Each casting shall have markings by the foundry showing: name of foundry, country of manufacture, AASHTO or ASTM designation number, Class number and letter and cast date. Lids shall have lettering, and CITY logo, as shown in the detail drawings in the appendix of this chapter. CITY logo is required on all castings except valve box covers and meter pit lids for meters 2 inch and smaller.

Castings shall be free from plugging, sand, blowholes, shrinkage, cracks, and other cold shuts and be well cleaned by shot blasting. Runners, risers, fins, and other cast-on pieces shall be removed from the castings and ground smooth. Bearing surfaces between manhole rings and covers shall be cast or machined with such precision that a uniform bearing surface shall be provided throughout the perimeter area of contact.

Covers shall be 23-7/8" in diameter and frame or ring height shall be 8" tall in accordance with the standard detail in the appendix of these STANDARDS AND SPECIFICATIONS, or as

otherwise approved in writing by the CITY ENGINEER. Concrete extension collars shall be used to adjust the manhole ring and cover to approved street or ground surface.

Gray iron ring and covers shall be the following type or CITY approved equal:

East Jordan Iron Works, No. 00240568 (cover); No. 00242011 (ring)

Water meter vaults for 3" and larger services and butterfly valve vaults shall have a 24" x 36" cover adaptor ring to enlarge the access opening as shown on the detail drawings in the appendix of this chapter. Meter vaults must have an aluminum 24" X 36" cover and adaptor. Adaptor rings for meter vaults shall have a 2-inch diameter machined hole and there shall be a 3-1/2-inch diameter recessed area above the hole so that the transponder can be installed flush with the surface pattern of the lid.

Gray iron 24" x 36" adaptor rings shall be the following type or CITY approved equal:

East Jordan Iron Works, No. 2455E (adaptor); No. 2455Z (ring)
D & L Foundry, No. A-1425 (adaptor and ring)

Water meter manholes for 1-1/2" and 2" services shall have aluminum rings and covers. The covers shall have a 2-inch diameter machined hole and there shall be a 3-1/2-inch diameter recessed area above the hole so that the transponder can be installed flush with the surface pattern of the lid. Aluminum rings and covers shall not be allowed in traffic areas.

Aluminum rings and covers shall be the following type or CITY approved equal:

Castings Inc., Model MH-100-24 AL

All manholes and vaults installed in "field conditions" or in areas prone to tampering shall have locking covers and shall have gaskets for a water tight seal to prevent inflow. Locking lids shall be ductile iron. Bolt down type locking covers will not be accepted.

Locking type rings and covers shall be approved by CITY ENGINEER.

3.57.03 Base Slabs and Base Beams

When required, manhole base beams shall be precast, reinforced concrete. The beams shall be 12 inches wide by 9 inches deep by 8 feet long. The reinforcement shall consist of three No. 5 bars longitudinally and No. 4 bars at 12-inch centers transversely.

Base slabs may be poured in place or precast. The slab shall be designed to uniformly support AASHTO H-20 traffic loading and any earth loading. The minimum slab thickness shall be 6 inches. The minimum reinforcement in the base slab shall conform to the detail drawings in the Appendix of this chapter.

3.57.04 Joint Material

Joint material used to join all sections shall be a flexible butyl resin joint sealing compound meeting Federal specifications SS-S-210-A and AASHTO M-198-B. Joint material shall be Conseal CS-102 manufactured by Concrete Sealants, Inc., or CITY approved equal.

3.57.05 Mortar

Mortar used in repair of precast sections and for grouting joints shall be composed of one part Portland cement and not more than three nor less than two parts of fine aggregate. Hydrated lime or masonry cement shall not be used. Portland cement shall meet the requirements of ASTM C-250, Type II. Fine aggregate shall consist of well-graded natural sand having clean, hard, durable, uncoated grains, free from organic matter, soft or flaky fragments or other deleterious substances. The fine aggregate shall be thoroughly washed and shall be uniformly graded from coarse to fine with a minimum of 95 percent passing a No. 4 sieve and a maximum of 7 percent passing a No. 100 sieve.

