

**CITY OF BELLEVUE
UTILITIES DEPARTMENT**



WATER ENGINEERING STANDARDS

JANUARY 2026

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CHAPTER W1 - GENERAL REQUIREMENTS

W1-01 GENERAL

These Engineering Standards set forth minimum standards for the planning, design, and construction of water facilities.

The Water Utility Code, part of Chapter 24.02 of the Bellevue City Code, is the basis for these Engineering Standards.

These Standards do not include design of special facilities, such as pump stations or reservoirs. These special facilities require unique design requirements and will be subject to individual review by the Utility.

Although these Standards are intended to apply to physical development within the Utility service area, the Standards will not apply for all situations. Compliance with these Standards does not relieve the designer of the responsibility to apply conservative and sound professional judgment. These are minimum Standards and are intended to assist, but not substitute for competent work by design professionals. The Utility may at its sole discretion due to special conditions and/or environmental constraints, require more stringent requirements than would normally be required under these Standards.

W1-02 DEFINITIONS

The following terms as used in this document shall be defined and interpreted as follows:

“ADA”

Americans With Disabilities Act (ADA) of 1990. 42 USC 12101 et seq with implementing regulations. See ADA Home Page: <http://www.ada.gov>

“Downtown (DNTN)”

That area of Bellevue generally bounded by Main Street, NE 12th Street, 100th Avenue NE, and 112th Avenue NE.

“Contractor”

The person, partnership, firm or corporation contracting to do the work under these Documents. The term shall also include the Contractor's agents, employees and subcontractors.

“Details or Additional Drawings”

All details or drawings prepared to further explain or amplify the plans, or for the revision of the same, all as herein provided.

“Developer”

Any individual, company, partnership, joint venture, corporation, association, society or group that has made, or intends to make, application to the City for permission to construct a water system connection, or extension, to the City's water system.

“Engineer”

The City of Bellevue Utilities Engineer or duly authorized assistants, which includes Chief Engineer, Project Engineer, Consultant Engineer and/or Inspectors.

“Equipment”

The machinery, accessories, appurtenances and manufactured articles to be furnished and/or installed under the Project.

“Material or Materials”

These words shall be construed to embrace machinery, manufactured articles, materials of construction (fabricated or otherwise) and any other classes of material to be furnished in connection with the Project.

“Mixed Use Building,” Multiple Use Building”

A building, or set of buildings with multiple tenant spaces, not including residential-only structures, served by a shared domestic water service. Ex. Strip malls.

“Or Approved Equal”

Any manufactured article, material, method, or work which, in the opinion of the Engineer, is equally desirable or suitable for the purposes intended in these standards as compared with similar articles specifically mentioned herein.

“Plan”

All official drawings or reproductions of drawings made or to be made pertaining to the work provided for in the permit or developer extension agreement.

“Plumbing Code”

The International Plumbing Code as adopted by the COB City Council, together with amendments, additions and exemptions per Municipal Code 23.60.

“Premise Isolation”

A method of protecting the public water system by installation of approved air gaps or approved backflow prevention assemblies at or near the service connection or alternative location acceptable to the purveyor to isolate the consumer's water system from the purveyor's distribution system.

“Project”

The structure or improvement to be constructed in whole or in part.

“Reference Specifications”

Reference specifications shall mean the technical specifications of other agencies incorporated or referred to herein.

“Specifications”

The specifications shall mean the prescribed directions, requirements, explanations, terms and provisions pertaining to the various features of the work to be done, or manner and method of performance. They also include directions, requirements, and explanations as set forth on the plans.

“Standard Details”

City of Bellevue Utilities Department standard detail drawings.

“Standard Specification”

The latest edition of the “Standard Specifications for Road, Bridge and Municipal Construction”, English edition, Washington State Department of Transportation and the American Public Works Association. ~~including all amendments.~~

“Unapproved Auxiliary Supply”

A water supply (other than the purveyor's water supply) on or available to the consumer's premises that is either not approved for human consumption by the health agency having jurisdiction or is not otherwise acceptable to the purveyor. Sites with unapproved auxiliary supplies require premise isolation.

