# City of Amity

## Yamhill County, Oregon

## DIVISION 1:
## WATER SYSTEM DESIGN STANDARDS MANUAL
### Guidelines for Development

**Effective: June 1, 2004**

## Section 1 – General Design Requirements

1.1 The purpose of this manual is to set standards for the design and construction of water system improvements to serve new and future development. This manual may be updated periodically and the design engineer shall ensure that they have the latest version.

1.2 Persons planning to construct development must obtain a Development Permit from the City of Amity and pay the necessary engineering review fees in accordance with the "Engineering Policy – Guidelines for Development". Other permits required may include a Public Works Construction Permit issued by Yamhill County, a 1200-C Erosion Control Permit from the Oregon Department of Environmental Quality (DEQ), ODOT permits, Corps of Engineers/Division of State Lands, and/or other as required by Federal, State, and County laws and regulations.

1.3 All surveys for development of public works facilities shall be performed under the direction of a Professional Engineer (PE) or Professional Land Surveyor (PLS) licensed in the State of Oregon. At least one Benchmark shall be established or located within the project limits. Elevations shall be referenced to the NGVD 29 datum. Survey shall be sufficient to accurately show existing facilities and topography.

1.4 Design drawings, specifications, and calculations shall be conducted by an Oregon licensed Professional Engineer.

1.5 The engineer preparing the plans shall make necessary arrangements for locates on all underground utilities in the vicinity for use in preparing the plans. Such utilities shall be shown in the plans.

1.6 Materials and details shall conform to the requirements of this manual.

1.7 All applicable laws, codes, regulations, and permit requirements shall be complied with.

## Section 2 – Design Plan Format

2.1 Engineering plans and specifications shall be prepared for all public works improvements. Plans shall be clear and legible and show all improvements in sufficient detail to allow for determination of compliance with City standards, and proper field construction. City engineer may require additional detail if deemed necessary.

2.2 Plans shall be computer generated in an AutoCAD compatible format.

2.3 The plans shall be submitted on 22 x 34-inch sheets unless otherwise pre-approved. Plans shall be blackline prints. Blueline copies are not acceptable. Letter height may not be less than 0.08-inches for capital letters, 0.10 for regular text.

2.4 Plans shall be drawn to scale. The scale shall be 1-inch = 2, 3, 4, or 5-feet vertically and 1-inch = 10, 20, 30, 40 or 50-feet horizontally. Details may be drawn at larger scales for clarity. Plan scale shall be called out for each drawing. A graphical scale bar shall be included on each sheet.

2.5 A north arrow shall be shown on each plan view sheet and other plan detail oriented differently than the main drawing on the sheet.

2.6 A title block shall appear on each sheet of the plan set placed in the lower right-hand corner, across the bottom edge of the sheet, or across the right-hand edge of the sheet. Title block shall include the name of the project, the engineering firm, the owner, the sheet title, and the sheet number.

2.7 The seal of the registered Oregon Professional Engineer responsible for the preparation of the plans shall appear on each sheet. Final Plans must be stamped and signed by a Professional Engineer licensed in the State of Oregon. Plan approval will not be granted until final signed sets are received. Approval by the City does not relieve the Applicant's Engineer from the responsibility of the design.

2.8 Plans shall begin with a title sheet identifying the project and including a vicinity map showing the location of the project within the City. General notes and a sheet index should also be included. A legend and standard abbreviations detail should be included within the general sheet(s).

2.9 Plan views must show existing and proposed improvements and features within or adjacent to the project including survey monuments, edge of pavement, road centerline, buildings, curbs, gutters, sidewalks, culverts, ditches, streams, utility poles, and other surface improvements and features. The location of underground utilities including power, gas, water and sewer shall be shown as accurately as possible. Right-of-way, property lines, easements, street names, lot numbers, and other labels shall also be shown. Existing and finish grade contours (2 foot maximum) should be shown where possible.

2.10 Plan shall show the location, stationing, and size of all water mains and services including appurtenances such as water meters, blow-offs, hydrants, combination air valve assemblies and fittings. Stationing shall be called out for specific items to be installed. Matchlines shall be used when continuing to other sheets.

2.11 At least one composite utility plan shall be included which shows all proposed improvements (water, sewer, streets, sidewalk, curb, culverts, storm drainage, etc.) in one plan view to help avoid conflicts and designate horizontal separations and locations.

2.12 Profile view with stationing and elevation shall be provided for water mains. Any required vertical fittings shall be shown (horizontal fittings should be shown in plan view and not repeated in profile view). Profile shall show existing ground, finish grade, depth of cover, backfill class materials, and all existing and proposed utilities crossing the profile. Profile alignment shall be generated at the centerline of the water piping. Vertical separation shall be shown for crossing utilities. Locations of any required air valves or blow-off valves shall be shown.