3.58.00 VAULT ELECTRICAL AND MECHANICAL

SECTION NOT USED

3.59.00 VENT PIPES

For typical above ground vent pipe installations, vent pipes shall be 3-feet tall and 8-inch diameter seamless pipe in accordance with the details in the appendix of these STANDARDS AND SPECIFICATIONS.

Below-ground, vent pipes shall be 6-inch diameter, SDR 35 or Schedule 40 PVC in accordance with the details in the Appendix of these STANDARDS AND SPECIFICATIONS. (Update detail W-28)

3.60.00 SERVICE CONNECTIONS

3.60.01 Pipe

Acceptable material for ¾" through 2" service lines is seamless copper tube and for 4" and larger service lines polyvinyl chloride (PVC) pipe shall be used. All service pipes shall conform to one of the following specifications.

(A) Seamless copper tube designated as "Type K" (soft) in the industry shall be used for ¾", 1", 1-1/2" and 2" service lines. Service pipe and fittings 1-1/4" in diameter are prohibited.

(B) Polyvinyl chloride pipe conforming to Section 3.52.02 of these STANDARDS AND SPECIFICATIONS shall be used for 4-inch and larger service lines. Three-inch service pipe is not readily available and service pipe specified as 3-inch shall be upsized to 4-inch from the main connection to the meter pit.

3.60.02 Saddles

For ¾" to 2" taps requiring saddles, the saddles shall be AWWA taper thread (CC thread) and shall be manufactured in accordance with AWWA C-800 current standard, Underground Service Line Valves and Fittings. Cast saddle top, strap, and nuts shall be constructed of ASTM A-536 Class 65-45-12 stainless steel.

The following saddles have been approved for use with ductile iron, cast iron, AC or PVC host pipes, 6" through 12":

	¾"	1	1½"	2"
McDonald	---------- 3825 Series ----------			
Ford	---------- FC202-905 Series ----------			
Mueller	---------- BR2B Series ----------			

3.60.03 Curb Stop Valves and Curb Stop Boxes

All curb stops shall be manufactured in accordance with (Current) AWWA C800 current standard, Underground Service Line Valves and Fittings, and shall be constructed of brass in accordance with ASTM-B62. Curb stop valves shall be ball type with a maximum working pressure of 300 psi and shall have compression fittings.

Curb stop valves for use with copper service pipe shall be the following type or CITY approved equal:

	¾”	1	1½”	2”
McDonald	n/a	n/a	6100Q	6100Q
Ford	n/a	n/a	B44-666-G	B44-777-G
Mueller	n/a	n/a	B-25209	B-25209

All curb stops shall have a valve box per Section 3.54.04.

3.60.04 Tapping Sleeve and Valve

Tapping sleeves shall be required on existing host pipe for all taps larger than 2 inch, unless a tee is provided**.**

Cast or Ductile Iron Host Pipe

Full body Mechanical Joint (MJ) cast or ductile iron tapping sleeves are required.

Tapping sleeves for Cast Iron or Ductile Iron shall be the following type or CITY approved equal:

Mueller H-615
Waterous Series 1004 or 2800
US Pipe T-9
Tyler/Union Compact (up to 12”)

PVC or AC Host Pipe

Fabricated stainless steel triangular sidebar style with stainless steel flange tapping sleeves are required. No coated carbon steel saddles will be allowed. A flange insulator kit between the valve and sleeve is required. Stainless steel bolts will be required on the tapping sleeve side of the valve. Tapping sleeve shall be rated for 250 PSI minimum operating pressure (sizes 4”-12”) and 200 PSI minimum operating pressure for larger sizes.

Tapping sleeves for PVC or AC host pipes shall be the following type or CITY approved equal:

JCM 432 or 452
Mueller H-304
Ford FTSS
Romac SST III or STS 420
Smith Blair 665

Steel Host Pipe
Weld on Saddles shall be required. These taps are application specific and require approval by the CITY ENGINEER.