“Words and Phrases”

Whenever the words, “as directed”, “as required”, “as permitted”, or words of like effect are used, it shall be understood that the direction, requirement or permission of the Engineer is intended. The words, “sufficient”, “necessary”, “proper”, and the like shall mean sufficient, necessary or proper in the judgment of the Engineer. The words, “approved”, “acceptable”, “satisfactory”, or words of like import shall mean approved by or acceptable to the Engineer.

“Work”

The work necessary to manufacture and deliver machinery, equipment and material and/or the furnishing of all labor, tools, material, equipment, construction equipment, working drawings, where required, and other, necessities for the construction or erection of the structures shown and called for in the plans, specifications and permit/Developer Extension Agreement, and the act of constructing or erecting said structures complete.

W1-03 REFERENCES

Wherever references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user, the following acronyms or abbreviations which may appear, shall have the meanings indicated herein:

AASHTO	American Association of the State Highway and Transportation Officials.
ANSI	American National Standards Institute, Inc.
WSDOT	Washington State Department of Transportation
APWA	American Public Works Association
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
DOH	Department of Health
IPC	International Plumbing Code
WAC	Washington Administrative Code

W1-04 GOVERNMENTAL AGENCY REQUIREMENTS

All construction on City, County or State roads or right-of-way shall be done in accordance with the agency's standards and requirements and in accordance with the franchise and/or permit requirements. The Contractor is responsible to determine these requirements prior to construction.

Where conflict exists between these Standards and permit requirements, the most stringent requirements shall take precedence.

Metal lids, hatches and manhole covers located in sidewalks, crosswalks or other pedestrian areas must comply with ADA requirements and have a slip resistant surface.

W1-05 THE REDUCTION OF LEAD IN DRINKING WATER ACT

New USEPA Regulations Regarding Lead-free Water System Materials

Effective January 4, 2015

The *Reduction of Lead in Drinking Water Act* was enacted on January 4, 2011, to amend Section 1417 of the *Safe Drinking Water Act*, which covers the use and introduction into commerce of lead pipes, plumbing fittings or fixtures, solder and flux. The *Reduction of Lead in Drinking Water Act* changes the *Safe Drinking Water Act* definition of "lead free." All water system materials installed under this Contract shall comply with revised *Act*. The Contractor shall provide Manufacturer's Certificate of Compliance in accordance with the current edition of the Washington State Standard Specifications for all water system materials to be used. The Certificate must clearly state that the materials furnished comply with "lead-free" requirements of the revised *Safe Drinking Water Act*.

END OF CHAPTER W1

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CHAPTER W2 - PLAN SUBMITTAL**W2-01 GENERAL**

Following these standards to design the water system will help ensure a timely review of the proposed project and keep review costs to a minimum.

W2-02 DEVIATIONS**W2-02.1 General**

The Developer may propose a deviation from the Standards. A non-standard system may take longer to review resulting in increased processing costs. The Developer acknowledges these risks when submitting a non-standard system for review.

W2-02.2 Deviation Criteria

Requests for deviations which are site or project specific shall be reviewed by the Utilities Technical Team. The City's decision to grant, deny, or modify the proposed deviation shall be based upon evidence that the deviation request meets the following criteria:

- A. The change will achieve the intended result through a comparable or even superior design; and
- B. The change will not adversely affect safety and/or operation; and
- C. The change will not adversely affect maintainability.

W2-03 ERRORS AND OMISSIONS

Any errors or omissions in the approved plans or information used as a basis for such approvals may constitute grounds for withdrawal of any approvals and/or stoppage of any or all of the permitted work, as determined by the Utility. It shall be the responsibility of the Developer to show cause why such work should continue and make such changes in plans that may be required by the Utility before the plans are re-approved.

W2-04 PLANS**W2-04.1 General**

Utility plans submitted for review shall meet "Boundary & Topographic Survey" and "Site Plan B" requirements. Current copies of these requirements are available at the City Hall Permit Center. The Utilities representative at the Permit Center will determine which requirements, if any, are not applicable to the proposed project.

W2-04.2 Submittal Standards

Water, sanitary sewer, and storm drainage designs (complete plan and profile) shall be on separate plan sheets, although alignments of all utilities shall be shown on each utility plan. Plan sets for all three utilities can be combined for small projects. Designs for water and sewer can be combined on the same plan sheets if plan scale is 1"=10', 1"=20', or 1"=30'. Contact the Utilities representative in the Permit Center for approval to combine plans.

