SECTION 3
WATER DESIGN AND CONSTRUCTION REQUIREMENTS

3-1 DESIGN REQUIREMENTS

3-1.01 *Introduction*

The City of Battle Ground's water utility provides drinking water to the City and to a water service area outside the City. The goal of the Engineering Department is to provide technical management, comprehensive planning, and sound engineering to expand and maintain a safe, reliable and sustainable water supply, distribution, and storage system for high-quality customer service and fire protection.

The Battle Ground Engineering Department provides engineering, standards, and conducts reviews to support a water supply and distribution system that is safe, reliable, durable, and maintainable. Privately-funded water mains proposed to be connected to the City's system are reviewed for compliance with City standards and to ensure that water mains can continue to be extended to new users in a logical and cost-effective manner.

The following requirements are intended to be helpful during the initial stages of the design of new developments needing connection to the City of Battle Ground water system. The Requirements do not replace professional engineering design or specific project reviews. City staff, including Fire Department officials, may impose different requirements based on site-specific reviews.

These requirements are intended to supplement but not duplicate the construction and installation details in "Construction Requirements" Section 1-2 and Water Standard Details WA-1.0 to WA-7.0.

3-1.02 *Distribution System Extensions to Support Development*

Developing properties must extend utility lines to the site, across the property frontage, and through the property, to allow connection and provide for future extensions for the development of adjacent parcels. Proposed water line sizes and alignments must be designed in accordance with the latest Water System Plan, or other appropriate master plans, as determined by the City staff for overall system development and network extension.

3-1.03 *Connection to Existing System*

All new water mains must connect to an existing public water main. This can be accomplished by cutting the existing main and inserting a tee or cross, by tapping an existing main, or by removing a cap or plug on an existing main and connecting to the end of the main. Connection to an existing main may be done only after disinfection, testing, and approval by City staff of the new main. An exception to this is to use a pre-sterilized, closed, approved valve to connect to the new main before any water is allowed to flow. A note should be added to the construction drawing, with text similar to the following: "After disinfection, pressure testing, bacteriological testing, and approval of the new main, connection to the existing main can be made."

3-1.04 *Water Main Locations and Easements*

Water mains shall generally be in public rights of way, except where needed to serve onsite fire hydrants, buildings on private roads, and adjacent properties.

The standard location for water mains is on the north or east side of street centerline, 6 feet from the curb, on the street side of the curb. Other locations may be approved by the Development Review Engineer.

Public water facilities that are not in the public right-of-way must be in an easement dedicated to the City of Battle Ground. The easement is intended to allow access for maintenance by City staff, and to prevent

any structure or tree from interfering with the facility or hindering access to it. The easement shall be of a standard form, provided by the Community Development Department.

Water facilities that require easements on private property include water mains, fire hydrants, water services to the water meter, and water meters. The easement boundary should generally be near the downstream side of a water meter or 7.5 feet past the fire hydrant.

Easements shall be 20 feet wide or greater. Allowances for 15 foot easements may be granted on a case by case basis. Shared utility easements with water and one other utility such as sanitary sewer or storm water shall generally be minimum 20 feet wide, with no exceptions. Shared utility easements with water and two other utilities such as sanitary sewer and storm water shall generally be minimum 25 feet wide. Wider easements may be required depending on the depth and size of the utilities. Easements shall have no structures on them, and shall be paved or covered with approved landscaping (not to include trees). Easements for private roads shall include the entire roadway and all water meters. The easement shall be described as such.

3-1.05 ***System Reliability and Looping***

Looped water mains are desirable for fire flow, system reliability during maintenance, and for water quality. Dead ends shall be avoided, except as needed to provide for future service and fire hydrants. Water main loops shall be completed wherever possible. An extension to provide for future looping may be required, even if such extension is not required to serve adjacent properties. Dead-end extensions shall be provided with a standard blowoff assembly, or with a standard temporary blowoff assembly per the Water Standard Details.

3-1.06 ***Water Pipe Materials and Size***

Water services shall be sized as required by water demand and on-site fire protection service flow. ¾ inch water services shall be Polyethylene. 1.5 inch and 2 inch water services shall be Type K Copper. 3 inch water services and larger shall be Class 52 Ductile Iron Pipe.