Tapping valves shall be resilient seat, cast iron or ductile iron body, fully bronze mounted with non-rising stem and shall be in conformance with Section 3.54.02 of these STANDARDS AND SPECIFICATIONS. Tapping valves shall have a flange connection on one side meeting the requirements of ANSI B16.1 Class 125 and a mechanical joint on the other side meeting AWWA C111 current standard, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings. Valves shall be delivered complete with bolts and gaskets.

Tapping sleeves for Steel host pipes shall be the following type or CITY approved equal:

Mueller, Series 2360 (sizes 4" – 12")
American AVK, Series 45 (sizes 4" – 12")

3.60.05 Corporation Stops

All corporation stops and threaded brass fittings shall be manufactured in accordance with AWWA C800 current standard, Underground Service Line Valves and Fittings, and shall be constructed of brass in accordance with ASTM-B62. All corporation stops shall be tested at the factory and shall meet the following minimum physical requirements:

Tensile strength	30,000 PSI minimum
Yield Strength	14,000 PSI minimum
Elongation in 2 inches	20 percent minimum

Corporation stops shall be ball valve type designed for a maximum working pressure of 300 psi. The inlet side shall have AWWA taper thread (CC thread) and the outlet side shall have a compression fitting.

Corporation stops shall be the following type or CITY approved equal:

	¾"	1	1½"	2"
McDonald	---------- 4701BQ ----------			
Ford	FB1000-3-G	FB1000-4-G	FB1000-6-G	FB1000-7-G
Mueller	---------- B-25008 ----------			

3.60.06 Stop and Waste

Stop and waste valves must be approved by CITY ENGINEER.

3.60.07 Compression Couplings

Only compression fittings will be allowed on copper service pipe. All compression couplings shall be manufactured in accordance with AWWA C800 current standard, Underground Service Line Valves and Fittings, and shall be constructed of brass in accordance with ASTM-B62.

Compression couplings shall be the following type or CITY approved equal:

Ford: C44-G Series (Grip Joint Connection)
McDonald: 74758-22
Mueller: H-15403

Upsizing of service lines after the meter shall be in accordance with the detail drawing of this chapter. Compression couplings for upsizing shall be the following type or CITY approved equal:

	¾" to 1"	1" to 1-1/2"	1½" to 2"	2" to 3"
McDonald	74758-22-33	74758-22-33	n/a	n/a
Ford	C44-34-G-NL	C44-46-G-NL	C44-67-G-NL	n/a
Mueller	H-15403	H-15403	H-15403	H-15403

3.61.00 ENCASEMENT

3.61.01 Concrete

All concrete shall be a minimum of Class D and shall conform Chapter 7 of these STANDARDS AND SPECIFICATIONS. All concrete encasements shall be a minimum of 6 inches thick from outside of pipe to outside of encasement. Reinforcement for pipe encasements shall include #4 "hoop" reinforcement steel on 12" centers transverse and longitudinal #4 reinforcement placement shall conform with detail W27 of these STANDARDS AND SPECIFICATIONS. Material properties for reinforcing steel shall conform with Section 3.67.00 of these STANDARDS AND SPECIFICATIONS.

3.61.02 Polyethylene Encasement

Polyethylene encasement material shall be a minimum of 8 mils thick and shall be a high density, cross-laminated polyethylene film. All polyethylene encasement material shall be manufactured in accordance with ANSI/AWWA Standard C-105/A21.5-05, Polyethylene Encasement for Ductile Iron Pressure Pipe and Fittings. The raw materials used to manufacture polyethylene film shall be Type I, Class A, Grade E-1 in accordance with ASTM Standard Designations D-1250.

3.61.03 Extruded Polystyrene Insulating Foam

"Extruded Polystyrene Insulating Foam" or "Rigid, Cellular Polystyrene Thermal Insulation" also referred to as "XPS" shall be manufactured in accordance with ASTM C 578-08b. Bonding sheets of "XPS" together shall be accomplished by using "3M 78 Polystyrene Foam Insulation Spray Adhesive" or CITY approved equal.

