CITY OF TIGARD

PUBLIC IMPROVEMENT DESIGN STANDARDS

Water Distribution System

City of Tigard
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APPROVED BY:

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A. WATER DISTRIBUTION

1. General

These standards shall be used for the design, construction, installation, and testing of water system improvements within the Tigard Water Service Area (TWSA) which includes the cities of Durham, King City, two-thirds of Tigard, and the unincorporated areas of Bull Mountain represented by the Tigard Water District. All water distribution system work within the Tigard Water Service Area shall require prior approval by City of Tigard City Engineer or designate and meet the requirements set forth. The Tualatin Valley Water District (TVWD) as shown on Map G serves water to a portion of the City. Contractors, builders and land developers should insure that work to be performed regarding water distribution facilities is within the service boundaries and City jurisdiction.

A. All design, construction, testing, and maintenance, where applicable, shall conform to the latest adopted revision of the Oregon State Health Division Administrative Rules Chapter 333 on Public Water Systems except where the provisions provided in these standards exceed the minimum requirements. An approved water system capable of supplying required fire flow for fire protection shall be provided to all premises with buildings constructed within the TWSA. The required fire flow must be available with a minimum residual pressure of 20 pounds per square inch (psi). Questions regarding required fire flow capabilities may be referred to the Fire Marshal's Office.

B. The City Engineer or designate may request that modifications be made as determined for each project. The City Engineer shall be the final authority on any approvals or denials of project requirements that deviate from these standards.

2. Design

2.1 Public Improvement Water Design Standards

The following standards shall be required for all water distribution system projects unless approved by the City Engineer:

A. All material shall be of new manufacture. Rebuilt, reconditioned, or used material shall not be allowed. Only materials designed for potable water service and meeting National Sanitation Foundation (NSF) Standard 61, Section 9, Drinking Water System Components – Health Effects, or equivalent shall be used in those elements of the water system which are in contact with potable water. All water distribution system pipe, fittings and mechanical equipment shall be rated at a minimum pressure of 150 psi.

B. Minimum size water main pipelines shall be 6-inch diameter, except that 4-inch diameter pipe may be permitted on runs less than 300 feet, when there are not more than eight (8) each 1-inch diameter service connections; where no fire hydrants are required; and when there is no possibility of future extension of water system facilities. The use of 10-inch and 14-inch diameter water main pipe is not permitted.

C. Thrust restraint, as required, shall be Tyton Field-Lok 350® gasket, Fast-Tite Flex-ring® gasket, Mega-lug® or other approved mechanical restraint on all push-on joints, fittings and valves. See Section 6.1 for further details.

D. Water mains shall be located in accordance with City Standard Drawing #575 and Section 2.5 for further details.

E. Dead end water mains normally shall not be allowed. When they are permitted, a blow off assembly will be required. See City Standard Drawing #570 for details. An approved Combination Air and Vacuum Release Valve shall be required as per City Standard details and drawings if risk of vacuum exists at end point of dead end water mains.

F. Water main pipeline extensions shall be installed in a manner consistent with standard practices regarding pipe alignment, phase break valves and force restraint to facilitate future expansion of adjacent undeveloped or underdeveloped properties.

G. All water main pipeline extensions and service connections shall be constructed within the public right of way. Public water system improvements may be constructed in private street developments but additional construction design and material requirements shall be required by the City Engineer. See Section 2.3 for further details.

H. Valves shall be located as described in Section 2.5. Valves shall be provided to permit closure and isolation of any section of the water main pipeline, not exceeding 500 feet, with valve operations in not more than three (3) locations. See City Standards Drawings #503, #504 and #505 for further details.

I. Valve boxes shall be type Cast Iron Style 910 valve box with cast iron covers or lids, eighteen (18) inch height. See City Standard Drawing #503 for further details.

J. Valves eight (8) inches and smaller shall be gate valves. Only resilient wedge gate valves shall be installed. Valves must meet AWWA C509 Standard for Resilient Seated Gate Valves. Valve body and bonnet shall be epoxy coated inside and out with fusion bonded epoxy. Coatings shall conform to AWWA C550 Standard Protective Coatings for Valves and Hydrants.

K. Valves twelve (12) inches and greater shall be butterfly valves. All butterfly valves installed shall conform to AWWA C504 Standard for Rubber Seated Butterfly Valves. If a 12-inch or larger live tap is required; see Section 9 regarding additional requirements. The City Engineer may require a "live" or "hot" tap into existing water system piping due to avoidance of loss of water service.

L. Fire hydrants shall not be connected to mains less than six (6) inches in diameter. As per the Uniform Fire Code, fire hydrants shall be located to allow a 36-inch clear space surrounding the hydrant. For example, street lights, sign posts, protective posts, or retaining walls shall be no closer than 36 inches from the nearest portion of a hydrant. There shall also be no obstructions directly in line with any of the ports of the hydrant. See City Standard Drawing #542 for further details.

M. Fire hydrants supplied must be selected from the following list. No other fire hydrant assemblies are acceptable.

1. Modern Mueller® Centurion A-442
2. Mueller® Centurion A-423
3. Clow® Medallion F-2545
4. Waterous® Pacer 6790

N. Fire hydrants shall be equipped with two 2-1/2 inch hose outlet nozzles and one 4-1/2 inch pumper outlet nozzle with threads conforming to NFPA 194 for National Standard Fire Hose Coupling Screw Threads. Minimum hydrant valve opening shall be 5-1/4 inches. The minimum hydrant branch line shall be 6-inches. The inlet connection to the base of the hydrants shall be 6-inches with end type as shown on the drawings or specified elsewhere in the specifications. Hydrants shall open to the left or counterclockwise. Hydrants shall be of the "break away" type to minimize breakage of hydrant parts in case of damage. The 4-1/2 inch port shall have a Storz® HPHA50-45NH permanent hydrant adaptor. See City Standards Drawing #542 for further details

O. Requirements for fire hydrant locations: These criteria are subject to change. For the most current information, contact the Fire Marshal's office.

1. Commercial Buildings: Fire hydrants shall be located so that no part of a commercial building is more than 250 feet from a fire hydrant measured along a route accessible to fire department vehicles. When a fire department connection (FDC) is installed in conjunction with an automatic sprinkler system, it is required to have a fire hydrant located within 70 feet of the FDC. Commercial building shall be a building used for other than R-3 or M occupancy as such occupancy is defined in Tigard Municipal Code Section 18. Specific location of fire hydrants requires the approval of the Fire Marshal.

2. Commercial Building Exception: When such buildings are protected with an approved automatic fire protection system, the Fire Marshal may allow variations from the 250-foot requirement up to a maximum of 500 feet measured along a route accessible to Fire Department vehicles.

3. Non-Commercial Buildings: Intermediate hydrants are required when the distances to any part of non-commercial buildings exceeds 500 feet measured along a route accessible to fire department vehicles.

Q. For design of public water system improvements, the water system analysis shall be conducted using a simultaneous demand for the maximum (peak) day demand or peak hour non-fire demand, whichever is greater, and the fire demand. Parameters to be used to calculate non-fire demand shall be approved by the City Engineer. The fire demand shall be as specified by the Fire Marshal as applicable for the location, land use type, buildings contemplated and occupancy hazard. See Sections 2.2 and 2.4 for further details.

R. Backflow devices as required shall be installed as per City Standard Drawings #550, #553, #554 and #555 and Section 11 for further details.

S. Pressure reducing devices are to be required and approved on a per project basis to ensure compliance with the Oregon Plumbing Specialty Code (OPSC). Vaults for large pressure reducing devices shall be designed in accordance with Standard Detail Drawing #588.