Water mains shall be constructed of ductile iron pipe (Class 52 up to and including 12 inches in diameter, Pressure Class 350 for 16 inches and larger) and per the Water Standard Details.

New water mains that are provided for future extensions will be sized consistent with the City of Battle Ground Water System Plan, as interpreted by City staff. For locations not covered by the Comprehensive Plan, City staff will determine the necessary size during the development review process. For preliminary planning, size the new main according to the existing grid, or 8 inches diameter, whichever is larger.

Mains of a size larger than indicated above may be required based on fire flow needs and the water system pressure at a particular location.

In certain cases, the City may require a water main that is larger than needed by the development alone. If this oversized main is 12 inch or more in diameter, the City may provide water SDC credits for the difference between the larger main required, and the size of the main needed for the development alone.

Dead end mains 50 feet in length or shorter, which serve only a hydrant, shall be a minimum of 6 inches in diameter. Dead end runs longer than 50 feet to a hydrant shall be a minimum 8 inches in diameter.

Dead end mains to the end of a residential cul-de-sac, where the water main can not be extended in the future, shall be minimum 8 inches in diameter to the last hydrant, and 4 inches in diameter past the last hydrant to the end. The diameter reduction is to minimize the amount of potentially stagnant water in the end of a main. However, wherever possible the main shall be looped. The Engineering Department shall determine if it is impossible to loop the line.

3-1.07 *Depth of Cover*

The minimum pipe cover is 3 feet for mains smaller than 12 inch and 4 feet for pipe 12 inches and larger, except for services as shown in the Water Standard Details. The cover shall not exceed 6 feet unless greater depth is required to avoid other utilities, or where special circumstances arise and greater cover is approved by the City.

3-1.08 *Coordination with Other Utilities and Water Main Profiles*

Parallel runs of water and sanitary sewer main shall be separated by 10 feet, edge to closest edge. If 10 feet separation is impossible, separations of between 5 feet and 10 feet may be approved, based on City staff review and on the guidance in Washington Department of Ecology's "Criteria for Sewage Works Design". Sewer mains should cross under water mains and be separated by 18 inches vertically. Where sewer mains cross over water mains, there shall be minimum 18 inches of vertical separation and the sewer mains shall be constructed of ductile iron pipe or other approved material, and the sewer main joints shall be located as far as possible from the water main. Oblique crossings (close to parallel) shall be avoided.

The water main shall be located more than 5 feet from other non-sanitary-sewer utility pipes, measured center-to-center. An edge-to-edge separation of 3 feet may be allowed where no reasonable alternative exists, if approved by the City of Battle Ground.

To facilitate coordination with other utilities, and City staff review of proposed water facilities, water main profile drawings must be included for all mains 12 inches or more in diameter. Profile drawings should show all crossings with other utilities. Water mains must be deflected vertically, or vertical bends must be used, as necessary, to provide 6 inch minimum crossing clearance with other utilities (18 inches minimum crossing clearance where water mains cross below sewer mains).

3-1.09 *Air Release, Vacuum Release, and Blow-Off Valves*

A combination air-vacuum release valve, Water Standard Detail WA-4.1, shall be installed at designated high points in 8 inch in diameter or larger main line runs. The release valve may not be required if a fire hydrant is close to the high point.

Standard blowoff assemblies, Water Standard Detail WA-4.2, shall be installed at designated low points in 8 inch diameter and larger mains, and near the end of dead-end mains that will not be extended in the future. The blowoff may not be required if a fire hydrant is close to the end of the main.

Standard temporary construction blowoff assemblies shall be installed in the plug at the end of water mains to be extended later, per Water Standard Detail WA-4.3.

3-1.10 *Isolation Valves*

Isolation valves must be installed to facilitate new connections to the system and to provide for the isolation of pipe segments during maintenance. Generally three isolation valves per tee and four isolation valves per cross are required. At least one isolation valve per 1000 feet of main run must be installed.

Where tees or crosses are installed to provide for both new and future connections, isolation valves should be located so as to minimize loss of service when the future connection is made.