3.62.00 CATHODIC PROTECTION

3.62.01 General

Unless otherwise specified, all materials and equipment shall be of the best quality used for the purpose in commercial practice. All materials and equipment shall conform to these STANDARDS AND SPECIFICATIONS.

3.62.02 Sacrificial Anodes

Dimensions of the magnesium anodes shall conform to the dimensions for standard sizes of anodes and of the weights specified. All magnesium anodes shall be cast around a galvanized steel core (flat strap or spring) and be made of high potential magnesium alloy conforming to the following compositions by weight:

Aluminum	0.01% Max.
Manganese	0.50% Min. to 1.30% Max.
Zinc	0.005% Max.
Copper	0.02% Max.
Nickel	0.001% Max.
Iron	0.03% Max.
Other Impurities	0.05% Each Max.
Other	0.30% Total Max.

Impurities	
Magnesium	Balance

CONTRACTOR shall furnish spectrographic analyses or a letter of compliance on samples from each heat or batch of anodes used on the project.

Sacrificial anodes shall be provided with specific backfill in a permeable cloth sack. Anodes shall be centered in the backfill material and shall be buried to a depth as specified by the DEVELOPER. The weight and nominal dimensions of the packaged anode shall be as follows:

48 lb. bare anode (5.50" X 5" X 31") = approx. 100 lb. packaged (8" Dia. X 38"L)

The anode backfill material shall consist of 75 percent gypsum, 20 percent bentonite, and 5 percent sodium sulfate, and shall be of the quick wetting type.

All anodes shall be shipped and stored in waterproof bags or wrapping and shall be AMAX "MaxMag", Dow "Galvomag" or CITY approved equal.

Sacrificial anode lead wires shall consist of #12 AWG Type RHW or USE, black insulated stranded copper wire. Lead wires shall be a minimum of 25 feet in length. The lead wires shall be connected to the galvanized steel core of the anode by silver soldering and this connection shall be sealed with a waterproof epoxy or electrical potting compound.

3.62.03 Wire Conductors

Test station wires shall be #12 AWG and #8 AWG single conductor, stranded copper Type RHW. Wire color coding shall be as shown on the construction drawings.

Joint bond wires shall be #4 AWG single conductors, stranded copper with Type HMWPE insulation.

3.62.04 Wire Splice Connections

All splices of buried test station or anode wires shall be made using a mechanical connector and soldered then sealed with an epoxy type material. Splice kits shall be Royston "MINI SPLICE-RIGHT" with a "Crimpit" type or CITY approved equal**.**

3.62.05 Exothermic Welds

All electrical cable connections to the buried piping shall be made by an exothermic weld. Exothermic type weld materials including the proper size and type of weld cartridges and welder molds for use on steel or ductile iron pipe shall be by Erico Products Inc. "CADWELD" or Burndy "THERMOWELD" or CITY approved equal.

Copper sleeves specifically designed for the purpose shall be crimped on all bare wire ends of all stranded cables prior to exothermic welding to improve mechanical strength and thermal capaCITY.

3.62.06 Exothermic Weld Coating

For ductile iron pipe, exothermic weld coatings shall be a cold applied compound such as Koppers "Bitumastic 50", Royston "Roskote A51", or CITY approved equal.

For steel pipe, exothermic weld coatings shall be a mastic filled plastic weld cap such as Royston "Handicap" or CITY approved equal.

3.62.07 Test Stations

Flush mount cathodic protection test stations shall be those made specifically for the purpose and shall consist of test station enclosure, cast iron lid, terminal block with studs, and shunt.

Test station enclosures in shall be composed of concrete and shall be Brooks Products Inc. Model" No. 1-RT" or Christy Mfg. Model "G3" or "G5" with the lid inscribed with the words "CP TEST". Test station enclosures within vehicle traffic areas shall be cast iron in accordance with Section 3.54.04 of these STANDARDS AND SPECIFICATIONS.

A separate terminal board manufactured from a minimum 3/16 inch thick plastic or glass reinforced laminate with minimum dimensions of 3 inches by 4 inches shall be provided to terminate the test station and anode wires. Terminal boards shall be CP Test Services Model NM-5 terminal board or CITY approved equal.