T. Water service size shall be evaluated by the City Engineer and shall be of sufficient size to meet requirements of Section 2. Booster pumps shall not be allowed on meter service lines in order to meet this requirement. The meter size shall be no smaller than the service line size. At the discretion of the City Engineer, a smaller meter may be installed but in no event should the meter be more than one size smaller than the service line.

U. Water meters shall be purchased through the City and installed by City upon final approval for occupancy. Water meters 3-inch diameter or larger shall be supplied by developer with vault and lid as specified in Section 12.4 and Standard Detail Drawing #523.

V. The design engineer shall provide a "pressure available" chart on the water system plan sheet of the construction plans; this sheet shall indicate the calculated pressures theoretically available to each lot during static and peak demand periods.

W. Water service lines are to be single runs, minimum 1-inch diameter American or Canadian Type K copper pipe, from the main line to each meter. No yoked service lines shall be allowed.

X. At high points in the water system, combination air and vacuum release valves (CARV) shall be installed as required by the City Engineer. All air and vacuum release valves shall vent to the outside of the vault. See City Standard Drawings #590 and #591 for further details.

Y. Blow-off assemblies are to be used at the end of cul-de-sacs and at the end of water lines that may be extended in the future. Blow-off assemblies are to be not less than two (2) inches in diameter and sized at a minimum of 25 percent of the line diameter. See City Standard Drawing #570 for further details.

2.2 Water System Design Parameters

A. All public water system improvements shall be designed to provide pressure within a range of no less than 50 pounds per square inch (psi) and not greater than 80 psi at peak demand (residual water system pressures at peak hour and peak day using network analysis modeling) excepting demand during fires. For practical application of the minimum 50 psi pressure requirement, a static pressure of 60 psi (theoretical pressure calculated from elevations or measured in the field) at non-peak times is required assuming a 10 psi drop during peak hour or peak day use. Exception may be granted or required by the City Engineer from the 80 psi maximum pressure for extenuating circumstances, including topography, water demand requirements, system configuration, and system operation.

B. Water system improvements shall also be designed to operate during a fire, to provide a system pressure of no less than 20 psi with a simultaneous peak day non-fire demand. Required fire flow capacity of the public water system is to be designated by the Tualatin Valley Fire and Rescue Fire Marshal in conformance with the Uniform Fire Code adopted by the City of Tigard.

2.3 Additional Requirements for Public Water Improvements in Private Street Developments

Public water system improvements within private street development or public urban development shall provide the following additional requirements regarding material selection and installation:

A. All water main pipe joints, fittings and valves shall have force restraint as described in subsections 2.1 and 6.1. These additional requirements are to reduce the risk of pipe separation at each joint and fitting.

B. All water meters shall include Sensus® MXU520-R Automated Meter Reading radio units at an additional cost to owner as determined in approved City Fees and Charges schedule.

C. All water pipe, fittings and meters shall be provided with an easement as described in Section 15.

2.4 Fire Flow Testing Requirements

Water system flow test and analysis if required as a condition of approval shall be requested by the design engineer for the project. The City shall conduct all fire flow tests for public fire hydrants within the service area. All fees and charges for fire flow testing shall be paid before testing is performed by the City. All information regarding hydraulic capacity within the area of the test shall be provided to the design engineer. This information shall also be part of the public record.

2.5 Component Location

A. Water main pipe lines shall be located South or East Side of street, 7 feet from face of curb (See Figure D-2, Utility Location) to the extent practical without crossing center line and as determined by placement of sanitary sewer pipe. Minimum cover over the pipe is 36 inches. The design engineer is responsible for proper alignment of the pipe to insure maximum pipe joint deflection is not exceeded.

B. Valves shall be located at the beginning and endings of curb returns at intervals that provide for the isolation and purging of air from lines, in lengths not exceeding 500 feet, by operating not more than three valves. Phase break valves matching pipe diameter shall be installed on line ends intended for future extension.

C. Fire Hydrants shall be located at beginning or ending of curb returns and as described in Section 2.1.

3. Materials

3.1 Water Pipes

Pipe shall be push-on joint ductile iron pipe, except where specifically shown or detailed otherwise, and shall be manufactured by United States Pipe and Foundry Company, American Ductile Iron Company, Griffin Pipe Products Company or approved equal. Fitting joints shall be mechanical joint ends, except where specifically shown or detailed otherwise. Push-on joint ductile iron pipe shall be cement-mortar lined and conform to ANSI/AWWA C151/A 21.51 and ANSI/AWWA A21.11. Tyton® or Fast-tite® joint configuration and

thickness class 52 shall be required. The rubber ring gaskets shall conform to ANSI/AWWA A21.11, be suitable for the specified manufacturer pipe sizes and pressures, and shall be furnished with the pipe. A non-toxic vegetable soap lubricant shall be supplied with the pipe in sufficient quantities for installing the pipe furnished.

3.2 Pipe Fittings

A. Mechanical Joint Fittings: Mechanical joint fittings shall be ductile iron short pattern conforming to AWWA C110 and shall be of a class at least equal to that of the adjacent pipe. Mortar lining for fittings shall be the same thickness specified for pipe. Alternately and the City preference, ductile iron fittings shall be provided with a 6-8 mil nominal thickness coating and lining of fusion bonded epoxy conforming to the requirements of ANSI/AWWA C550 and C116/A21.16. Bolts shall be domestic Cor-Ten or ductile iron tee-head bolts.

B. Flanged Cast Ductile Iron Fittings: Flanged fittings shall conform to ANSI/AWWA B16.12 and shall be faced and drilled 250-pound ANSI. The fittings shall be cement-mortar lined to same thickness specified for pipe, and shall meet ANSI/AWWA C110/A21.11 for all other aspects.

C. Gaskets: Gasket material for flanged joints in cast ductile iron pipe fittings shall be cloth-inserted sheet rubber gaskets conforming to ANSI/AWWA C207/B16.21, 1/8-inch thick. The gasket shall be full-cut, with holes to pass bolts. Gasket material shall be free from corrosive alkali or acid ingredients.

D. Non-buried Mechanical Couplings: Mechanical couplings, not a part of the pipe itself, shall be cast iron couplings with rubber rings and ductile iron bolts and nuts. Couplings shall be Dresser®, Smith-Blair®, or as approved in writing by the City Engineer.

3.3 Service Connections and Valves

Service connections and service valves shall meet the following requirements. In these requirements, the term "connection" refers to the outlet end of corporation stops, the inlet and outlet end of curb valves, the inlet of meter valves, and the inlet and outlet end of service fittings; the term "service valves" refers to corporation stops, curb valves/stops and meter valves/stops.

A. The service connection requirements herein are for copper tubing and pipe in sizes 1 inch diameter Type L – Soft and 2 inch diameter Type L – Hard (rigid).

B. Service fittings and connections shall be manufactured in accordance with the latest revision of AWWA C-800.

C. Service valves shall be "Mueller 300"® ball valves rated for 300-psi maximum working pressure or an equal product that is identical to Mueller 110® in configuration, materials, performance and all other respects except for external markings and labels, and shall be manufactured and tested in accordance with ANSI/AWWA Standard C800, with heavy brass components constructed of ASTM B62 (85-5-5-5) brass, lock-wing accepting a bullet lock, double O-ring seals supported in precision machined grooves and providing secure, leak-tight sealing, with blow-out proof stem design, and with stainless steel reinforced seat O-ring, nitrile rubber seat, Fluorocarbon coated ball, valve nut composed of brass meeting applicable ASTM standards, with interior coated with Fluorocarbon to reduce torque resistance, and "Mueller 110®" end connections.