3-1.11 *Restrained Joints*

Bends, tees, dead ends, valves, and all reducers shall be supported from separation by mechanical restraints. There must be no unrestrained joints within a sufficient distance from the fitting to provide the necessary earth support and frictional resistance. This distance must be calculated by accepted engineering methods, such as the calculative methods provided by the Ductile Iron Pipe Research Association (see Resources). Design assumptions are indicated in Water Standard Detail WA-3.2.

Restrained joints must be Megalug or approved equal. Tie rods may not be used for buried water mains. Thrust blocks are not allowed.

Isolation valves for hydrants shall be located or restrained such that the hydrant can be removed for maintenance without the closed valve being displaced due to water pressure. This is normally achieved by a flange by mechanical joint (MJ) valve being bolted to an MJ by flange branch tee in the street main, per Water Standard Detail WA-3.0. Where the hydrant isolation valve is not at a tee, additional restrained joints upstream from the valve may be required.

Underground flanged joints are only allowed for restraining valves installed for "Live Taps", fire hydrants, or fire protection services. They can not be used elsewhere, because of the difficulty of achieving the precise alignment needed for flanged joints during field repair.

All the joints on fire hydrant mains including the tee are to be restrained. Thrust blocks for hydrants shall not be allowed.

Two adjacent MJ fittings, or a valve and adjacent MJ fitting, may be joined with a Foster adapter or similar approved product.

3-1.12 *Deflection at Pipe Joints*

Water main pipe joints can be deflected to achieve a non-linear alignment, provided the deflection at each joint does not exceed 80% of the maximum allowed by the connection. The deflection angle shall be stated on the civil plans.

3-1.13 *Cross-Connection Control*

The prevention of non-potable water or any harmful substance from entering the distribution system is extremely important to public safety. The City of Battle Ground recognizes the Washington State Department of Health regulations (WAC 246-290-490) with regard to the protection of the public via minimum requirements for design, construction, operation, and maintenance of public water supplies. All developers or applicants constructing public water mains or facilities should be familiar with, and comply with, these requirements. These referenced regulations and standards are the minimum required and the City specifically reserves the right to require additional safety features and items as may be deemed appropriate by the City. Water Standard Details WA-5.0 to WA-5.3 provides some guidance as to when backflow prevention devices are required. For other information or interpretation contact the Engineering Department.

3-1.14 *Water Demand versus Meter Size*

For water services that require more flow than available through a standard 5/8 inch-3/4 inch residential meter, the water meter size requested should be sized to serve the expected peak and continuous demands. Guidance for the safe maximum operating capacity and the recommended rate for continuous operation can be found in the American Water Works Association Standards, C-700 through C-710. General guidance can be found in the American Water Works Association Manual of Water Supply Practices, "Sizing Water Service Lines and Meters", M22.

The minimum diameter for a new service pipe is 1 inch. The service pipe shall be reduced at the meter as necessary.

3-1.15 *WSDOT/Railroad Crossings*

The developer shall obtain and make full payment for any permits required from WSDOT/railroad prior to constructing a water main under any highway or railroad tracks. The permit should be on behalf of the City of Battle Ground. All requirements of the permit shall be met prior to acceptance of any construction. Requirements usually include boring with a steel casing for installation of the main.

3-2 CONSTRUCTION REQUIREMENTS

3-2.01 *General*
Materials and construction methods shall be in conformance with the most current version of the Standard Specifications for Road, Bridge & Municipal Construction as prepared by Washington State Department of Transportation. All references to American Water Works Association (AWWA) specifications shall mean their latest revision. Operation of or connection to existing city water facilities shall only be performed under the observation of authorized city personnel.

3-2.02 *Ductile Iron Pipe*
All water main pipe furnished shall be new ductile iron (DI) pipe conforming to the requirements of AWWA C151. Pipe sizes 12 inch and smaller shall be Class 52 and pipe 16 inch and larger shall be Class 51 or Pressure Class 350, unless otherwise noted on the plans. All pipe shall be furnished in 18 to 20 foot lengths and shall be cement lined per AWWA C104. All rubber gasket joints for ductile iron shall conform to the requirements of AWWA C111.