2.13 Detail drawings shall be provided for typical trench sections, specific complex valve and fitting clusters, fire hydrant assemblies, combination air valve assemblies, water service laterals and meter installations, valve-setting details, and others as required.

2.14 Project specifications shall be provided covering materials and workmanship in accordance with this document and standard engineering practice. Specifications not detailed herein shall generally conform to 2002 Oregon Standard Specifications. All specifications shall be subject to City approval.

2.15 Refer to the City's "Engineering Policy – Guidelines for Development" document for additional requirements and submittal procedures.

**Section 3 – Water System Design Requirements**

3.1 Minimum size for new water mains is 8-inches unless otherwise approved. Hydraulic calculations shall be performed to ensure that pipe size is adequate for conveying fire flows during peak demand periods.

3.2 Peak domestic water demand used in calculations shall be at least 10 gpm per single family dwelling or EDU for developments with 1-10 lots, 5 gpm for 10-25 lots, and 3 gpm for larger developments.

3.3 Minimum depth of cover is 36-inches over top of pipe barrel.

3.4 Water piping shall be located 10 feet horizontally away from any parallel sanitary sewer mains or laterals when possible. Vertical separations less than 18-inches shall not be designed into new improvements unless conditions prevent such separation. All water line and sewer line shall be separated in accordance with OAR 333-061-0050 provisions.

3.5 Permanent utility easements shall be provided granting the City access to the public water system improvements for future maintenance and repair. Minimum easement width is 15 feet for a single pipeline. Waterlines shall be located within and no closer than 6 feet from the edge of the easement except where the public portion of an individual service terminates at the edge of the easement.

3.6 Creation of dead-end water mains shall be avoided by looping new piping to connect to existing system piping in at least two locations. If a dead-end is allowed by the City for unusual cases, a fire hydrant or adequately sized blowoff shall be provided at the end of the line.

3.7 Fire Flow and Hydrant Requirements:

3.7.1 A minimum flow of 1,000 gpm is required at hydrants for one- and two-family dwellings not exceeding 3,600 square feet and located greater than 10 feet apart. Dwellings 10 feet or closer apart require a flow of 1,500 gpm.

3.7.2 Other structures or situations will require greater fire flows. Greater flow shall be determined by using the "Guide for Determination of Needed Fire Flow", Edition 10-2001 published by the Insurance Services Office (ISO) to obtain an optimum public protection classification.

3.7.3 Fire flow is the flow rate of water supply available measured at a 20 psi residual pressure.

3.7.4 Fire Hydrants shall be located to provide easy access from streets. Hydrants shall be spaced such that the entire perimeter of all buildings can be reached within a 400-foot radius from a hydrant. A hydrant shall also be available for each 160,000 square feet of developed area.

3.7.5 Fire flows and hydrant locations may be subject to Fire District approval. City reserves the right to modify fire flow requirements and hydrant spacing on a case-by-case basis.

3.8 Provisions for system flushing of all segments of water mains shall be incorporated into the design. Flushing may be accomplished through fire hydrants and/or blow-off assemblies. A velocity of at least 5 feet per second shall be possible in the water main through the operation of the hydrant or blow-off assembly.

3.9 Combination air valve assemblies shall be placed at all high points in the piping system where air could potentially accumulate. Additional valves may be required on long sections of pipe.

3.10 Backflow prevention assemblies are required on all domestic lines for commercial buildings, all fire service lines, and all irrigation lines. Backflow prevention assemblies are also required on residential domestic service lines greater than or equal to ¾ -inches in diameter, or when internal plumbing is greater than 32 feet above the water main, or when the property has a well connected to the domestic plumbing. Other instances may require backflow prevention devices when required by the City. The type of backflow prevention device required is dependent on the degree of hazard and must be approved by the City and in accordance with OAR 333-061. Device must be included in the current "Approved Backflow Prevention Assembly List" published by the Oregon Drinking Water Program. All backflow prevention devices shall be located on the applicant's property and are the property owner's responsibility to test and maintain in accordance with the manufacturer's instructions and Oregon statutes. All devices shall be installed downstream from a water meter or shall include flow detectors as applicable.