D. Service line connections shall be "Mueller 110®" Compression-type connection or an equal product that is identical to Mueller 110® in configuration, materials, performance and all other respects except for external markings and labels, and having the following characteristics. Compression fitting shall be designed and constructed to provide a positive metal to metal stop to prevent over tightening and provide a visual means to insure the connection is adequately tightened, with gasket that is a single piece assembly which includes stainless steel gripper band and the molded conductor spring. Gasket shall be composed of ASTM D2000 4AA815 molded synthetic rubber. The gripper band shall be identical to Mueller 110®, composed of hardened stainless steel, type 410. The entire width of the gripper band shall overlap after it is installed in the gasket to ensure maximum holding power. A stainless steel insert shall be provided for use with copper sized plastic tubing or iron pipe sized plastic pipe. The gaskets for copper tubing or copper tube sized pipe shall have a conductor spring composed of ASTM B134 alloy C26000 bronze wire.

E. Manufacturing tolerances and testing methods for ball valves/stops shall be equal to or better than Mueller 300® ball valves. Manufacturing tolerances and testing methods for connections shall be equal to or better than Mueller 110® compression connections.

3.4 Water Meters

Water meters shall be supplied by the City and purchased by owner as per approved City Fees and Charges schedule. Water meters shall be installed by City. Water meter boxes and covers shall be provided by owner as per Section 5. Water meters greater than 2-inch diameter shall required vault and lid provided by owner as per Section 12.4. Water meters ¾-inch to 2-inch diameter shall be Sensus® SRII Touch Read displacement style, water meters greater than 2-inch diameter shall be Sensus® SRH compound style. See Standard Detail Drawings #520, #521, and #523 for further details.

4. Approved Products and Acceptance of Warranties

Only approved service connections and service valves shall be provided and installed. All service connections and service valves shall be of approved material, properly installed and in good working order, safe for public use.

5. Water Meter Boxes

A. General: All water meter boxes and covers furnished under this specification for the City of Tigard shall be polymer concrete and shall comply with the provisions of this specification.

B. Water Meter Box and Cover Assemblies: Water meter box and cover assemblies shall be of polymer concrete material consisting of calcareous and siliceous stone, glass fibers and thermoset polyester resin and shall be manufactured by Armorcast® Products Company. Boxes shall be manufactured to the dimensions and configurations shown on Armorcast® drawings using male and female molds. Covers shall be manufactured to the dimensions and configurations shown on Armorcast® drawings using matched die molds. The model numbers for the parts of the Armorcast® meter boxes that the City requires for its three service connection sizes are listed in the table below.

C.

Service Connection Size	Part Description	Armorcast® Part No.
¾" & 1" water meters	12"x20"x12" Polymer Concrete Meter Box	P6000485
	12"X20"x1-3/4" Polymer Concrete Cover W/ touch read hole	A6000484-H1
¾ & 1" Services Required for sidewalk/concrete	Use 1 ½" & 2" Service box size	
1 ½" & 2" Services		
	17"x30"x12" Polymer Concrete Meter Box	A6001640PCX12
	17"X30"x2" Polymer Concrete Cover W/ touch read hole	A6001643-H1
1 ½" & 2" Services Required for sidewalk/concrete	24"x36"x12" Polymer Concrete Meter Box	A6001974PCX12
	24"x36"x2" Polymer Concrete Cover w/9"x14" drop in opening	A6001426-D
	9"x14"x2" Polymer Rectangle Drop in W/AMR slot	A6000482-H2

C. Color: Meter boxes and covers shall be "concrete gray" in color.

D. Vertical Load Test: Polymer Concrete box and cover assembly shall withstand a vertical test load of 20,800 pounds (16,000 lb. plus 30% impact factor) load over a 10"x20"x1" thick steel plate centered on the cover area and backed with a 10"x20"x1/2" rubber plate. The test loading shall not cause any failure to the box or cover.

E. Chemical Resistance: Polymer concrete material shall be resistant to chemicals commonly found in the soil or in the operating environment. Polymer concrete material shall be tested in accordance with ASTM D-543. The polymer concrete material shall be resistant to sunlight and any climatic condition and shall be tested in accordance with ASTM D-756, procedure "E".

F. Manufacturer: Meter boxes and covers shall be manufactured by Armorcast® Products Company ("Armorcast"). Substitutions will be considered only if they are equal and virtually identical in all respects to the Armorcast® models specified including they are dimensionally interchangeable with the Armorcast® models specified and that they meet or exceed the 20,800 pound load rating of the Armorcast® models specified.

G. Meter boxes shall not be installed in concrete sidewalks, curb or drive aprons. When meter box is set in concrete due to circumstances regarding space limitations within the right of way, as

approved by City Engineer, the next larger size box identified on the table, or as specified by the City Engineer shall be installed.

1. Pipeline Installation

6.1 Installation Requirements

A. The work necessary to excavate, bed, and backfill water pipelines shall conform to the requirements of Appendix G, Section 6.2 and AWWA C600, Section 4.

B. Distributing Pipe: Distribute material on the job from the cars, trucks, or storage yard no faster than can be used to good advantage. In general, distribute no more than one week's supply of material in advance of the laying.

C. Handling Material: Provide and use proper implements, tools, and facilities for the safe and proper prosecution of the work. Lower all pipe, fittings, and appurtenances into the trench, piece by piece, by means of a crane, slings, or other suitable tools or equipment, in such a manner as to prevent damage or contamination to the pipeline materials and protective coatings and linings. Do not drop or dump pipeline materials into the trench.

D. Cleaning Pipe and Fittings: Remove all lumps, blisters, and excess coal-tar coating from the bell and spigot ends of each pipe. Wire brush the outside of the spigot and the inside of the bell and wipe clean, dry, and free from oil and grease before the pipe is laid. Wipe the ends of mechanical joint pipe and fittings and of rubber gasket joint pipe and fittings clean of all dirt, grease, and foreign matter. Check interior of pipe for obstructions or debris and if found, remove from pipe.

E. Placing of the Pipe in the Trench: Do not allow foreign material to enter the pipe while it is being placed in the trench. If it is necessary to place pipe in such a manner that bedding material may enter pipe because of trench configuration or shoring detail, then tight woven canvas boots or other protective coverings shall be used and removed when placing pipe.

F. Push-on Joint Pipe: After the first length of push-on joint pipe is installed in the trench, secure pipe in place with approved backfill material tamped under and along sides to prevent movement.

G. Cutting Pipe: Cut pipe for inserting valves, fittings, or closure pieces in a neat and clean manner without damaging the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe. Cut pipe with milling type cutter or saw. Do not flame cut.

H. Dressing Cut Ends: Dress cut ends of push-on joint pipe by beveling, as recommended by the manufacturer.

I. Direction Of Laying: Unless otherwise directed, lay pipe with bell end facing in the direction of the laying. For lines on steep slopes, face bells upgrade only.

J. Installation of mechanical joint pipe shall be as specified in AWWA C111 Appendix A, including bolt torque ranges. Mechanical joint gaskets shall be vulcanized rubber and no more than three (3) years old.

K. All material shall be of new manufacture. No rebuilt or reconditioned material will be allowed.

L. Permissible Deflection of Joints: Wherever it is necessary to deflect pipe from a straight line either in a vertical or horizontal plane, or where long-radius curves are permitted, the amount of deflection allowed shall not exceed the values in the following table:

Maximum Deflection Permitted*
18-Foot Length Pipe

	Mechanical Joint** Maximum Deflection		Push on Joint Maximum Deflection	
Diameter Inches	Angle Degrees - Minutes	Deflection Inches	Angle Degrees	Deflection Inches
4	8-18	31	5	19
6	7-07	27	5	19
8	5-21	20	5	19
10	5-21	20	5	19
12	5-21	20	5	19

* The maximum deflection shall be whichever is less, the table or that recommended by the pipe manufacturer.