Site plans shall include:

1. Title Block - Border and title block shall conform to standard City of Bellevue format. Include Section – Township – Range, grid number, and project site address in the lower right-hand corner. See Appendix W-3.
2. Project Name Utility Extension (UE) Permit Number – provide if applicable.
3. Engineering Plans - Plan, and detail sheet(s) for the proposed water system.
 - a. Plan View:
 - i. List pipe length, size, and material alongside of pipe, e.g. 150 L.F. - 8" PVC. Pipe material can be listed in a general note in lieu of listing along pipe.
 - ii. Pipe length is to be based on horizontal distance between appurtenances (e.g. valves, fittings).
 - b. Profile View
 - i. List pipe length, size, and material to 4 decimal places (ft per ft). Pipe material can be listed in a plan note in lieu of listing on profile.
4. Scale - Be consistent and indicate your scale on each sheet using a bar symbol (for plan reproduction integrity). Drawings are to be at a scale of 1"=10', 1"=20', or 1"=30' for combined utility plans. Drawings at 1"=40' or 1"=50' scale shall show utility plans on separate sheets. Architectural scales for utility drawings will not be accepted. If the scale results in more than three pages of plan sheets, a cover sheet showing the entire project site (at a smaller scale) shall be provided.
5. North Arrow - Include on all plan view drawings. Where possible, north arrow shall face up and/or to the right-hand side of plan sheet except as follows:

- a. For gravity mains, plan view drawing orientation shall show downstream-to-upstream going left-to-right on the plan sheet regardless of the resulting north arrow direction.
6. Datum - Show both horizontal NAD-83 (NSRS 2011) and vertical (NAVD 88) control points. Use U.S. Survey Foot basis for measurements.
7. Vicinity Map - Include on the plan for each utility. The vicinity map covers the project site and surrounding streets and property within a minimum of 600' of the site.

Plan submittals shall conform to Development Services "Standards for Plans and Drawings," including the following:

1. Line Types – Use line types that clearly distinguish existing utilities from new; new facilities and call-outs for new facilities should be a heavier line type.
2. Drawing Quality - The drawing should be easy to read, with all lines and letters dark enough to provide good contrast with the paper.
3. Drafting Media - Plans sheets shall be on 24"x 36" or 22" x 34" bond paper.
4. Drafting Standards - Plotting shall be on bond paper with a non-smudging, ink or ink-like media. Pencil drawings (including corrections or alterations) will not be accepted.
5. Drafting Standards/Symbols shall conform to Washington State APWA Chapter CAD Standards. See Appendix W-2. Lettering shall be done with "Leroy-style" font (SIMPLEX font if using AutoCAD).
6. Text Height:
 - a. Text identifying existing features shall be 0.08" in height (Leroy 80 template).
 - b. Text identifying street names shall be 0.24" in height (Leroy 240 template).
 - c. Text for instructions and call outs for proposed facilities shall be 0.12" in height (Leroy 120 template).
7. Stationing - On plans with more than one sheet, stationing shall proceed from left to right or from bottom to top. For gravity mains, station numbers shall increase from downstream to upstream.
8. Copies of Plans - Blueline or blackline prints and photocopies are acceptable. Brownline prints and microfilm copies of plans will not be accepted.

9. Type of Paper for Plan Copies - Blueprint quality or standard drafting paper. Tissue paper, graph paper, poster board, cardboard, and similar materials will not be accepted.

For all water projects, the Developer or City Department responsible for the project shall include the following information on the project plans:

- _____ Horizontal dimensions to within one tenth (0.1') of a foot.
- _____ Rim and invert elevations are labeled to within one one-hundredth (0.01') of a foot (Storm & Wastewater).
- _____ References/dimensions from right-of-way centerline for utility features in the public right-of-way, or from property line for utility features located within easements.
- _____ New assets (pipes, structures, etc.) drawn in bold line type.
- _____ Label slope distance for pipes >20% slope (indicate "Slope Distance")
- _____ Utility Asset Number for the existing structure to which new pipes are connected to (Asset #'s can be obtained from the City's GIS data download webpage)
- _____ Asset ownership changes (e.g. City owned to Private or other agency and vice-versa).
- _____ Easements boundaries, widths and recording numbers.