Terminal board hardware shall be nickel plated brass and consist of a minimum of five 1/4 inch studs with double nuts, flat washers, and lock washers. The layout of the hardware shall be as shown on the CITY construction drawings.

Each test station shall also be furnished with a Colt Mfg. Co. calibrated 0.01 ohm - 8 ampere color code yellow) test station shunt or CITY approved equal. Exception: the shunt is not required at test stations designated as insulating fitting or test stations with no anodes type test stations.

3.62.08 Insulating Flange Kits

Dielectric flange kit materials shall consist of full faced gaskets, bolt sleeves, non-metallic washers, and steel backing washers.

Gaskets shall be “Type E”) (full face) phenolic with a Buna-N o-ring type sealing element**.** Insulating bolt sleeves shall be the single one-piece sleeve and washer type made of Minion or acetyl resin plastic, shall fit within the bolt facing of the flange, and shall allow the standard size bolt or stud for the flange to be inserted. This subparagraph shall also apply to harness rods or tie bolts where insulating sleeves and washers are specified.

The steel backing washers shall be 1/8" thick; cadmium plated, hot rolled steel and shall fit within the bolt facing on the flange.

3.63.00 METERS

3.63.01 General

All water meters and transmitters shall be approved by the Utilities Department. Approval of the meter by size, type and brand shall be obtained from the CITY Meter Shop prior to purchasing the meter. All meters, other than residential 5/8” x ¾”, shall be purchased by the CONTRACTOR and delivered to the CITY Meter Shop to be pre-tested prior to installing the meter in the meter setting in accordance with Section 3.39.00 of these STANDARDS AND SPECIFICATIONS.

3.63.02 Magnetic Drive Positive Displacement-Type Water Meters

All magnetic drive displacement-type meters and displacement Type Bronze Main Case, and cold Water Meters Displacement Type Plastic Main Case shall conform to AWWA standards.

3.63.03 Compound and Turbine Meters

Compound meters shall conform to AWWA 702 current standard, Cold Water Meters Compound Type, and AWWA 701 current standard , Cold Water Meters Turbine Type, and C703 current standard (reaffirmed 2004) Cold Water Meters Fire Service Type. Strainers shall be provided upstream of all compound meters. Turbine meters shall be supplied with integral strainers.

3.63.04 Mastered Meters

Every "Master Metered" system to which fire hydrants or fire protection lines will be connected shall have a UL/FM approved "Fire Service Protection Water Meter" in accordance with AWWA C703 current standard (R04), Cold Water Meters – Fire Service Type. Public Works and Utility Department shall be contacted prior to design for meter requirements.

3.63.05 Meter Bypass Line

Bypass lines shall be required on all 1-1/2" and larger domestic water meter installations and shall contain an independent control valve. The bypass shall not contain tees, plugs, or other outlets through which water could be withdrawn. Bypass valves shall have locking devices.

3.63.06 Meter Check Valves

For 1-1/2" and 2" meter installations, single check valves shall be installed inline with the service pipe and downstream of the meter setter in accordance with the standard details of this chapter. Single check valves shall be manufactured in accordance with AWWA C800 current standard, Underground Service Line Valves and Fittings, and castings shall be constructed of brass in accordance with ASTM-B62.

Single check valves for 1-1/2" and 2" meter installations shall be the following type or equal as approved in writing by the CITY ENGINEER:

Ford HS11-666 (1-1/2"); HS11-777 (2")

For 3" and larger meter installations, swing check valves shall be installed downstream and adjacent to the meter as well as on the bypass. Swing-check valves shall be manufactured in accordance with AWWA Standard C-508 current standard, Swing-Check Valves for Waterworks Service (2 in through 24 in) and shall have interior epoxy coating in accordance with AWWA Standard C-550 current standard, Protective Interior Coatings for Valves and Hydrants. Swing check valves shall have an outside lever and weight and shall have metal seats. Swing check valves shall be iron body bronze mounted with flanged ends in accordance with ANSI B16.1.