** Safe deflection for 150 pounds pressure. For higher pressure, reduce tabulated deflection proportionally ten (10) percent for each 150 pounds added pressure.

M. Alignment: Pipelines intended to be straight shall not deviate from the straight line at any joint in excess of one inch horizontally or vertically.

N. Unsuitable Conditions for Laying Pipe: Do not lay pipe in water or when determined by the City Inspector trench conditions are unsuitable.

O. Joining Push-On Joint Pipe and Mechanical Joint Fittings: Lay and join pipe with push-on type joints in strict accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for the installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes will be permitted under any circumstances.

Mechanical joint fittings vary slightly with different manufacturers. Install the particular fittings furnished in accordance with the manufacturer's recommendations. In general, the procedure shall be as hereinafter specified. Clean the ends of the fittings of all dirt, mud, and foreign matter by washing with water and scrubbing with a wire brush, after which, slip the gland and gasket on the plain end of the pipe. If necessary, lubricate the end of the pipe to facilitate sliding the gasket in place. Then guide the fitting onto the spigot of the pipe previously laid.

P. Mechanical Anchorage and Thrust Blocking: On all pipelines two (2) inches in diameter or larger, securely anchor all tees, plugs, caps, and bends 11 ¼ degrees and greater by an approved engineered system of suitable mechanical joint restraint devices, and at other locations where unbalanced forces exist, as determined by the design engineer and approved by the City Engineer. Restraint devices for mechanical joint pipe, fittings, and appurtenances shall conform to ANSI/AWWA C111/A21.11 or ANSI/AWWA C153/A21.53 as applicable and consistent with City requirements.

Q. Concrete Anchorage and Thrust blocking: Concrete thrust blocks shall only be substituted for engineered mechanical restraint as approved in writing by the City Engineer.

1. Installation of concrete thrust block shall provide reaction or thrust blocking as directed, if approved. All fittings shall be wrapped properly according to manufacturer's recommendations with approved plastic protectorate to prevent bonding of concrete to fittings being restrained.
2. The concrete mix shall have a compressive strength of not less than 3,000 pounds per square inch. Place blocking between the undisturbed ground and the fitting to be anchored. The bearing surface shall be as shown on Standard Detail Drawing #560 and #561 for thrust blocking.
3. Place the blocking so that all pipe and fitting joints (new and existing) will be accessible to repairs. Replace any existing thrust blocks that have been disturbed with new thrust blocks meeting all City requirements.
4. All concrete used for thrust blocking shall have a minimum of 72 hours set time before pressurization of piping and fittings can occur.
5. Tie rods as required shall be suitable diameter size and material as per manufacturer's recommendations.
6. City Engineer may require both mechanical restraint and concrete thrust blocking for additional restraint.

Q. Downtime Protection: When stopping work for extended periods of time or for the day, the contractor shall plug pipe ends to prevent rodents, other small animals, or debris from entering the pipe. Plugs used shall be watertight when submerged up to fifteen (15) feet.

R. All water system improvement construction inspection shall be performed as described in Section K.

6.2 Trench Excavation and Backfill

This subsection covers the work necessary for the proper trench excavation and backfill pipe base and pipe zone backfill. All work shall be in accordance to AWWA C600-05. Native or excavated material shall not be permitted as trench backfill unless approved in writing by the City Engineer.

A. Type of Backfill Material: Trench excavation and backfill shall be Class B, ¾-inch -0 aggregate rock gravel. Rock shall be crushed gravel or rock meeting the following quality standards:

Abrasion (AASHO T 96) Maximum Wear	35 Percent
Fractured Face Min. of Particles	75 Percent

The aggregate shall consist of uniform quality, clean, tough, durable fragments of rock or gravel, free from flat, elongated, soft or disintegrated pieces, and other objectionable matter occurring either free or as a coating on the stone.
The gradation of 3/4-minus aggregates to be furnished shall be as indicated below.

GRADATION PERCENT PASSING	TOP COURSE
1 inch square sieve	100
3/4 inch square sieve	90-100
1/2 inch square sieve	65-100
1/4 inch square sieve	40-60

U.S. No. 40 sieve	8-23
U.S. No. 200 sieve (Wet Sieving)	0-10
Sand Equivalent	40 min.
All percentages are by weight	

B. Foundation Stabilization: Material for foundation stabilization shall be at a minimum 2½-inch minus crushed rock, with reasonably even gradation from coarse to fine and free from excessive dirt or other foreign material, placement subject to approval by the City Engineer.

C. Water for Trench Backfill: It will be the Contractor's responsibility to make all arrangements for a source of water and bear all costs for delivery of the water to the trench site.

D. Trench Width: The width of trenches in which pipe is to be laid shall be 12 inches greater than the inside diameter of the pipe or 24 inches minimum, unless otherwise approved by the City Engineer.

G. Grade: Carry the bottom of the trench to the lines and grades shown or established with proper allowances for pipe thickness and for gravel base or special bedding when required. If the trench is excavated below the required grade, restore any part of the trench excavated below the grade with Class B backfill material.

H. Shoring, Sheeting and Bracing of Trenches: Erect, maintain, and remove shoring, sheeting and bracing as required by all federal, state and local laws, codes, and ordinances. The most stringent of the requirements shall apply.

Where sheeting and bracing are used, increase the trench widths accordingly by the thickness of the sheeting. Keep trench sheeting in place until the pipe has been placed and backfilled at the pipe zone. Shoring and sheeting shall be removed, as backfilling progresses, in a manner that will not damage the pipe or permit voids in the backfill.

I. Location of Excavated Materials: During trench excavation, locate the excavated material within the construction easement, right-of-way or specified working area so that the excavated material will not obstruct any private or public traveled roadways or streets. Pile and maintain material from trenches so that the toe of the slope of the material excavated is at least 36 inches from the edge of the trench. It shall be the Contractor's responsibility, however, to determine the safe loading of all trenches with excavated material.

J. Removal of Water: Provide and maintain ample means and devices with which to promptly remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe, and until the backfill at the pipe zone has been completed. These provisions shall apply during the noon hour as well as overnight.

Dispose of the water in an approved manner without damage to adjacent property. Drainage of trench water through the pipe under construction is prohibited. The pipe should be plugged so that no groundwater may enter at any time.

K. Definitions of Pipe Zone: The pipe zone shall be the full width of the trench from the bottom of the pipe to a point six inches above the top of the barrel.

M. Backfill at Pipe Zone: After the pipe is in place and ready for backfilling, place imported backfill material for pipe zone at approximately the same rate on each side of the pipe

such that the elevation of the backfill on each side of the pipe is approximately equal at all times. Compact the backfill by tamping in six-inch lifts to the horizontal centerline of the pipe. Each layer shall be compacted to at least 95 percent of its maximum density as determined by AASHO T-99. Particular attention shall be given to the backfilling and tamping procedures to assure that no unfilled or uncompacted areas occur beneath the pipe. The remainder of the backfill in the pipe zone shall be placed without compacting by layers. After backfilling to the top of the pipe zone, compact the remaining backfill material to at least 95 percent of its maximum density as determined by AASHO T-99 standards.