3-2.03 *Ductile Iron or Cast Iron Fittings*
All fittings shall conform to the requirements of AWWA C110 or C153. Fittings shall be of the size, type, and type of joint as called for on the plans. All fittings shall have a pressure rating of 350 psi minimum. All fittings shall be ductile iron. All ductile iron fittings shall be cement or fusion bonded epoxy lined. Fusion bonded epoxy lined fittings shall conform to the requirements of AWWA C509. All compact fittings shall be ductile iron, cement lined, and have a pressure rating of 350 psi. All rubber gasket joints for ductile iron fittings shall conform to the requirements of AWWA C111. All reducers shall be restrained. All vertical elbow installations shall be engineered, and calculations submitted with plans to the City's Engineering Department for approval. Bolts for buried flanged fittings shall be galvanized, zinc-cadmium plated, or low alloy steel and coated with 2 coats of bitumastic coating after installation. Bolts for mechanical joints shall be NSS Cor-Ten steel or ductile iron only. No flange by flange fittings are allowed, flange by mechanical joint fittings are only allowed on fire hydrant and fire protection tees, "live taps", compound meters, DCVA, and RPBA.

3-2.04 *Restrained Joint Pipe*
All Restrained Joint Pipe, as called for on the plans, shall be TR Flex by US Pipe, Lok Ring by American Pipe, or approved equal.

3-2.05 *Allowable Restraint Systems*
On water main fittings and valves 12 inch in diameter and smaller, mechanical joint restraining glands, Megalug brand or approved equal, are required. See "Design Requirements: Restrained Joints" Section 1-1.11 regarding the number of joints adjacent to a fitting that must be restrained. The minimum working pressure rating of restrained joint systems shall be 350 psi. Restraining gaskets may be used where thrust restraint is required for push-on joint (tyton) pipe, 12 inch or smaller. Restraining gaskets shall be US Field Lok or approved equal and installed per manufacturer's written instructions. Tie rods for joint restraint shall not be allowed.

3-2.06 *Valves*
Resilient-seated gate valves may be used for valve installations of 8 inch and smaller and shall be used on all fire hydrant and fire protection service lines. Resilient-seated gate valves shall conform to AWWA C509 or C515 and shall be epoxy coated on the inside. Butterfly valves may be used for valve installations of 6 inch and 8 inch, except for fire hydrant and fire protection installations. Butterfly valves shall be used for all valve installations of 10 inch and larger. Butterfly valves shall conform to AWWA C504 and shall be Class 150-B with short body. Butterfly valves shall be required to have a minimum of 28 turns to move from fully open to fully closed. The operator shall be mounted directly on the valve with no exposed or external couplings. Units shall be fully gasketed and grease packed. Valves shall be installed with the operator on the side of the pipe nearest the road centerline. All valves shall be furnished

with an underground manual (AWWA 2 inch square) operating nut with a counterclockwise rotation. Install the operator nut such that the depth from finish grade to the operator nut is 18 to 36 inches. Valves shall be installed directly to tees and crosses, spools are not allowed. No flange by flange valves shall be allowed.

3-2.07 ***Valve Boxes***
Valve boxes shall be Fort Vancouver Pattern No. 910, cast iron or approved equal. Valve box extensions shall be one piece and constructed of 6 inch ASTM D 3034 SDR 35 PVC pipe. Valve boxes not set in paved areas shall be set in a concrete or asphalt pad per Water Standard Detail WA-3.1.

3-2.08 ***Standard Air Release Valves***
Manual and Combination Air Release Valves are to be furnished as called for in the plans. Valves shall be of the size indicated and shall be suitable for a working pressure of 150 psi. All Air Release Valves shall be installed at the crest of pipe runs. Valves shall be APCO No. 145C or approved equal.

3-2.09 ***Standard Blowoff Assembly***
Standard blowoff assemblies are to be placed 1 foot from the end of a dead end main, when that main will not be extended. Standard blowoff assemblies shall be placed at low points in the main, as indicated in the plans, to allow for main cleaning.

Temporary construction blowoff assemblies shall be placed on the end of water mains that will be extended, or connected to at a later date.