Water-specific Items:

- _____ Water Mains: Label length (horizontal length, center of fitting to center of fitting), pipe diameter, pipe material, pressure zone, class of pipe, joint restraint type and length (if applicable), thrust block (size and location).
- _____ Private water system components are labeled as "PRIVATE SYSTEM". All private water systems are shown including fire lines and service lines to commercial and multi-family buildings. Note "fire line" (if applicable).
- _____ Valves: Show size, type (GV, BF, PIV, etc.), joint type (e.g. MJ, PO, etc.).
- _____ Fittings: Call-outs are in order, number of each fitting, diameter, joint type (e.g. "2 – 8" 45° bend, MJ")
- _____ Services: Size & location of service is shown, length of service from main to meter.
- _____ Hydrants: Note the distance from foot valve to hydrant.

W2-04.3 Water General Plan Notes

The following is a listing of General Notes that should be incorporated on the first water plan sheet. All the notes on the list may not pertain to every project. The Developer should include only those notes that are relevant to the project and may omit non-relevant

notes.

However, do not renumber the remaining General Notes. If additional notes are needed for specific aspects, they should be added after the General Notes.

Water General Notes:

1. All work shall conform to the current City of Bellevue Water Engineering Standards and the Developer Extension Agreement.
2. All pipe shall be ductile iron class 52 unless otherwise shown.
3. All pipe and fittings not to be disinfected in place per AWWA C651 shall be swabbed with 1% available chlorine solution prior to installation.
4. The new water main shall be connected to the existing system only after new main is pressure tested, flushed, disinfected and satisfactory bacteriological sample results are obtained and received by the City's Inspector. See Standard Detail W-9.
5. After disinfecting the water main, dispose of chlorinated water by discharging to the nearest operating sanitary sewer.
6. Water main shut-downs shall be coordinated with the Water Operations Division for preferred timing during flow control conditions. Water main shutdowns shall not be scheduled to take place on Fridays, or on the five days before nor one day after a City holiday, unless otherwise approved by the Utility.
7. The locations of all existing utilities shown hereon have been established by field survey or obtained from available records and should therefore be considered approximate only and not necessarily complete. It is the sole responsibility of the Contractor to independently verify the accuracy of all utility locations shown, and to further discover and avoid any other utilities not shown here on which may be affected by the implementation of this plan.
8. Deflect the water main above or below existing utilities as required to maintain 3 ft. minimum cover and 12-inch minimum vertical clearance between utilities unless otherwise specified.
9. Wrap all ductile iron pipe and adjacent valves and fittings with 8-mil. polyethylene conforming to AWWA C105.
10. The water main shall be installed only after the roadway subgrade is backfilled, graded and compacted in cut and fill areas.
11. Trench backfill and surface restoration of existing asphalt pavement shall be as required by the right-of-way use permit.
12. All fittings shall be blocked per Standard Details unless otherwise specified.

13. All services shall be 1" x 1" per Standard Details unless otherwise specified. Adaptors for 3/4" meters shall be used where applicable.
14. When working with asbestos cement pipe, the Contractor is required to maintain workers' exposure to asbestos material at or below the limit prescribed in WAC 296-62-07705.
15. Call 1-800-424-5555, or 811, 72 hours before construction for utility locations.
16. Uniform plumbing code requires the installation of privately owned and operated pressure reducing valves where the operating pressure exceeds 80 psi.
17. The Contractor shall use a vacuum street sweeper to remove dust and debris from pavement areas as directed by the Engineer. Flushing of streets shall not be permitted without prior City approval.
18. Before commencement of trenching, the Contractor shall provide catch basin inserts for all catch basins that will receive runoff from the project site. The Contractor shall periodically inspect the condition of all inserts and replace as necessary.
19. Abandonment of existing water services shall be accomplished as follows:
(See W5-29 Abandoning Facilities for other facility abandonment)
 - a. Remove existing service saddle from water main and replace with new stainless steel repair band, Romac SS2, Ford Service Saddle FC101, CC threaded saddle and a CC thread brass plug, or approved equal (will not be required when water main is to be abandoned).
 - b. Remove and dispose of existing setter and meter box.
 - c. Cap or crimp (if copper) existing service line to be abandoned in place, each end.
 - d. Return existing meter to the Utility Inspector.
20. Where new utility line crosses below an existing AC main, the AC pipe shall be replaced with DI pipe to 3 feet past each side of the trench as shown on Standard Detail W-8. Wrap DI pipe and couplings with 8-mil polyethylene conforming to AWWA C105. Alternatively, where directed by the Engineer, the trench shall be backfilled with controlled density fill (CDF, aka flowable fill) from bottom of trench to the invert of the AC main.
21. Avoid crossing water or sewer mains at highly acute angles. The smallest angle measure between utilities should be 45 to 90 degrees.
22. Where water main crosses above or below sanitary sewer, one full length of water

pipe shall be centered for maximum joint separation.