Swing check valves for 3" and larger meter installations shall be the following type or CITY approved equal:

American Flow Control, Series 52-SC and 600
AVK, 41 Series

Mueller, A-2600-6-01
Kennedy, Style 1106

3.63.07 Meter Valves

Meter valves for ¾" through 2" services shall be manufactured in conjunction with the setter. Valve shall be an angle lock wing type ball valve and shall be on the inlet side of the setter for ¾" and 1" setters and on the inlet and outlet sides for 1-1/2" and 2" setters.

For valves 4" and larger, gate valves shall be used and shall conform to Section 3.54.02 of these STANDARDS AND SPECIFICATIONS.

3.63.08 Meter Yokes (Setters)

All meter setters shall be manufactured in accordance with AWWA C800 current standard, underground Service Line Valves and Fittings, and all castings shall be constructed of brass in accordance with ASTM-B62. Meter setters shall be designed in accordance with the detail drawings in the appendix of this chapter.

The following meter setters: shall be the following type or CITY approved equal:

	¾"*	1**	1½"***	2"***
McDonald	732-3-09WX2233	732-4-WX2244	720B618WWFF665	720B718WWFF775
Ford	VB83-9W-44-33-G	VB84-10W-44-44-G	VBB76-18-11-66-G	VBB77-18-11-77-G
Mueller	B-2474N	B-2474N	B-2474N	B-2474N

* 9" setter height
** 10" setter height.
*** 12" setter height. Requires bypass piping.

Bypass orientation will not be allowed on a meter setter solely dedicated for irrigation use.

For installation of a smaller meter on an existing setter, size changes shall be accomplished by providing a full sized meter vault and setter for the line size installed and using industry standard adapters to install a reduced size meter in the full size line. Adapters: shall be the following type or CITY approved equal:

1 ½" meter on 2" line	- 1 pair Ford A67 adapters
1" meter on 2" line	- 1 pair Ford A47 adapters
1" meter on 1 ½" line	- 1 pair Ford A46 adapters
5/8" X ¾" meter on 1" line	- 1 pair Ford A24 adapters
¾" meter on 1" line	- 1 pair Ford A34 adapters
Other sizes	- Contact Utilities/Meter Shop

3.63.09 Valve and Meter Supports

Meter supports shall be fabricated of concrete and valve supports shall be fabricated of steel in conformance with detail W13 of these STANDARDS AND SPECIFICATIONS.

3.63.10 Meter Pits (3/4" and 1" service lines)

Meter pits for ¾" and 1" service lines shall be constructed of modified high density polyethylene with a minimum nominal wall thickness of 0.50", shall have protective UV degradation with a low temperature brittleness which exceeds -76°F, a thermal transfer rate of .40, smooth walled (inside and out) and shall have a vertical crush rating which exceeds 20,000 pounds. No meter pits shall be set in streets, concrete areas, driveway alignments, or other areas of vehicle traffic.

Meter pits shall be the following type or CITY approved equal:

Mid-States Plastics Inc. B-Series (20" dia. for ¾" services and 24" dia. for 1" commercial services, and 30" dia. for 1" residential services)

A concrete meter pit is available as an alternate to the plastic meter pit upon approval in writing by the CITY ENGINEER. Note that this meter pit is not intended for installation in areas of vehicle traffic. Concrete meter pits: shall be the following type or CITY approved equal:

Copeland Enterprises, Inc., 24" & 30" Water Meter Pit.

Meter pit covers shall be airtight and shall have a cast iron recessed top lid and bonnet with a locking screw forged pentagon bolt. Lids shall have a 2" diameter hole centered in the lid for the transponder. A deep dish plastic inner lid shall be provided below the top lid. Meter risers shall not be allowed on new meter pit installations.