3.10.1 Reduced Pressure Backflow Assemblies generally required for:
- 3.10.1.1 Any tax lot with an auxiliary water supply on or available to it, including above or below ground source (wells are most common)
- 3.10.1.2 Commercial buildings within industrial zones
- 3.10.1.3 Medical or veterinary centers
- 3.10.1.4 Dry cleaners and commercial laundries
- 3.10.1.5 Any water system which has a pump to supplement pressure
- 3.10.1.6 Sewage pump stations
- 3.10.1.7 Irrigation systems designed to use chemical injection
- 3.10.1.8 Gas stations
- 3.10.1.9 Other high hazards as determined by the City

3.10.2 Double Check Backflow Assemblies generally required for:
- 3.10.2.1 Any fire system or water line to a private fire hydrant (see Section 9)
- 3.10.2.2 Multi-story buildings with plumbing in excess of 32 feet above the water main
- 3.10.2.3 Shopping centers or large retail stores
- 3.10.2.4 Restaurants or fast food establishments
- 3.10.2.5 Any water service which is equal to or larger than ¾ -inches in diameter
- 3.10.2.6 Any tax lot served by two water services

3.11 Minimum system operating pressures shall be 20 psi at the property line during peak domestic flow conditions and simultaneous fire flows. This minimum pressure applies to the entire distribution system. All public water system improvements shall be designed

to provide pressures not less than 50 psi and not greater than 95 psi during normal peak demand periods without fire flows. If minimum pressures cannot be obtained, developer must provide a high-level water system for the development area subject to City approval.

3.12 All new water services shall be individually metered. Minimum service line size is ¾-inch. Commercial and industrial user service line sizing greater as required. Services shall be perpendicular to the water main and not off at an angle. Service laterals shall be located close together for two adjoining lots to facilitate quick meter reading. A customer shut-off valve shall be included immediately outside of each meter box

3.13 Main extensions shall be installed through new development to allow logical extension of the City waterline grid to allow future development of adjacent undeveloped or underdeveloped properties. This will allow future connection without disrupting improvements constructed for the development.

3.14 For pipe placed on slopes steeper than 15%, restrained joint pipe or joint restraint devices shall be installed.

3.15 All details shall conform to the Standard Detail Drawings. Required items or installations for which no detail drawing exists, applicant's engineer shall submit sufficient design data and drawings for City approval. All such submitted drawings may require modification prior to approval for use.

**Section 4 – Construction Provisions**

4.1 All work within the public right-of-way shall be conducted by a licensed and bonded contractor. This requirement shall be stated on the construction drawings.

4.2 City shall be notified at least 3 working days in advance prior to commencing construction work.

4.3 Traffic control shall be signed, flagged and conducted in a manner conforming to ODOT standards (Manual of Uniform Traffic Control Devices, MUTCD). If road closures or detours are anticipated, prior approval from the City of Amity, ODOT, or Yamhill County must be obtained, as applicable.

4.4 Safety Requirements. The contractor is responsible for observing the safety of the work and all persons and property coming into contact with the work. The contractor shall conduct his work in a manner complying with the requirements prescribed by OSHA.

4.5 Progress. Construction shall proceed in a systematic manner to minimize public inconvenience and disruption of services. All excavations, embankments, stockpiles, waste areas, etc. shall be kept protected. All roads, ditches, etc. shall be kept free from debris and shall be continually cleaned during the work. Dust control measures shall be employed as required and directed by the City.

4.6 Protection of Existing Improvements. Contractor shall contact the Utility Notification Center at least 48 hours in advance of digging operations to get approximate locations for buried utilities. Exact locations of buried facilities may not be known or shown and contractor is responsible to pot-hole carefully in advance of the work to avoid such

facilities. Contractor shall coordinate with all utilities and notify them immediately in the event of any damage. Contractor shall protect, repair, and replace any damaged utilities as directed by the persons responsible for such utility. All landscape, grass, shrubs, signs, pavements, mail boxes, driveways, culverts, gravel surfacing, fencing, etc. shall be protected from damage and returned to conditions as good, or better than existed prior to construction. All costs for protection, repair, and replacement of all existing items shall be borne entirely by the contractor. Contractor shall obtain a release from any property owners for any claims of injury or property damage prior to final acceptance of the work by the City.

4.7 All existing survey monuments and control shall be protected, including individual property corner stakes. Any such monuments destroyed or altered during construction shall be restored by the contractor or developer by a licensed surveyor in accordance with ORS Chapter 672 and OAR 820-030.

4.8 Any temporary disruption to water service must be coordinated with, and approved by the City and kept to the minimum length of time necessary. City shall be notified at least 2 working days in advance of when an approved shut-down is desired as necessary to make tie-ins. Contractor shall not operate any valves or hydrants without City approval.

4.9 Trench foundation grades shall be constructed to within 0.1 feet of the grade shown in the plans. Surface tolerances shall be within 0.02 feet of plan elevation at any one point.