23. At points where existing thrust blocking is found, minimum clearance between the concrete blocking and other buried utilities or structures shall be 5 feet.
24. Workers must follow confined space regulations and procedures when entering or doing work in COB owned confined spaces. Completed Permit must be given to the Utilities inspector prior to entry.
25. Manholes, catch basins and vaults are considered to be permit-required confined spaces. Entry into these spaces shall be in accordance with Chapter 296-809 WAC.
26. When work is to occur in easements, the Contractor shall notify the easement grantor and Bellevue Utilities in writing a minimum of 48 hours in advance of beginning work (not including weekends or holidays). Failure to notify grantor and Bellevue Utilities will result in a Stop Work Order being posted until the matter is resolved to the satisfaction of Bellevue Utilities. A written release from the easement grantor shall be furnished to the Utilities Inspector prior to permit sign-off.
27. The Contractor shall restore the Right-of-Way and existing public utility easement(s) after construction to a condition equal or better than condition prior to entry. Contractor shall furnish a signed release from all affected property owners after restoration has been completed.

W2-05 RECORD DRAWINGS

For all water projects, the Developer or City Department responsible for the project shall provide record drawings at completion of the project.

W2-05.1 General Standards

Record drawings shall be based on field survey information and field measurements. All survey work shall be performed under the supervision of a Professional Land Surveyor registered in the State of Washington.

Record drawing information shall be recorded on the detail, plan and profile views of the approved construction drawings. Incomplete, inaccurate, illegible, or poor-quality drawings will be rejected.

All plan sheets must have a "Record Drawing" stamp block.

W2-05.1(a) General CAD Standards

All AutoCAD "DWG" files are to utilize NAD_1983_HARN_StatePlane_Washington North Zone (FIPS 4601) coordinate system and the City of Bellevue NAVD 1988 vertical datum. Both must state on the drawings as the datums used.

Survey shall be located and field tied to at least three (3) City of Bellevue Survey Control Network monuments. Topographic elevations shall be referenced to City of Bellevue vertical control benchmarks. Survey Control Data Cards and Survey Benchmark Reports are available on-line at <http://www.bellevuewa.gov/surveycontrol/>, or from the Survey staff (425-452-4385).

- Sample Title Block with north arrow, scale, vicinity map, etc. are predefined in Appendix W-3.
- Block names, layer names, colors, and line types are predefined in Appendix W-2.
- All digital line work must be geometrically correct, topologically clean without slivers, dangles, undershoots or inappropriate breaks. Polygon features drawn as polylines must properly close without gaps.
- Each AutoCAD “DWG” file shall be prepared in Model space and UCS must be set to “World” then “Plan”
- XREF's and bound features are not allowed in the final AutoCAD "DWG" file. Each feature shall be a single feature and not merged into a single record.
- The standard insertion scale shall be feet.
- No blocks shall be “exploded”
- The standard text font shall be “Simplex”
- All drawing units shall be English.
- Clearly identify existing and as-built utility CAD files, via file names and/or a table of contents (Word or PDF).
- For multi-site projects, every site shall be included and clearly labeled.
- Remove "bad" data (design features not built and/or notes unrelated to utilities).

W2-05.1(b) Submittals

The AutoCAD files shall include all plans, profiles, notes, and details of the water improvements.

All record drawing sheets must be submitted electronically:

- Digital record drawing files are to be saved in AutoCAD version 2018 or newer and be consistent with the CAD standards in section W2-05.1(a).
- City shall be provided with a minimum of two AutoCAD sets: One comprehensive set containing all data and sheets for the project, and one distilled set containing as few layers as possible with only the utility relevant data (new and existing utilities, parcels, easements). The distilled set shall consist of a single “DWG” file per utility or a single “DWG” file with all new utilities.
- CAD and PDF shall contain the same as-built utility data geometry.
- The as-built set shall be formatted and submitted as a full-size (22” x 34” or 24” x 36”) PDF file. PDF shall include all sheets from the original submittal in addition to all sheets with marked up as-built info.