N. Trench Backfill Above Pipe Zone: When backfill is placed mechanically, push material used in backfilling first onto the slope of the backfill previously placed and allow to roll down into the trench in such a way as to permit free fall of the material into the open trench until at least two feet of cover is provided over the pipe. Under no circumstances allow sharp, heavy pieces of material to drop directly onto the pipe or the tamped material around the pipe.

O. Backfill Compaction: Compaction of materials shall be by mechanical means. If compaction results indicate that compaction or moisture content is inadequate, material placement shall be terminated and corrective action shall be taken prior to continued placement. Provide results of compaction testing performed by certified testing agency.

P. Repair of Trench Settlement: Any settlement of the finished surfacing during the warranty period shall be promptly repaired by the Contractor.

Q. Settlement: Any settlement noted in backfill, fill, or in structures built over the backfill or fill within the one-year warranty period will be considered to be caused by improper compaction methods and shall be corrected at no additional cost to the City. The Contractor shall restore any structures damaged by excessive settlement to their original condition.

S. Testing: Testing of backfill compaction shall include a test at the surface and at 2-foot increments below the surface. The compaction testing shall utilize a Proctor prepared using a sample of rock selected from material being used for trench backfill. Compaction testing shall be conducted every 25-feet or as directed by the City Engineer. Any trench backfill showing visible failure shall be rejected.

T. Controlled Density Fill (CDF) shall be used as surface backfill material in place of crushed rock in open trenches that impact the travel portions of the highway as required within Oregon Department Of Transportation (ODOT) right of way, subject to approval by City Engineer.

2. Hydrostatic Test of Newly Installed Water Pipeline

The contractor shall make pressure and leakage tests on all newly laid pipe, including main line pipe, valves, blow-offs, fire hydrant and other appurtenances. Furnish all necessary equipment and material, make all taps in the pipe as required, and conduct the tests. The owner's construction engineer will monitor the tests. The construction engineer shall also indicate that any concrete thrusting blocks have obtained the needed strength to resist the pressures obtained during the hydrostatic test. The contractor shall furnish the following equipment and materials of the tests:

Amount	Description
2	Approved graduated containers.
2	Pressure gauges (maximum 2 psi increments) with annual certified calibration.

1 Hydraulic force pump approved by the City Inspector.
Suitable hose and additional equipment as required.

Conduct the tests after the trench has been backfilled. Where any section of pipe is provided with concrete reaction blocking, do not make the pressure tests until at least five days have elapsed after the concrete thrust blocking is installed.

Conduct pressure tests in the following manner, unless otherwise approved by the City Engineer. After the trench has been backfilled or partially backfilled as specified herein, fill the pipe with water, expelling all air during the filling. The minimum test pressure shall be 150 pounds per square inch (psi). For lines working with operating pressures in excess of 100 psi, the minimum test pressure shall be one and one-half times the operating pressure, with the same loss allowances.

A. Duration: The duration of each pressure test shall be 60 minutes, unless otherwise directed by the City Engineer.

B. Fill the pipe with water and apply the specified test pressure by pumping, if necessary. Then valve off the pump and hold the pressure in the line for the test period. At the end of the test period, operate the pump until the test pressure is again attained. If the line pressure drops more than five (5) psi during the test, repeat the test (again for 60 minutes each time) until the drop in line pressure is five (5) psi or less, and then measure the leakage amount. The pump suction shall be in a clean barrel or similar device approved prior to filling with clean water, or metered so that the amount of water required to restore the test pressure may be measured accurately.

C. Leakage: Leakage shall be defined as the quantity of water necessary to restore the specified test pressure at the end of the test period. No pipe installation will be accepted if the leakage corresponding to a pressure drop of 5 psi or less is greater than one-half (1/2) the number of gallons per hour calculated by the following formula:

$$L = \frac{SD\ (\sqrt{P})}{148000}$$

In the above formula: L = Allowable leakage, in gallons per hour for a 2-hour test.
S = Length of pipe to be tested.
D = Nominal diameter of pipe, in inches.
P = Average test pressure during the leakage test, in pounds per square inch.

The design engineer shall provide a table on submitted construction drawings indicating the allowable leakage based on the above formula criteria.

D. Correction of Excessive Leakage: Should any test of pipe laid exhibit leakage greater than that allowed or a loss in pressure greater that five (5) psi during the pressure test, locate and repair the defective joints, pipe or other leaking water system component(s) until the leakage and pressure loss of a subsequent test are within the specified allowance.

E. Isolation of existing systems prior to testing: Existing water pipelines shall be protected from contamination during the testing process for new construction. Use of special "blind flanges" will be necessary if the line being tested cannot be adequately separated from existing systems. The design engineer shall submit shop drawings and proposed procedures to the City prior to installing any special testing device.

3. Disinfection of Newly Installed Water Pipeline

Pipeline intended to carry potable water shall be disinfected before placing in service. Disinfection procedures shall conform to AWWA C-651 as hereinafter modified or expanded.

A. Flushing: Before disinfection, flush all foreign matter from the pipeline. Provide hoses, temporary pipes, ditches, etc. as required to dispose of flushing water without damage to adjacent properties. Disposal site and method shall be approved by the City Engineer prior to use. Flushing velocities shall be at least 2.5 feet per second (fps). For large diameter pipe where it is impractical or impossible to flush the pipe at 2.5 fps, clean the pipeline in place from the inside by brushing and sweeping, then flush the line at a lower velocity. See table below:

Flushing Volume Table – Velocity 2.5 feet per second

Pipe Diameter (inches)	Cubic Feet per Second (CFS)	Gallons per Minute (GPM)
4	.22	97
6	.5	220
8	.87	392
12	1.96	881
16	3.48	1,175

B. Disinfection Mixture: All chemical additives used for disinfection mixtures in contact with public water shall be UL/NSF 60 approved. Disinfection mixture shall be chlorine-water solution having a free chlorine residual of 40-50 ppm. The disinfection mixture shall be prepared by injecting a calcium hypochlorite or sodium hypochlorite and water mixture into the pipeline at a measured rate while fresh water is allowed to flow through the pipeline at a measured rate so that the chlorine-water solution is of the specified strength.

Dry chlorine gas shall not be permitted to be used for any field disinfection.

If the calcium hypochlorite procedure is used, first mix the dry powder with water to make a thick paste, thin to approximately a one percent solution (10,000 ppm chlorine). If the sodium hypo chlorite procedure is used, dilute the liquid with water to obtain a one percent solution. The following proportions of hypo chlorite added to water will be required.

Product	Quantity	Water
Calcium Hypo chlorite (1) (65-70 percent Cl)	1 lb.	7.5 gal.
Sodium Hypo chlorite (2) (5.25 percent Cl)	1 gal.	4.25 gal.

C. Point of Application: Inject the chlorine mixture into the pipeline to be treated at the beginning of the line through a corporation stop or suitable tap in the top of the pipeline within three (3) feet of the water source filling the line. Water from the existing system or other approved source shall be controlled so as to flow slowly into the newly laid pipeline during the application of chlorine. The rate of chlorine mixture flow shall be in such proportion to the rate of water entering the pipe that the combined mixture shall contain 40-50 ppm of free available chlorine. Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Use check valves if necessary.

D. Retention Period: Treated water shall be retained in the pipeline long enough to destroy all pathogenic bacteria. With proper flushing and the specified solution strength, 24 hours is adequate. At the end of the 24-hour period, the disinfection mixture shall have a solute strength of at least ten (10) ppm of chlorine.

Operate all valves, hydrants, and other appurtenances during disinfection to assure that the chlorine mixture is dispersed into all parts of the line, including dead ends, new services, and similar areas that otherwise may not receive the treated water.