4.10 Compaction testing equipment (nuclear gauge) shall be furnished and operated by the contractor or an independent testing firm shall be retained by the contractor or developer to perform compaction testing. Testing shall conform to the ODOT Manual of Field Testing Procedures (MFTP). Compaction testing shall be conducted in the presence of the City's inspector. Sufficient tests will be taken to ensure that the materials and compaction efforts being used are adequate to obtain the required density. Several tests shall be taken on each lift placed during the first day of backfill operations. Additional tests will be taken periodically during the work. At minimum, 2 compaction tests shall be taken for each 500 feet of trenchline. Alternate materials or methods will be required if adequate compaction is not being obtained. In no case shall pipe laying continue if inadequate compaction results until a resolution is provided.

4.11 Construction staking shall be provided by the Developer's Engineer for establishing the location of the system. Offset stakes shall be placed at no more than 100 foot intervals along the mainline. Each service and appurtenance location shall be staked.

4.12 Open trench length at any one time shall not exceed 300 feet unless otherwise approved. Related resurfacing shall be completed within 800 feet of the open trench limit.

**Section 5 – Water System Materials**

5.1 All materials shall be newly manufactured. No rebuilt, reconditioned or used material will be allowed.

5.2 Oregon Standard Specifications (OSS) – Means the 2002 Oregon Standard Specifications for Construction produced by ODOT and APWA, including latest revisions.

5.3 Concrete shall conform to OSS Section 00440, Commercial Grade Concrete. Compressive field strength shall not be less than 3,000 psi at 28 days. Maximum aggregate size shall be 1½-inches. Slump shall be between 2 and 4 inches.

5.4 Non-Shrink Grout. Grout shall be Sika 212, Euco N-S, Five Star, or approved equal nonmetallic cementitious commercial grout exhibiting zero shrinkage per ASTM C827. Grout shall not be amended with cement or sand and shall not be reconditioned with water after initial mixing. Nonshrink grout shall be placed and packed only with the use of an approved commercial bonding agent. Unused grout shall be discarded after 20 minutes.

5.5 Trench Backfill Materials

5.5.1 Foundation Stabilization: 1½”-0 or 2”-0 aggregate base rock meeting OSS Sections 00641 and 02630. Required when native trench foundation material contains groundwater, or is unsuitable to provide a firm foundation in the opinion of the City Engineer.

5.5.2 Pipe Bedding and Zone: ¾”-0 dense-graded aggregate, uniformly graded from coarse to fine and meeting OSS Section 02630.10.

5.5.3 Class A Backfill: Native or common excavated material, free from organic or other deleterious material, free from rock larger than 3-inches, and which meets the characteristics required for the specific surface loading or other criteria of the backfill zone in the opinion of the City Engineer. If stockpiled material becomes saturated or unsuitable, Class B, C or D Backfill shall be substituted.

5.5.4 Class B Backfill: ¾”-0 dense-graded aggregate, uniformly graded from coarse to fine and meeting OSS Section 02630.10.

5.5.5 Class C Backfill: Clean sand with no particles larger than ¼-inch.

5.5.6 Class D Backfill: Pit run or bar run material, well graded from coarse to fine, with maximum aggregate size of 3 inches.

5.5.7 Class E Backfill (CLSM): Controlled Low-Strength Material (cement slurry) conforming to OSS Section 00442.

5.5.8 Compaction: Material (except Class E Backfill) shall be compacted in multiple lifts (6-inch maximum lift) to obtain 95% of the maximum dry density as determined by AASHTO T-99.

5.5.9 All Backfill within public right-of-ways or within 5 feet of a traveled surface shall be Class B Backfill, except where Class E Backfill is required under pavements.

5.6 Water Pipe Materials

5.6.1 Water mains shall generally be constructed of PVC, as described below, unless ductile iron pipe is called for. Exposed piping in vaults and vault penetration spools shall be ductile iron.

5.6.2 PVC pipe, 4- through 12-inch nominal diameter shall be rigid PVC made from class 12454-A or B compounds as defined in ASTM D1784. Pipe shall be NSF 61 approved for use as water distribution piping. Pipe shall be Class 150 meeting DR18, minimum, conforming to all requirements of AWWA C900. Pipe shall integral wall-thickened bells with bonded-in elastomeric gaskets meeting ASTM F477.

5.6.3 PVC pipe, 14- through 30-inch nominal diameter pipe shall meet the requirements of AWWA Standard C905 and shall be NSF 61 approved for use as water distribution piping. Pipe shall integral wall-thickened bells with bonded-in elastomeric gaskets meeting ASTM F477. Joint design shall conform to ASTM D3139. Pipe shall be Class 165 meeting DR25, minimum.

5.6.4 Ductile iron pipe shall be Class 52 minimum thickness manufactured in accordance with ANSI/AWWA C151/A21.51 under method of design outlined in ANSI/AWWA C150/A21.50. Pipe interior shall be cement mortar lined in accordance with ANSI/AWWA C104/A21.4. External pipe coating shall be an asphaltic coating in accordance with ANSI/AWWA C151/A21.51.