Meter pit covers shall be the following type or CITY approved equal:

Residential 5/8 & ¾" meter pits- AY McDonald CM70TPLIDCI or Vestal #32-764
Residential 1" meter pits- AY McDonald 74ML20HT
Commercial meter pits- refer to diagrams

3.64.00 PRESSURE-REDUCING VALVE

All pressure-reducing valves shall be approved by CITY ENGINEER. The valve shall be designed to reduce a high upstream pressure to a constant downstream pressure by way of a pilot control system. The pilot system shall control the main valve which shall be single-seated, hydraulically-operated, diaphragm, globe-valve type. The typical valve seats shall be bronze (Note that the manufacturer recommends stainless steel seats when subjected to sustained high velocities through the valve). An indicator rod or flow tube shall be furnished as an integral part of the valve to show the position of the valve.

3.65.00 COMBINATION AIR VALVES

Air release valves shall be in conformance with AWWA C512 current standard, Air Release, Air/Vacuum and Combination Air Valves.

Single body combination air valves shall be the following type or CITY approved equal:
Note that inflow preventers shall be required on all vault installations:

Val-Matic, Flood Safe

Combination air valves 2" and smaller shall have threaded NPT type inlets and outlets. For 3" and larger combination air valves, inlets shall be flanged.

3.66.00 RESTRAINING SYSTEMS

3.66.01 Harness Rods

Harness rods and nuts shall be SAE type 304 stainless steel

3.66.02 Joint Restraint Devices

Joint restraint devices shall be manufactured of ductile iron conforming to ASTM A 536. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to AWWA C111/A21.11-07, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings, and ANSI/AWWA C153/A21.53-06, Ductile Iron Compact Fittings. Twist-off nuts, sized the same as the tee-head bolts, shall be used to insure that the proper torque is applied to the bolts. In no case shall the twist-off bolts be torqued beyond the manufacturers' recommendations.

Mechanical joint restraint device shall have a working pressure of at least 350 psi for pipe sizes 4-16 inch and 250 psi for pipe sizes 18-48 inches, with a minimum safety factor of 2:1. Mechanical joint restraint devices shall be the following type or CITY approved equal:

EBAA Iron, Mega-lug, Series 1100 (DIP), Series 2000 (PVC)
Star, Series 3000, 3000S and 3000OS (DIP), Series 4000 (PVC)
Uniflange, Series 1400

Push on joint bell restraint harnesses shall have working pressures for PVC pipe of at least 200 psi for sizes 12 inches and smaller, 235 psi for pipe sizes 14 to 16 inches and working pressures for ductile iron pipe of at least 350 psi for pipe sizes up to 16 inches. Bell restraint harnesses shall be the following type or CITY approved equal: (bell restraint harnesses are not recommended for pipe sizes above 16 inches):

EBAA Iron, Mega-lug, Series 1700 (DIP), Series 1500, 1600 and 2800 (PVC)
Star Pipe Products, Series 3100P (for DIP only)
Smith-Blair, Series 165 (for PVC only)

3.67.00 CONCRETE REINFORCEMENT

All deformed reinforcing bars shall conform to ASTM Standards A-615, Grade 40 or 60, or ASTM Standard A-671, Grade 40 or 60. All welded wire steel fabric shall conform to ASTM Standard A-185.

3.68.00 BACKFLOW PREVENTION ASSEMBLIES

Backflow prevention assemblies shall conform to the requirements of AWWA C510 current standard, Double Check Valve Backflow Prevention Assembly, and C511 current standard, Reduced Pressure Principle Backflow Prevention Assembly. Backflow assemblies shall also meet the application requirements in Section 3.24.08 of these STANDARDS AND SPECIFICATIONS and Section 8-7-27 of CITY CODE.

3.69.00 REPAIR CLAMPS

Repair clamps shall be entirely 18-8 Type 304 stainless steel including bands, lugs, nuts, and bolts. Gaskets shall be gridded virgin GPR compounded for water service and meeting the requirements of ASTM D 2000-90M 4AA607. Repair clamps shall be single or double panel as required to fit the pipe and shall have a minimum working pressure rating of 150 psi. Repair clamp length shall be greater than or equal to the host pipe diameter.

Repair clamps approved by the CITY shall be one of the following types:

PowerSeal, Model 3121AS or 3122AS
Ford, Style FS1 or FS2
Smith-Blair, Models 261 and 262
Romac, XR-501, Style SS1 or SS2