3-2.10 ***Tapping Sleeves***
Tapping sleeves shall be rated at 150 psi working pressure with ANSI/AWWA C207 Class D 150 pound flanges or equivalent stainless steel pattern. All sleeves shall be designated by the manufacturer as suitable for the service proposed. All fabricated steel tapping sleeves shall have fusion-applied epoxy coating. All stainless steel tapping sleeves shall have stainless steel nuts and bolts. All bolts for the sleeve body shall be the drop-in type, not welded. All nuts and bolts shall be stainless steel (with nuts or bolts treated to prevent galling) or high-strength, low alloy steel bolts with the steel meeting ANSI/AWWA C111/A21.11 specifications. After a tap is made, all exposed areas of the pipe and sleeve shall be coated with either bitumastic coating or Brown primer and Trenton #1 wax or approved equal. Tapping sleeve gaskets shall be NSF approved for potable water. Sleeves shall be tested, on the pipe, at 150 psi for 15 minutes with no pressure drop prior to making the tap. All sleeves shall have a test outlet and plug. Sleeves furnished for ductile iron pipe taps, reduced outlet taps on steel pipe, or reduced outlet taps on cast iron pipe larger than 12 inches, shall be fabricated steel with outlet gasket. JCM 412, Dresser style 610, Smith-Blair 622, Romac FTS420, Ford FTSC, or approved equal. For reduced outlet taps on steel, JCM 422 is also approved. Size on size taps on steel pipe shall not be allowed. Tapping sleeves furnished for taps on cast iron 12 inches and smaller, or taps on asbestos cement, shall be stainless steel with full circumferential gasket: Romac SST III, JCM432, Smith-Blair 664/5, Dresser 630, Ford FTSS, or approved equal. Tapping sleeves for pipes not listed above must be approved by the City.

3-2.11 ***Tapping Valves***
Tapping valves shall have the same construction as specified for gate valves. The inlet end of valve shall be flanged and outlet end shall be a mechanical joint. Tapping valves shall be supported by an 8 inch by 8 inch concrete block prior to making the tap. Tapping sleeves and valves shall be used only when specifically called for in the plans.

3-2.12 ***Standard Fire Hydrant Assembly***
All fire hydrants shall conform to AWWA standard specifications (C502) for fire hydrants. All fire hydrants shall be of the latest design that the manufacturer is producing. All hydrants shall be 3 port with two 2-1/2 inch hose nozzles with national standard fire hose coupling screw thread, 7-1/2 threads per inch, and one 4-1/2 inch steamer nozzle with Storz quick connect fitting or equal.

Quick connect coupling: Aluminum alloy hydrant adapters shall be 5 inch and secured to steamer nozzle if adapter is threaded on steamer nozzle. Each unit shall have 1/4 inch #20 thread stainless steel set screws for permanently securing adapters to hydrant. Each unit will have a blind cap with plastic coated aircraft cable attaching it to the hydrant steamer post. Facing on the adapter shall be metal and not rubber gasketing to avert sticking during freezing weather conditions. The blind cap shall fit the adapter tight enough so that it cannot be removed without a spanner wrench.

All hydrant nozzle caps must be installed with gaskets. All hydrants shall have 'O' ring seals on the operating stem, and all working parts shall be of bronze and all 'O' ring surfaces shall be rust-free material. The compression hydrant operating threads shall be lubricated and shall be 'O' ring sealed from water, moisture and foreign matter. The operating nut shall be 1-1/2" square. The center of the lowest port shall be minimum 17 inches from the ground bury mark.

All hydrants shall be constructed with mechanical joint connections and provisions shall be made to automatically drain the barrel in order to protect the unit from freezing. The barrel shall be a minimum 7 inches interior diameter and of such length as to be suitable for installation with connections to piping. Minimum barrel length shall be 28-1/4 inches. All working parts shall be removable through the top of the hydrant without the necessity of digging.

All hydrants shall have the interior and exterior prepared and coated or painted per AWWA standard C502. The exterior of the barrel shall be factory painted with safety yellow. The Storz adapter shall not be painted. Mechanical restraint shall be used on all fire hydrants. Thrust blocks are not allowed on fire hydrants.