5.6.5 Galvanized steel pipe shall be Schedule 40, hot-dipped galvanized, seamless or electric resistance welded type, standard weight, threaded fitting type, conforming to ASTM A53.

5.6.6 Polyethylene pipe, ¾- through 2-inch nominal diameter shall be high-density polyethylene pressure rated pipe (PE3408) meeting cell classification 345464A and having NSF 14/61 certification. Pipe shall be compatible with IPS fittings. SIDR 7, 200 psi, meeting the requirements of ASTM D2239 and AWWA C901. Pipe shall have a 50-year manufacturer's warranty.

5.6.7 Unless otherwise allowed by City Engineer, all services shall be copper service piping and shall be seamless Type "K" copper piping, conforming to AWWA C-800, 160 psi rated. Service piping will be no smaller than ¾" diameter.

5.7 Fittings

5.7.1 Gray and ductile iron fittings shall be used for water main piping. Fittings shall conform to ANSI/AWWA C110/A21.10 Standard (full body) or ANSI/AWWA C153/A21.53 (compact), with 250 psi minimum working pressure rating.

5.7.2 All gray and ductile iron fittings shall be cement mortar lined inside in accordance with ANSI/AWWA C104/A21.4. Exterior of fittings shall have an asphaltic coating in accordance with ANSI/AWWA C110/A21.10.

5.7.3 Joints and gaskets for mechanical joint fittings shall conform to ANSI/AWWA C111/A21.11 Standard. Furnish with ductile iron "T" head bolts and hexagonal nuts conforming to AWWA C111.

5.7.4 Flange fittings shall be faced and drilled to standard 125-pound template per ANSI B16.1 Standard unless otherwise indicated or required to connect to other 250-pound fittings. Flange gaskets shall be commercial neoprene rubber

conforming to ASTM D2000, SAE J200, 1/8-inch thick. Gasket shall be full-face cut with holes to pass bolts. Furnish with coarse thread cadmium plated nuts and bolts conforming to ANSI B18.2 and B1.1 American Standards for Class 2A and 2B fit.

5.7.5 Joint restrainers for MJ fittings shall be Megalug by EBAA Iron, or approved equal, specifically designed for the type of pipe material used.

5.7.6 Restrained flange adapters shall be Megaflange by EBAA Iron, or approved equal, specifically designed for the type of pipe material used.

5.7.7 Red brass pipe nipples shall be seamless, M.I.P threaded, rated for 150 psi and conforming to ASTM B43 and ASTM B687. Bronze fittings shall meet the requirements of ASTM B62 with NPT threaded ends conforming to ANSI/ASME B16.15.

5.7.8 Galvanized iron fittings shall be 150-lb standard malleable iron fittings with NPT standard threads, conforming to ASTM A53 and ASTM A153.

5.7.9 Tapping Sleeves shall have ASTM A240 Type 304/304L stainless steel shell and lugs and ASTM A536 Grade 65-45-12 ductile iron flange. Bolts shall be ASTM A193 Type 304 stainless steel. Nuts shall be ASTM A194 Type 304 stainless steel, heavy hex, coated. Gaskets shall be SBR per ASTM D2000 MAA 610 compounded for water service. Romac Industries “SST”, or approved equal.

5.7.10 Couplings shall have ASTM A536 Grade 65-45-12 ductile iron center sleeves and end rings. Bolts and nuts shall be trackhead, heavy hex, rolled thread, high strength, low alloy, corrosion resistant steel per AWWA C111. Gaskets shall be SBR per ASTM D2000 MBA 710, compounded for water service.

5.7.11 Service brass and other water service appurtenances shall be as shown on the standard details Drawing No. W-600.

5.7.12 Other fittings not specified herein are described further on the Standard Drawings.

5.8 Valves

5.8.1 Valves shall be placed at logical locations in accordance with the minimum locations shown in the standard details. Valves shall be sized equivalent to the water piping adjacent to the valve. Valves 8-inch and smaller shall be gate valves. Valves 10-inch and larger shall be butterfly valves. All valves shall open when stem or operating nut is rotated counterclockwise. Valves shall be approved by the City.

5.8.2 Gate Valves 2-inch through 8-inch shall be iron bodied, resilient wedge, non-rising stem (NRS), O-ring sealed, fusion bonded epoxy lined and coated valves conforming to the latest revision of AWWA C509. Valves shall have a 200 psi working pressure (water, non-shock) rating. Valve ends shall be mechanical joint or flanged joint as applicable. Furnish with standard 2-inch square operating nut when buried and handwheel operator where exposed.