W2-05.2 Required Information

All Record Drawings shall include the following:

- _____ Horizontal locations are recorded to within one tenth (0.1') of a foot.
- _____ References/dimensions from right-of-way centerline for utility features in the public right-of-way, or from property line for utility features located within easements.
- _____ Profile view notes any changes from the design finished grade over each pipe line.
- _____ Label slope distance for pipes >20% slope (indicate "Slope Distance"
- _____ Changes to design attributes (elevations, pipe lengths, etc.) struck through or crossed out and new information relabeled in bold font.
- _____ Cross out items not built.
- _____ New assets (pipes, structures, etc.) drawn in bold line type.
- _____ Utility Asset Number for the existing structure to which new pipes are connected to (Asset #'s can be obtained from the City's GIS data download webpage)
- _____ Asset ownership changes (e.g. City owned to Private or other agency and vice-versa).
- _____ Consistency between plan, profile, and details (ensure all three are updated).
- _____ Installation year shown on cover sheet (last year of construction for project).
- _____ Show all details for connections to existing assets.
- _____ No CAD artifacts present (e.g. annotation stored as comments).
- _____ All as-built annotations are included (e.g. ownership, materials and sizes, elevations, etc.).
- _____ Final easement(s) boundary, width, type (public or private), and recording number.

Water-specific Items:

- _____ Water Mains: Label length (horizontal length, center of fitting to center of fitting), diameter, material, pressure zone, class of pipe, joint restraint type and length (if applicable), thrust block (size and location), depth, whether new main crosses over or under new or existing main (if applicable).
- _____ Private water system components are labeled as "PRIVATE SYSTEM". All private water systems are shown including fire lines and service lines to commercial and multi-family buildings. Note "fire line" (if applicable).
- _____ Valves: Show size, type (GV, BF, PIV, etc.), joint type (e.g. MJ, FL, etc...).
- _____ Insertion Valves: Show size, joint type, manufacturer.
- _____ Fittings: Call-outs are in order, number of each fitting, diameter, joint type (e.g. "2 – 8" 45° bend, MJ")

Services: Size is shown, length from main to meter, setter type (e.g. vertical, horizontal, low bypass), meter box model (e.g. Olympic SM30), and the type of connection to the main (direct tap or saddle).

Hydrants: Note the distance from foot valve to hydrant, depth of bury at the hydrant (e.g. “5’ bury”), name of hydrant manufacturer.

END OF CHAPTER W2

CHAPTER W3 - WATER PLANNING/DESIGN STANDARDS**TABLE OF CONTENTS**

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CHAPTER W3 - WATER PLANNING/DESIGN STANDARDS**W3-01 PLANNING CRITERIA****W3-01.1 Serve to Extreme of Property**

Ensure adjacent properties can be provided water service (extend to extreme of property with adequate capacity and pressure).

W3-01.2 Demand Projections

Demand projections are taken from Water System Plan (WSP).

A. Unit Demands

Single Family - 84 Gallons per Capita per Day (GPCD)

Multi-family - 75 GPCD

Commercial - 32 GPCD

Hotel/Motel - 50 GPCD

B. Population Densities

2.80 people per single family unit

1.90 people per multi-family unit

1.5 people per hotel/motel room

C. Peaking Factors

Maximum Day Demand (MDD) = Average Day Demand (ADD) x 2.2

Peak Hour Demand (PHD) = MDD x PF_{summer} (varies by land use; see WSP)

W3-01.3 System Parameters

A. Water velocity in mains - velocities shall not exceed 10 feet per second during highest demand including fire flow.

B. Distribution System Pressures (Measured at ground elevation at the customers meter):

Desirable	Minimum 50 psi
	Maximum 80 psi

Allowable Minimum 43 psi
 Maximum 125 psi

Minimum 30 psi is allowed for existing systems.

Individual pressure reducing valves are required on all domestic services when water pressure exceeds 80 psi.

During fire suppression events, the water system must be able to provide 20-psi minimum pressure at ground level at all points throughout the distribution system. The water system must be able to provide this minimum pressure under fire-flow conditions plus the MDD rate when all equalizing and fire flow storage is depleted (WAC 246-290-230(6)).