3-2.13 *Trench Excavation, Bedding, and Backfill*

The existing road surface shall be cut in a neat line by saw or wheel cutting prior to removal. Trench backfill shall be according to the backfill section, shown on the plan and/or the right-of-way permit. Per restoration details, all excess material not used for trench backfill shall be removed and disposed of by the contractor. Placement of backfill shall be brought up at substantially the same rate on both sides of the pipe and care shall be taken so that the pipe is not floated or displaced.

During construction, the contractor shall stockpile the excavated trench materials so as to do the least damage to adjacent lawns, gardens, shrubbery, trees or fences, regardless of the ownership of these areas. All excavated materials shall be removed from these areas, and these surfaces shall be left in a condition equivalent to, or better than their original condition and free from all rocks, gravel, boulders, or other foreign material.

Replace topsoil areas as specified. All existing drainage ditches and culverts shall be reopened and graded, and original drainage restored. All damaged irrigation lines, house drainage pipe, drain tiles, sewer laterals, and culverts shall be repaired or replaced. All clearing, grubbing, and stripping shall be performed in advance of excavation operations.

All weeds, roots, trash, debris, and similar objectionable materials shall be removed from excavation areas. All asphalt rubble, rocks, trash, or debris shall be hauled away. Asphalt pavement shall be neatly saw-cut at designated limits and shall be removed and hauled away.

3-2.14 *Compaction of Backfill*

The contractor shall conduct periodic testing of backfill compaction, using a nuclear densometer, at intervals of the City inspector's choosing. The contractor shall provide safe trench conditions at all times for testing at any depth. Compaction control tests to determine optimum moisture content and maximum density shall be by the following methods:

A. For granular materials - Method of test for compaction of granular materials (WSDOT Materials Manual Test Method No. 606).

B. Field moisture and density of backfill material shall be determined by the Nuclear Moisture/Density Gauge.

The contractor shall fill all open trenches at the completion of each day's work or plate with city inspector approval. Open trenches over night shall not be allowed. Trenches filled but not compacted shall be re-excavated the following working day and compacted according to these specifications.

3-2.15 ***Cutting and Plugging Existing Pipe***

Where shown on the plans, the contractor shall cut and plug the existing main. The existing main, which is to be abandoned, shall have a concrete plug poured around and in the end of the pipe to be abandoned and the part of the main which is to remain shall have a new metal plug installed on the existing pipe, cross, or tee, or shall be connected to the new fitting or pipe with thrust restraint. All valve boxes on mains which are abandoned (cut and plugged) shall be removed and the holes shall be patched to match finished surface.

Cutting of all pipe and specifically asbestos cement pipe shall conform to the latest rules and regulations of the Department of Labor and Industries.

3-2.16 ***Water Services and Meters***

Water services are to be installed by the contractor and inspected by the city. Call (360) 342-5071 48 hours in advance. Water meters will be installed by the City when the following have been satisfied:

1) Acceptance of newly installed mains and services by the Construction Inspector including:
    a) Disinfection, flushing, and testing of mains
    b) Submittal and approval of record drawings
2) Payment of required hookup fees and main charges
3) Completion of requirements per the right-of-way permit from the Construction Inspector, which will occur just prior to issuance of the Certificate of Occupancy

*) City personnel will not install the meter if the meter box or its contents is out of compliance with the City's water meter detail

The minimum water service size to be installed shall be ¾ inch in diameter and constructed of a material consistent with "Design Requirements: Water Pipe Materials and Size" Section 1-1.06.

3-2.17 ***Abandoning Water Service***

If an existing meter is to be taken out of service, when the main is not being abandoned, the service shall be abandoned by turning off the corporation stop at the main, followed by cutting and plugging the service just after the corporation stop, and removing the meter set (yoke), angle stop, etc.

3-2.18 ***Hydrostatic Testing***

All sizes of pipe shall be tested hydrostatically as per the requirements of section 7-09.3(23) in the most current version of the *WSDOT Standard Specifications*, or at 200 psi for 30 minutes with no pressure drop.