5.8.3 Butterfly Valves shall be rated for buried service and meet the requirements of the latest revision of Class 150B, AWWA C504. Valves shall have cast iron body, ASTM A126 Class B, resilient Buna-N rubber seat and cast iron disc with stainless steel contacting edge. Shaft shall be 18-8 type 304 stainless steel conforming to ASTM A276. Valve ends shall be mechanical joint or flanged joint as applicable. Furnish with standard 2-inch square operating nut when buried and lever operator where exposed.

5.9 Hydrants

5.9.1 Fire hydrants shall meet or exceed AWWA C502, latest revision. Rated working pressure shall be 250 psig. Test pressure shall be 500 psig.

5.9.2 Nozzle section, upper and lower standpipes, and hydrant base shall be ductile iron.

5.9.3 Main valve closure shall be compression type, opening against the pressure and closing with the pressure. Seat diameter shall be 5¼ inches. The seat shall be bronze threaded into bronze mating material for easy field repair.

5.9.4 Nozzle section shall be designed for easy 360 degree rotation by the loosening of no more than 4 bolts.

5.9.5 Hydrant shall be designed so that removal of all working parts can be accomplished without excavating.

5.9.6 The draining system shall be bronze and be positively activated by the main operating rod. Hydrant shall have a sliding bronze drain valve.

5.9.7 Hydrant shall have an internal travel stop nut in the top housing. Operating threads shall be factory lubricated and be O-ring sealed from water, moisture, and dirt.

5.9.8 Hydrant shall have a traffic flange design allowing for quick repair of damage resulting from a vehicular impact. Main valve shall remain closed upon impact.

5.9.9 Upper operating nut shall be ductile iron, 1½-inch pentagon standard. Opening direction shall be counter-clockwise (CCW).

5.9.10 Hydrant shall have two (2) 2½-inch hose nozzles, and one (1) 4½-inch pumper nozzle. Threads shall conform to NFPA National Standard Fire Hose Coupling Screw Threads.

5.9.11 Hydrant bottom connection shall be 6-inch nominal diameter mechanical joint. Flange joint may be approved in some cases due to space constraints.

5.9.12 Hydrants shall be painted Fire Hydrant Yellow. Field touch-up will be required if scratched or marred.

5.9.13 Hydrants shall be Kennedy Guardian unless otherwise approved.

5.10 Other materials not covered herein should generally conform to the 2002 Oregon Standard Specifications and are subject to City approval. Service brass shall be as shown in the standard detail drawings.

**Section 6 – Water System Installation**

6.1 Prepare trench in accordance with the standard detail in a safe manner. Place and compact foundation stabilization materials as required. Notify City to allow for inspection of trench bottom.

6.2 Place and compact pipe bedding material before placing pipe in the trench. Dig depression for pipe bells to provide uniform bearing along the entire pipe length. Thoroughly compact bedding material.

6.3 Prior to lowering pipe into the trench, the Engineer and City's representative will check for damage to the pipe. The Contractor shall repair or replace, as directed, all damaged or flawed pipe prior to installation.

6.4 PVC pipe shall be installed and handled in accordance with the Uni-Bell Plastic Pipe Association standards UNI-B-3, AWWA C605, these specifications and the manufacturer's installation guide. The Contractor shall have on site all proper tools and equipment to properly and safely install the pipe.

6.5 Thoroughly clean inside the pipe before laying. Prevent foreign material from entering the pipe while it is being placed in the trench. Remove all foreign material from the inside of the pipe and joint before the next pipe is placed. Keep debris, tools, rags or other materials out of the pipe at all times. When pipe laying is not in progress, cover the exposed end of the pipe using a watertight expanding plug, or by other approved means to prevent entry of trench water or other foreign materials into the pipe.

6.6 Lay pipe with bell ends facing the direction of laying. For lines on an appreciable slope, face bells up-grade unless otherwise directed by the City.

6.7 Thoroughly clean the ends of the pipe to remove all foreign matter from the pipe joint. Lubricate the bell and spigot ends with NSF approved pipe lubricant, as recommended by the manufacturer. Furnish the gaskets required for the joint being assembled. Install the gasket with uniform tension around the joint groove before placing the pipe in the trench.

6.8 Provide concrete thrust blocking at all bends, valves, tees and other fittings in accordance with the Plans, as required to prevent movement due to thrust. Mechanical joint restraints shall also be installed.

6.9 At no time shall pipe be deflected, either in the vertical or horizontal plane, in excess of the maximum deflection recommended by the pipe manufacturer. Deflection at any joint shall not exceed 2½º. Maximum deviation from grade shall not exceed ½-inch.