Do not place the concentrated quantities of commercial disinfection mixture in the line before it is filled with water.

After chlorination, flush the water from the line until the water through the line is exchanged at least twice the entire pipe volume with public water supply, and is free of turbidity and excess chlorine. Under no circumstance shall pressure testing occur while chlorine solution is in the line.

E. Disposal of Disinfection Water: Dispose of chlorinated water in an approved manner as provided in Section 2.4(A). Do not allow chlorinated water to flow into a waterway without adequate dilution or other satisfactory method of reducing chlorine to a safe level. De-chlorination procedures are to be submitted in writing and approved by the City Engineer prior to flushing system.

F. Sampling and testing of new water mains shall be performed by City personnel utilizing City equipment and facilities. The cost of the initial sampling event, consisting of one (1) sample at each determined sample point shall be paid by the City. Should the initial sampling event reveal the presence of bacteria, the water main shall be flushed and refilled in accordance with Sections 7(A) and 7(B), and sampling and testing of the line will continue until a negative sample is obtained for each sample point. A bacteriological sampling service charge, as per City Charges and Fees Schedule, shall be paid to the City by the responsible party for each sample tested beyond the initial sampling event. No water meter(s) shall be installed until all service charges for sampling and testing due and owed to the City has been paid.

4. Tapping

A. All tapping of four (4) inch and larger public water pipe shall be performed using a all stainless steel tapping sleeve - JCM® 432 or equal by written approval of City Engineer.

B. If a live tap is required in order to extend a line over twelve (12) inches in diameter, and the maximum design static pressure is less than 75 psi, a gate valve will be allowed. If the maximum design static pressure is over 75 psi, a butterfly valve will be required. All valves shall be installed with valve boxes and lids per City standards.

C. Prior to tapping, all items that may come in contact with the public water shall be swabbed with a 300 mg/L chlorine solution. The following items shall be the minimum items swabbed: tapping machine bit and cutter, tapping valve, tapping sleeve, and the exterior section of pipe to be tapped after the pipe has been cleaned with a wire brush (to be extended a minimum of six (6) inches outside the tapping area).

D. Hot tapping and line stopping equipment must be used in accordance with the manufacturer's guidelines and instruction booklets. Tapping and line stopping shall only be performed by qualified personnel using the proper equipment and procedures. The City Inspector must be present during the time of the hot tap procedure.

5. Sampling Stations

All sampling stations shall be Eclipse® Number 88. The sampling station shall have a ¾- inch FIP inlet, and a ¾-inch hose nozzle. All stations shall be enclosed in a lockable, non-removable, aluminum-cast housing. When opened, the station shall require no key for operation, and the water will flow in an all-brass waterway. All working parts will also be of brass and be removable from above ground with no digging. A copper vent tube (standard) will enable the station to be pumped free of standing water to prevent freezing and to minimize bacteria growth. The exterior piping will be brass, and a ¼-inch ball valve shall be provided in place of the ¼-inch pet cock on the vent pipe. See Standard Detail Drawing #572 for further details.

6. Cross Connection Control and Backflow Prevention Assemblies

11.1 General

A. Cross connection control and backflow prevention assemblies shall conform to the requirements of this section and the Standard Drawings. An approved backflow prevention assembly is required on all fire line systems, domestic water service larger than two (2) inches, and/or a structure having water supply fixtures that could result in a standing water in excess of 30 feet above the water main, in accordance with Tigard Municipal Code section 12.10.110, this manual, and all backflow prevention requirements of the City Engineer or the applicable water provider. It is the design engineer's responsibility to select the proper backflow prevention assembly and vault and to include the proper City Standard Drawings for them in the detail sheets provided with both site development permit and site plumbing permit application plan sets as applicable for the particular circumstances. The design engineer is also responsible for coordinating selection of the proper backflow prevention assembly and vault design with the owner, architect, contractor and City Plumbing Inspector.

B. If, after the City's initial approval, there is a change in the building's intended use or other factors that requires an alternative backflow prevention design, it is the design engineer's responsibility to select an alternative backflow prevention assembly and vault as required to reflect the change, and to submit new detail drawings for review and approval by the City Engineer prior to submittal to the City Building Division for plumbing permit issuance and, as applicable, reflect any such changes to the private plumbing system in the "as-builts" of a site development permit. City approval of plans and detail drawings within a site development permit plan set is not formal approval of the private backflow prevention assemblies and vaults in said plan set, which are governed by the Oregon Administrative Rules Chapter 333, the Oregon Plumbing Specialty Code (OPSC), Uniformed Plumbing Code (UPC) and the National Fire Prevention Association (NFPA) rules governing backflow prevention. Rather, the formal plan approval for backflow prevention assemblies and vaults occurs only with the issuance of a Plan Review Letter by the Building Division, which can only be issued upon the Building Division's receipt of written approval of the backflow assemblies and vaults from the City Engineer or the applicable water provider through the City Engineer. Further, City approval of plans and detail drawings within a site development permit plan set does not relieve the design engineer of any of the aforementioned responsibilities.

C. The assembly shall be installed at the location normally established for water meters, usually at the property line. A water service shall not be turned on until all required backflow prevention assemblies are installed, inspected, tested, approved, and registered with the City of Tigard. Costs of all installations, including all costs of inspection and testing fees, shall be the responsibility of the customer. The backflow prevention assembly will remain the property of the customer. The customer will be responsible for all maintenance and testing of the assembly and vault.

D. When required, backflow prevention assemblies for protection of the public water system shall meet the requirements set forth in the current OAR Chapter 333-61-0070, OPSC 603.0, UPC, and Tigard Municipal Code section 12.10.110.

11.2 Types of Backflow Prevention Assemblies

There are four types of backflow prevention assemblies that the City will allow as protection of the public water system. The Oregon Department of Human Services, Drinking Water Program, Cross Connection/Backflow Prevention Program, provides a list of approved assemblies.

The type of backflow prevention assembly that is required is determined by the aforementioned rules and codes, based on the type of premises to which water service is being provided. The approved types of assemblies are listed below with some of the types of premises that must be protected by each type of assembly. However, these lists are not complete and are only intended as basic guidelines.

A. Reduced Pressure Principle Backflow Prevention Assembly (RP): An approved Reduced Pressure Principle Backflow Prevention Assembly shall be installed above ground on the service connection to the following premises:

1. Any tax lot that has an auxiliary water supply on or available to it. This will include any above or below ground water source. (The most commonly encountered type of auxiliary water supply is a private well.)
2. Commercial buildings located within an industrial zone.
3. Hospitals, medical centers, and clinics.
4. Mortuaries and nursing homes.
5. Gas stations.
6. Sewage pump and lift stations.
7. Dry cleaners and commercial laundries.
8. Any water system that has a pump to supplement pressure.
9. Irrigation systems that are designed to use chemical injection.
10. Any fire system that is designed or required to use a chemical solution within the piping (such as an antifreeze loop fire sprinkler system).

The above list may change from time to time and it is the engineer of record's responsibility to ensure that the latest version of the list is consulted.

B. Double Check Valve Backflow Prevention Assembly (DC) or Double Check Detector Backflow Prevention Assembly (DCDA): An approved double check valve backflow prevention assembly or an approved double check detector backflow prevention assembly shall be required (provided that all internal plumbing is installed and maintained in accordance with the OPSC), on the service connection to premises where there is:

1. Any fire system or water line to a private fire hydrant.

2. Multi-story buildings which are in excess of 30 feet above the water main at the service connection.

3. Shopping centers or large retail stores.

4. Restaurants or fast food establishments.

5. Any tax lot that is served by two water services supplied by the City.

6. Any water service that is larger than two (2) inches in diameter.

The above list may change from time to time and it is the engineer of record's responsibility to ensure that the latest version of the list is consulted.