- C. Reservoir Replenishment - Facilities (i.e. transmission mains, pump stations) shall be sized to enable storage facilities to be refilled within 3 days after an emergency or major fire.

W3-01.4 Fire Flow Requirements

Fire flow requirements shall be as determined by either City of Bellevue or King County Fire Marshal.

- A. The Utility will determine available fire flow using its computer simulated model.
- B. Minimum system pressure during fire flow analysis is 20 psi at all service connections and 5 psi where there are no service connections.

W3-02 GENERAL DESIGN STANDARDS

- A. Each fitting/valve shall have attachment type listed (e.g. FL, MJ, FL x MJ, etc.).
- B. List pipe length (from center-of-fitting to center-of-fitting), size, and material alongside of each pipe, e.g. 150 L.F. - 8" D.I. Pipe material can be listed in a general note in lieu of listing along each pipe.
- C. Indicate type of pavement restoration required by right-of-way authority having jurisdiction (if working in existing streets).
- D. Dimension existing and new main locations from right-of-way line and/or property line, or label stations and offsets.
- E. Blocking - Reference Standard Details
- At vertical bends, pipe shall be restrained a minimum of 36 feet (2 joints) from each side of bend. Reduced-size concrete blocks

shall be installed at bends per Standard Detail W-2. No change in pipe direction or diameter shall occur within 36 feet of the vertical bend. In addition, bends, tees, reducers, etc., beyond the 36-foot limit, shall be restrained with standard blocking per Standard Detail W-1 and W-3. Where these criteria cannot be met, plans should call for vertical blocking without joint restraint per Standard Detail W-3, or a restraint method should be designed and detailed on the plan.

- Check if special blocking or joint restraint designs are necessary (e.g. poor soil, conflicting utility, etc.).
 - Show all blocking on any detail drawing that shows vertical bends.
 - See Appendix W-4 - Approved Materials List for joint restraint methods, other than concrete blocking.
- F. Check if system may require additional looping (i.e. eliminate dead end lines).
- G. To assure compatibility with existing systems, check with Utilities Development Review section to determine hydraulic gradients.
- H. Drawings shall reference distance to nearest existing valve and/or hydrant from new point of connection to existing water main.
- I. Check with local jurisdiction for necessary permitting requirements.
- J. Provide temporary 2" blow off assemblies for testing and disinfection of new water mains (where hydrants are not available). Place blow-off at high end of line, where possible.
- K. Cap end of existing water lines to be abandoned as follows:
- Asbestos cement lines: use end cap coupling.
 - Cast or ductile iron lines: use MJ cap or plug.
- L. Minimum water main size
- 8" minimum when serving fire hydrants.
 - 6" minimum may be used in localized conditions where fire hydrants are served by looped lines, subject to Utility approval.

- 4" minimum shall be used to serve water to end of cul-de-sac when no future extension is required.
- M. Pressure reducing station plans should show location of pressure relief discharge pipe and discharge point of floor drain piping (drain to daylight). Pressure relief discharge pipe shall be shown at a location that will not be subject to damage or erosion during discharge of water.
- N. All water vaults (water service, backflow assembly, pressure reducing station, etc.) shall include designs for floor drain piping draining to daylight, or, if daylight is not feasible, to the storm system. Discharge point of vault floor drains shall be shown on the plan. Where vault floor drain cannot drain to daylight or the storm system, consult with the Utility during project design review to determine the best alternative.

Exception: Outside-installed Reduced Pressure Backflow Assemblies (RPBA) shall be installed in above ground enclosures. The following drain requirements shall apply to enclosures. RPBA shall not be installed in vaults. Each enclosure design shall be as approved by the Utility. Floor drains for RPBA shall not connect to closed storm drain systems. All RPBA enclosures shall be provided with a bore sighted daylight drain. This bore sighted drain to daylight shall be clearly visible end to end, sized to meet the flow requirements of the RPBA relief vent.
- O. Placement of surface appurtenances (manhole lids, water valve lids, etc.) in tire track of traffic lanes shall be avoided whenever possible. Meter vaults shall be located outside the sidewalk whenever possible.
- P. Service connections or water utility distribution system piping shall not be used for grounding of electrical systems or for the maintenance, integrity or continuity of any grounding attachment or connection.
- Q. Manufacturer's certification of testing and accuracy shall be provided for all commercial meter installations larger than 2-inch diameter.