6.10 Where new water pipe is installed near existing or new sanitary sewer lines, all provisions of current OAR 333-61-050 (Crossings – Sanitary sewers and waterlines), regarding placement of pipe near, under, or over sanitary sewer lines shall be followed.

6.11 Place materials in the pipe zone in layers not greater than 6 inches thick and in a manner that equalizes the pressure on the pipe and minimizes stress. As required under the haunches of pipe and areas not accessible to mechanical tampers or to testing, compact with hand methods to ensure thorough contact between the material and the pipe. Before placing the pipe zone material, condition, aerate, or wet the material so that the moisture content of each layer is within minus 4% to plus 2% of optimum moisture content.

6.12 Provide proper Backfill Class material as required. Backfill the trench above the pipe zone in successive lifts. Do not allow the backfill to free-fall into the trench until at least 3 feet of cover is provided over the top of the pipe. Modify the compaction as necessary to protect the pipe. Compact each lift to not less than 95% of the maximum density.

6.13 If the specified compaction is not obtained, contractor shall remove material, modify compaction procedures, and/or reduce the thickness of lifts as required. Do not proceed with additional excavation or pipe laying until the backfill can be compacted to the satisfaction of the City.

6.14 CLSM. When CLSM Backfill is required, backfill above pipe zone with CLSM material. If the CLSM is to be used as a temporary surfacing, backfill to top of the trench and strike off to provide a smooth surface. If CLSM is not to be used as a temporary surface, backfill to bottom of the proposed resurfacing. Use steel plates to protect the CLSM from traffic a minimum of 24 hours.

6.15 Restore all surfaces after backfill is complete. Base rock, asphalt paving and concrete paving methods and materials shall conform to Oregon Standard Specifications as approved by the City.

6.16 Filling and Flushing. After installation of water piping, fill pipes slowly with potable water at a maximum rate of 10 cfs while venting all air. Take all required precautions to prevent entrapping of air in the pipes. Flush all sections of pipe to remove any solids or material that may be in the pipe. If no hydrant is installed at the end of the main, provide a tap large enough to develop sufficient flow rates to achieve a velocity of at least 5 feet per second in the main. Control and dispose flushing water in a proper manner to avoid erosion, flooding, property damage, and discharge of chlorinated water in an unacceptable manner.

6.17 Testing and Disinfection. After flushing, water system shall be tested for leakage and disinfected according to the following Sections. Provide all temporary taps as required. All items not passing tests shall be repaired or replaced as required.

**Section 7 – Water System Pressure (Leak) Testing**

7.1 All waterlines and service lines shall be subjected to hydrostatic pressure testing. Testing shall be conducted by the Contractor in the presence of the City Engineer. City must be notified at least 2 working days in advance.

7.2 Testing shall not be commenced until all thrust blocking has been in place for not less than 10 days and sufficient backfill has been placed to prevent pipe movement.

7.3 Furnish and operate all pumps, gauges, plugs, saddles, corporation stops, miscellaneous hose and piping, and measuring equipment necessary for performing the test. Provide certifications of accuracy for gauges from an approved laboratory when requested.

7.4 Test Procedure

7.4.1 The test section shall be filled with water and all air expelled from the pipe prior to testing. City will provide water for testing at a time of day when sufficient quantities of water are available for normal system operation.

7.4.2 All valves isolating the test section shall be securely closed and the specified test pressure applied by means of a pump connected near the lower end of the test section.

7.4.3 The test pressure shall be 150 psi and the duration shall be at least 2-hours at the test pressure. Provide additional pumping during the test period to continuously maintain pressure within 5 psi of that required. Use a clean container of potable water to supply the pump.

7.4.4 Accurately determine the quantity of water required to maintain and restore the required pressure at the end of the test by pumping through an approved positive displacement water meter.

7.4.5 The allowable leakage rate for the test section shall be determined from the following formula:

$$L = \frac{ND\sqrt{p}}{7400}$$

L = allowable leakage (gph)
N = number of joints in length of pipe tested
D = nominal diameter of pipe (inches)
p = average test pressure during test (psi)

7.4.6 If the amount of water added to the section exceeds the allowable leakage, the Contractor shall, determine the source of leakage, repair or replace the defective elements, and repeat the test until the allowable leakage requirements have been satisfied.

7.4.7 All visible leaks on new waterlines shall be repaired, regardless of the amount of leakage.

7.4.8 Make all tests with hydrant auxiliary gate valves open and pressure against the hydrant valve. After the pipe test is completed, test each gate valve in turn by closing it and relieving the pressure beyond. This test of the gate valve is acceptable if there is no immediate loss of pressure.