After installation, all backflow prevention assemblies that are installed must be tested upon installation by a State of Oregon certified tester in accordance with Tigard Municipal Code section 12.10.110. The results of the testing shall be received by the City prior to issuance of "final occupancy."

11.3 Location of Backflow Prevention Assemblies and Vaults/Boxes

Backflow prevention assemblies shall be installed in vaults or boxes, as applicable, in accordance with this subsection and the Standard Drawings.

Backflow prevention assemblies two (2) inches and smaller and their boxes shall be installed:

A. At the water meter, which is usually at the property line, unless an alternative location for the assembly away from but near the meter, is approved by the City Engineer or applicable water provider

B. On the customer side of the meter.

Backflow prevention assemblies larger than two (2) inches shall be installed entirely on private property, in a vault or in the building to be served if the main water line is within 20 feet of said building, and at a location approved by the City Engineer or applicable water provider, as appropriate to the design of the premises to be served.

11.4 Installation and Testing of Backflow Prevention Assemblies

Backflow prevention assemblies shall be tested promptly:

A. Upon installation, all backflow prevention assemblies must be tested by a State of Oregon Certified Backflow Assembly Tester in accordance with Tigard Municipal Code Section 12.10.110. A "final certificate of occupancy" shall not be issued for the premises served until the results of the testing have been received and approved by the City Engineer.

B. Conduct testing one (1) year after installation and annually thereafter, as required by state law.

C. After any repair of the assembly.

D. Any time the assembly has been moved.

12. Requirements for Water System Vault Installations

12.1 General

Vaults for water meters, PRVs, backflow prevention devices and assemblies, fire services, and combination air and vacuum release valves, and vaults' appurtenances including but not limited to ladders, access doors, sump pumps, and drains, shall conform to the requirements of Subsection 11, and the Standard Drawings for water vaults.

Vault penetrations shall be sealed with non-shrink grout from the outside. Backfill around vault per the manufacturer's specifications.

Access into the vault shall be through a standard Bilco® door or approved equal per the Standard Drawings. All Bilco® doors or approved equal on any public vault in the public right-of-way shall be structurally adequate for an H-20 loading. If any public or private vault is within a parking or maneuvering area (including the travel lane of any public or private street), the engineer of record shall evaluate the specific loading conditions and specify the proper door for those loading conditions. The design engineer evaluation and recommended lid design shall be submitted to the City Engineer for review and approval prior to submittal to the City Building Division for plumbing permit issuance.

Provide approved ladder if the vault or chamber depth is five (5)-foot - 0-inches or greater and entry is through the vault or chamber roof. Provide approved ladder extension meeting Occupational Safety and Health Administration (OSHA) requirements as required by City, state, and federal standards.

Adequate drainage that prevents water from accumulating on the vault or chamber floor shall be provided for the vault or chamber. Trapped water in the vault shall be drained to daylight by gravity or pump, in conformance with the Oregon Plumbing Specialty Code. In no case shall the drainage be connected to a piped sanitary or storm water system. If a sump pump is used, the pump shall be capable of removing accumulated water at a minimum rate of five (5) gallons per minute (GPM) from the vault. The pump shall be equipped with an automatic flow switch; the pump and all wiring shall conform to the National Electrical Code. All drain piping shall have proper metal screening to prevent small animals from entering vault.

Vault must be equipped with a moisture proof light fixture if adequate lighting is not available.

Vault is to have no other use, except for use described by these standards.

Vault shall be installed on undisturbed base or compacted ¾ - 0 inch gravel base.

No piping shall be installed in excess of three (3) feet above the vault floor.

Assembly is to be adequately supported from the floor, and suitably restrained from movement. Supports shall consist of steel supports; no wood supports shall be used.

All electrical wiring shall be inspected by the City Electrical Inspector (permit is required). A copy of the final electrical inspection shall be provided to the City Inspector by the contractor.

The assembly shall be readily accessible with adequate room for maintenance.

All new fittings and appurtenances are to be pressure tested and disinfected by the contractor and proven to be free of pathogenic bacteria, safe from the existing main to the vault.

12.2 Backflow Prevention Device Assembly Vaults

Backflow prevention device assembly vaults shall be constructed in accordance with subsection 11.1 and 11.3, and the Standard Drawings.

12.3 Fire Services and Domestic Service Vaults

No part of the backflow prevention assembly shall be submerged in water or installed in a location subject to flooding. In a vault or chamber, adequate drainage shall be provided and test cocks shall be plugged. The plugs shall not be of dissimilar metals.

The backflow prevention assembly shall be protected from freezing and other severe weather conditions.

All backflow prevention assemblies shall have a minimum 12-inch clearance on the inlet side, 24-inch clearance on the test-cock side, and 12 inches below the assembly. Adequate clearance (three (3) inches minimum) must be maintained above gate-valve stem at full extension. Headroom of six (6) feet, 0 inches is required in vaults without a full opening top. Access to the device and to any vault or chamber shall remain clear at all times.

12.4 Large Water Meter Vaults

The vault is to be provided and installed by the contractor per City Standard Drawing #523 and #525.

The contractor shall install pipe through the vault in a manner that allows proper sealing from water infiltration. The water main pipeline shall enter and exit the vault as one solid section without fittings. The design engineer shall provide adequate thrust restraint based on calculated dynamic forces to ensure proper protection from pipe movement within the vault structure. Any restraint utilizing the vault structure to prevent thrust is prohibited. At a minimum there shall be at least two (2) pipe lengths on each side of vault restrained to prevent pipe joint separation. Vault penetrations shall be sealed with non-shrink grout from the outside. The backfill around the vault shall be as per the manufacturer's specifications.

City personnel shall install the large meter and appurtenances by cutting and removing a section of pipe. The City shall install the meter, fittings, flanges, bypass piping, valves, and tees as needed.

12.5 Pressure Reducing Valve Vaults

The City Public Works Department shall provide consultation for the design of each proposed pressure reducing valve vault installation. Contact the City Public Works Department for assistance. All pressure reducing valve vaults shall be constructed per the Standard Drawings unless otherwise approved by the City Engineer.

13. Inspection of Water Lines and Appurtenances

The City Engineer may require inspections of water main pipes, water services, water fittings (e.g., a bend or tee) and appurtenances (e.g., a fire hydrant or valve) on a random basis, in addition to the inspections required by Section K. Inspections may require the contractor to uncover water system components previously backfilled by the Contractor prior to such

inspections. Such additional inspections shall continue until the City Engineer has evidence to reasonably conclude that the components are of approved material, properly installed and in good working order, safe for public use.

14. Easements

A. When it is not possible or practical to install the water main pipeline within a dedicated public street, an easement shall be provided. In general, a 15-foot wide easement will be adequate where vehicular access is not necessary and 20-foot wide easement will be required if vehicular access is necessary.

B. All water pipe lines not within a dedicated public street will meet all requirements as described in subsection 2.3 - Additional Requirements for Public Water Improvements in Private Street Developments.

15. Repair of Any Damage to City Facilities

Repair of any damage to the City's facilities (including buried water lines, valve boxes, meter boxes, combination air and vacuum release valves, etc.) during construction activities shall be made at the contractor's expense. The City shall have the option to make any repairs deemed necessary to continue providing water service. In this instance, the contractor will be billed for repairs based on time and materials.