3-2.19 ***Disinfecting Water Mains***

Disinfection and bacteriological testing of water mains shall conform to the requirements of AWWA C651. Flushing shall be per the requirements of section 7-09.3(24)A in the most current version of the *WSDOT Standard Specifications*. Discharges to the storm system shall be de-chlorinated to a concentration of 0.1 ppm or less, pH-adjusted, if necessary, and volumetrically and velocity controlled to prevent re-suspension of sediments per NPDES Phase II Stormwater Permit S5.C.3.b.ii.

3-2.20 *Preventing Reverse Flow*

Pipelines that have not been disinfected may be connected to the existing distribution system with a pre-tested closed inline valve and only at points approved by the Engineer. The contractor shall supply documentation from the valve supplier certifying that the valve has been pre-tested.

3-3 RESOURCES

American Water Works Association Standards, covering many aspects of water supply, treatment, and distribution.

City of Battle Ground, "Battle Ground Municipal Code Title 13: Water and Sewers," available from Battle Ground's website: *http://www.cityofbg.org*.

City of Battle Ground, Water Standard Details, available from the Engineering Department, City Hall, 109 SW 1st Street, Battle Ground, Washington or the City's website: *http://www.cityofbg.org*.

Ductile Iron Pipe Research Association (DIPRA), Birmingham, Alabama, "Installation Guide for Ductile Iron Pipe," Chapter 5, Restraining Thrusts, and DIPRA computer program, "Thrust Restraint for Ductile Iron Pipe."

Great Lakes Upper Mississippi River Board of State Public Health & Environmental Managers, Recommended Standards for Water Works (also known as 10-State Standards), latest version.

Washington Department of Ecology, Water Quality Program, Publication #98-37 WQ, "Criteria for Sewage Works Design (Orange Book)".

Washington State Department of Health, Environmental Health Programs, Division of Drinking Water, "Water System Design Manual", DOH #331-123, June 1999. Post-1999 revisions are available on: *http://www.doh.wa.gov/ehp/dw/publications/design.htm*.

Washington State Department of Transportation, Standard Specifications for Road, Bridge, and Municipal Construction, M41-10, latest version adopted by the City of Battle Ground.

3-4 WATER STANDARD PLAN DETAIL SHEETS

Standard Plan Description and Numbers

WATER STANDARD DETAILS		
Detail	**Number**	**Latest**
Water General Notes	WA-1.0	9/21/07
Backflow Prevention General Notes	WA-1.1	9/24/07
1" Water Service	WA-2.0	9/24/07
1½" & 2" Water Service	WA-2.1	8/7/07
Compound Water Service	WA-2.2	9/24/07
Fire Hydrant Assembly	WA-2.3	9/24/07
Hydrant Retaining Wall	WA-2.4	4/16/07
Main Line And Valves	WA-3.0	8/7/07
Standard Valve Box And Cover	WA-3.1	4/16/07
Mechanical Restraints	WA-3.2	4/16/07
Typical Trench Backfill And Bedding	WA-3.3	9/24/07
Standard Manual Air Release Valve	WA-4.0	4/16/07
Combination Air Release Valve	WA-4.1	4/16/07
Standard Blowoff Assembly	WA-4.2	9/24/07
Temporary Construction Blowoff Assembly	WA-4.3	4/16/07
Pipe And Casing	WA-4.4	4/16/07
Standard Double Check Valve Assembly (2" & Smaller)	WA-5.0	4/16/07
Standard Double Check Valve Assembly (2.5" & Larger)	WA-5.1	4/16/07
DCVA Installation	WA-5.2	9/24/07
Standard Reduced Pressure Backflow Assembly (2" & Smaller)	WA-5.3	9/24/07
Standard Reduced Pressure Backflow Assembly (2.5" & Larger)	WA-5.4	4/16/07
Standard Fire Protection Backflow Installation Locations	WA-6.0	9/24/07
Single-Family Water Meter/Backflow Installation Locations	WA-6.1	9/24/07
Non Single-Family Water Meter/Backflow Installation Locations	WA-6.2	9/24/07
Testing Schedule	WA-7.0	4/16/07