**Section 8 – Water System Disinfection**

8.1 All lines installed or modified under this Contract shall be sterilized prior to connection to the existing system, in accordance with the following procedure, AWWA Standards C651 through C654, and current OAR 333-61-050 (Disinfection of Facilities).

8.2 Prior to commencing disinfection procedures, all lines shall be flushed thoroughly to remove dirt, construction debris and other potential contaminants.

8.3 The Contractor shall have the option of utilizing either a liquid chlorine gas-water mixture, direct fed chlorine gas, sodium hypochlorite solution, or a calcium hypochlorite and water mixture for disinfection.

8.4 Disposal of chlorinated water from the reservoir tank or pipelines shall be performed in conformance with the most recent draft or edition of *Best Management Practices for the Disposal of Chlorinated Water* by the Oregon Department of Environmental Quality. Chlorinated water used for disinfection of waterlines and service lines shall not be directly disposed of into or impair the waters of the State (i.e. lakes, creeks, streams and wetlands).

8.5 The Contractor shall provide all equipment, materials, and workmanship required to complete the flushing and disinfection of waterlines and appurtenances.

8.6 Disinfection Procedure

8.6.1 The Contractor shall inject chlorine solution into the beginning of the waterline through a corporation stop inserted in the horizontal axis of the pipe. Make no connections between the existing distribution system and the non-disinfected pipelines unless a State Drinking Water Program approved backflow preventer is installed in the connecting line.

8.6.2 The solution shall have a free chlorine residual of at least 25 mg/L, but not more than 100 mg/L. All entrapped air shall be discharged from the line and all surfaces wetted. Chlorinated water shall be retained in the pipe for at least 24-hours. A free residual of not less than 10 mg/L shall be found in all parts of the line after the 24-hour period has elapsed.

8.6.3 After the 24-hour period, all valves in the mainline shall be operated and all hydrants flushed with a residual of at least 10 mg/L being found. If the residual concentration within any part of the chlorinated section is found to be less than 10 mg/L, the Contractor shall flush, rechlorinate, and retest all sections until a 10 mg/L residual is obtained.

8.6.4 Upon obtaining the minimum 10 mg/L residual following the 24-hour disinfection period, the Contractor shall flush the section with potable water until the chlorine residual is equivalent to the residual of the existing system water. A minimum of one sample shall then be taken from the pipe for microbiological analysis.

8.7 Microbiological Sampling and Analysis

8.7.1 The Contractor is responsible for collecting and submitting samples to a certified independent testing laboratory for microbiological analysis.

8.7.2 The Engineer or City representative shall be present to witness the collection of the water samples for testing. Chain of custody procedures shall be utilized during the collection and transport of samples to the laboratory.

8.7.3 The Contractor shall bear all costs associated with the required testing, including laboratory fees, materials required, and transportation costs. The Contractor also shall pay for all additional tests required as a result of failing to meet the bacterial limits.

8.7.4 If the results of the microbiological analysis indicate that the water is free of coliform organisms, the waterline may be put into service.

8.7.5 If the results of the microbiological analysis indicate that coliform organisms are present, then the waterline shall be flushed, rechlorinated, and retested until a coliform-free sample is obtained.

8.7.6 A minimum of one sample from each separable structure or pipeline shall be obtained for analysis. The presence of coliform organisms shall be determined using the Colilert 24-hour test, Method MMO-Mug, or other methods approved by the Oregon State Drinking Water Program.

8.8 Where new waterlines connect to existing lines and the tie-in requires a portion of the new construction to be brought into service immediately upon completion of the tie-in, the new piping and appurtenances shall be disinfected by liberally spraying or brushing on 1% hypochlorite solution (i.e. 1 gallon 5.25% bleach mixed with 4 gallons potable water), waiting 10 minutes, and then thoroughly flushing.

8.8.1 The Contractor shall take care not to allow foreign material to enter the pipe and appurtenances during installation.

8.8.2 Upon completion of the tie-in, the new piping and appurtenances shall be flushed.

**Section 9 – Standards for Fire Protection Systems**

9.1 Fire service backflow prevention assemblies shall be installed at the property line, or edge of the public waterline easement as approved by the City. The fire service line from the public right-of-way or utility easement to the backflow assembly will be privately owned and shall meet all City standards. The delineation between the public and private line shall occur as close to the public main as possible and delineated with an in-line public valve in accordance with City standards. A backflow prevention assembly for a fire service line may be installed inside of a building if it can be done within twenty feet of the tapping valve or tee.

9.2 Only approved Double Detector Check Backflow Assemblies are to be used for backflow prevention on fire line services.

9.3 Only approved resilient seat indicating valves are allowed on fireline assemblies.

9.4 Installation must comply with the Oregon Uniform Fire Code as adopted and amended by the State of Oregon Fire Marshal, and City Standards.