17. Relocation Design Work

Any relocation work within existing right-of-way that is a requirement of land development shall be performed by the developer/contractor at the developer/contractor's expense.

APPENDIX E - Water Construction Notes

1. An estimated 12 percent of the water system cost must be on deposit prior to beginning construction on water lines, and to receive a TPW (City of Tigard Public Works, Water Division) stamped approval on construction plans.

2. The contractor shall maintain one set of TPW stamped approved plans on the construction site at all times.

3. Curbs must be in place prior to installation of water mains within new subdivisions.

4. Notify TPW, Water Division, 48 hours prior to commencing construction to schedule a pre-construction meeting. Telephone 639-4171.

5. All work shall be in accordance with AWWA (American Water Works Association) standards.

6. All work will be inspected and approved by TPW, Water Division.

7. All pipe and fittings shall be ductile iron, cement-lined, of new manufacture and made in the USA. Pipe shall be "Tyton" Joint Ductile Iron, Class 52. All fittings shall be MJ (mechanical joint) unless otherwise specified.

8. Cover for all water mains in street and rights-of-way shall be 36". Backfill shall be ¾"-0" gravel.

9. All valve-operating nuts shall be within 36" of finished grade, otherwise valve operating nut extensions will be required.

10. Poured concrete thrust blocks of at least eight square feet of bearing surface are required at each tee, cross, and bend locations (see details for minimum bearing areas).

11. A 4" x 4" x 8'-0", painted blue, shall be installed in front of every 2-inch water service location, and remain there until the water meter is installed. All 2-inch water services shall consist of a MJ x 2" IPT tee and 2" IPT x 110 compression fitting as manufactured by Mueller Company.

12. Fir hydrant assembly consists of a MJ x 6" Flg. (Flange) tee, 6" Flg. x MJ gate valve, 6" MJ x MJ holding spool, and a Modern Mueller Centurion fire hydrant, A-442, 6" MJ, 5-1/4" MVO, 3-port (2-2½" NST hose connection, 1-4½" NST pumper), 1½" pentagon operating nut, opening left, color: yellow; Approved Equal: Mueller Centurion A-423, Waterious Pacer 6790, Clow Medallion

13. Each fire hydrant shall be installed upon a pre-formed concrete block with 1½ cubic yards of crushed 2" – ¾" drain rock. Tarpaper will be laid on top of the drain rock to separate the rock from earth cover.

14. All sanitary sewer lines within 10 feet laterally or 3 feet vertically of a water main shall be encased in a reinforced concrete jacket 6" thick for a distance of 10 feet on both side of the crossing. Where crossings are necessary, they must be made at approximately 90 degrees with at least 18" of separation below the water line.

15. All mains with a static pressure up to 100 psi (pounds per square inch) shall be tested at 150 psi for 1 hour with a maximum loss of 5 psi. Water mains with a static pressure greater than 100 psi shall be pressure tested at 1.5 times the static pressure for 1 hour with a maximum loss of 5 psi.

16. Upon satisfactory completion of testing, the new mains and connections to existing mains shall be cleaned and flushed with potable water prior to disinfection. Flushing velocities shall be at least 2.5 feet per second. Disinfection shall be in accordance with AWWA Standard C651-92, the State Health Division and City requirements. The continuous feed method of disinfection shall be used. Disinfecting mixture shall be a chlorine-water solution having a free chlorine residual of 40-50 mg/l (milligrams per liter). The disinfection mixture will be prepared by injecting a calcium/sodium hypochlorite and water solution into the pipeline at a measured rate while fresh (potable) water is allowed to flow through the pipeline so that the chlorine-water solution is of the specified strength. Treated (chlorinated) water shall be retained in the pipeline long enough to destroy all nonspore-forming bacteria. Typical retention period is 24 hours. At the end of the 24-hour period, the pipeline is to have a free chlorine residual of a least 10 mg/l. After satisfactory chlorination, flush the water from the line until the water throughout the pipeline is equal chemically and bacteriologically to the permanent source of supply.

    Dispose of the disinfection water in an approved manner. Do not allow disinfection water to flow into a waterway without adequate dilution or other satisfactory methods of reducing chlorine residuals to a safe level as mandated by DEQ. After disposal and flushing of the disinfection solution, there will be another 24-hour retention period prior to bacteriological testing. Bacteriological tests will be taken by TPW.

17. Provide an Eclipse No. 88 Sampling Station manufactured by Kupferte Foundry, St. Louis, MO 63102. The sampling station shall be 2'-0" bury, with a ¾" FIPT(Female Iron Pipe Thread) inlet, and a ¾" unthreaded hose nozzle. All sampling stations shall be enclosed in a lockable, non-removable, aluminum-cast housing. When opened, the sampling station shall require no key for operation, and the water will flow in an all-brass waterway. All working parts will be of brass and be removable from above ground with no digging. A copper vent tube (standard) will enable the sampling station to be pumped free of standing water to prevent freezing, and to minimize bacteria growth. The exterior piping will be brass, and a ¼" ball valve shall be provided in place of the ¼" pet cock on the vent pipe.

18. TPW will install all copper services and sampling stations prior to surfacing of streets. Water meters will be installed by TPW upon individual request and payment by others (owners). All water meters connected to an irrigation system must have the proper Oregon State approved backflow prevention

device , minimum of a DCVA (Double Check Valve Assembly) installed on the property side of the water meter. In addition, every meter for commercial, multi-family, industrial, and institutional service, regardless of size, shall have the proper Oregon State approved backflow prevention device minimum of a DCVA installed on the property side of the meter. The backflow prevention device shall be installed and tested by the owner, with the results forwarded to TPW Water Division, before water services can begin.

19. Upon completion of installation of the water system, the contractor or owner shall advise TPW of the total construction costs to which will be added 10% for TPW inspections, water loss, overhead, administration, sampling, etc. and 2% for engineering review, including "as-builts" drawings, updating master map, intersection maps, etc.

OPERATION OF VALVES IN THE TIGARD WATER SERVICE AREA IS PROHIBITED

Water (revised August 2009)

- ☐ 503 Typical Gate Valve
- ☐ 504 Typical Butterfly Valve
- ☐ 505 Operating Nut Extension
- ☐ 520 3/4"-1" Water Service
- ☐ 521 2" & 1 1/2" Water Service
- ☐ 523 3" & 4" Meter
- ☐ 525 Large Meter w/Fire Bypass
- ☐ 530 Double Check Assembly
- ☐ 531 Irrigation Double Check Assembly
- ☐ 532 Double Check Valve Assembly
- ☐ 533 Double Check Detector Valve Assembly
- ☐ 542 Fire Hydrant Assembly
- ☐ 550 Reduced Pressure Detector Backflow Assembly 2 1/2" - 10" (Below Ground)
- ☐ 553 RP Backflow Assembly 2 1/2"+ (Above Ground)
- ☐ 554 Reduced Pressure Detector Backflow (Above Ground)
- ☐ 555 Reduced Pressure Backflow Assembly
- ☐ 557 Reduced Pressure Backflow Assembly Discharge Rates
- ☐ 558 Pressure Reducing Station
- ☐ 560 Standard Thrust Block
- ☐ 561 Straddle Block
- ☐ 563 Vertical Bend Restraint
- ☐ 570 2" Standard Blowoff
- ☐ 571 6" Blowoff
- ☐ 572 Sampling station
- ☐ 573 Minimum Protection For Filling Tanker Trucks
- ☐ 575 Typical Valve And Hydrant Location
- ☐ 590 1" Combination Air & Vacuum Valve
- ☐ 591 2" Combination Air & Vacuum Valve