W3-03 VALVING

- A. Maximum valve spacing shall be 200 feet in commercial and multi-family areas, and 600 feet in all other areas, or as necessary as identified by the Engineer.
- B. Provide a valve at each end of an easement.
- C. At water main intersections, valves shall be placed on 4 out of 4 legs at each cross, and 3 out of 3 legs at each tee.
- D. For all fire service connections greater than 3 inches in diameter, isolation valves shall be installed on all legs of the tee. Tapping Tees are not allowed for fire service connections greater than 2 inches in diameter.

- E. For all domestic water service connections greater than 2 inches in diameter, isolation valves shall be installed on all legs of the tee. Tapping Tees are not to be used for domestic service connections greater than 2 inches in diameter.
- F. Additional valving may be required for area isolation.
- G. The Utility may, at its discretion, reduce the number of valves required for any one connection given the proximity of other valves in the vicinity.
- H. Combination Air/Vacuum with vacuum check valves shall be installed at local high points in the water main, as directed by the Utility.

W3-04 FIRE HYDRANTS

The following information is provided as a guideline to be used during design. The final number of hydrants and their location shall be approved by the City of Bellevue or King County Fire Marshal.

- A. Guard posts are to be used where fire hydrants are subject to impact by a motor vehicle in low-speed situations, such as in parking lots when no curbs are present, or in exposed areas in parking lots.
- B. Fire line/hydrant run over 50' in length must be 8" (terminate with tee, plug and hydrant assembly).
- C. Fire hydrant location:
 - Single-family residential: Spacing = 500' apart. Coverage = 250' from front property line of the main body of a lot.
 - Multi-family/commercial: As determined by the fire marshal.
 - Exceptions:
 - On arterial streets without residential access (through traffic only), maximum hydrant spacing shall be 1000'.
 - On dead-end streets, reduce single-family residential spacing to be 400' apart.
- D. A 3' minimum clearance shall be provided around outside of hydrant for operation. Provide 5' horizontal clearance from the outside of the hydrant to concrete walls, structures, utility poles and above grade electrical enclosures.
- E. Where feasible, fire hydrants shall be installed on the same side of the street as the water main.
- F. Private Fire Hydrants:

When a fire hydrant is to be installed on commercial, multi-family and institutional property, outside of the right-of-way or designated public water utility easements, and the fire hydrant is intended to provide fire protection for only that property, the fire hydrant and the water line serving the fire hydrant shall be privately owned and maintained by the benefiting property owner. Such water line and fire hydrant are considered to be part of the benefiting property's fire protection system and shall be designated on the approved construction drawings and the Utility's record drawings as "PRIVATE" or "PVT".

The private water line that serves the private fire hydrant and/or the fire sprinkler system shall be owned by the benefitting property owner beginning immediately downstream of the valve where the private water line connects to the public water main.

The private fire hydrant and private water line (fire protection system) shall be designed and constructed in accordance with the fire hydrant and water main standards set forth in the Utilities Engineering Standards. No domestic, irrigation or industrial water services shall be connected to the fire protection system.

The benefiting property owner shall have responsibility for all maintenance, repair, annual testing and flushing of the fire protection system in accordance with the fire system maintenance standards set forth by the Fire Department. At the time of permit issuance, the property owner/applicant shall execute a Private Fire Hydrant System Indemnification and Hold Harmless Agreement acknowledging that the property owner/applicant shall be responsible for the proper maintenance and repair of the fire protection system.

If the fire protection system is contributing to a water quality issue, the property owner/applicant may be required to conduct more frequent flushing of the fire protection system or install a backflow assembly, at the discretion of the Utility.

W3-05 PIPE CLASS / PROTECTION / COVER

- A. Pipe shall be ductile iron, class 52.
- B. Ductile iron pipe shall be encased in a steel or ductile iron casing when crossing under improvements where the ability to remove and replace pipe without disturbance to the improvement is needed. Casings are required when:
 - Crossing under rockeries over 4' high.
 - Crossing under retaining wall footings over 4' wide.
 - Crossing under reinforced earth retaining walls (both wall and reinforcing material).

Casings shall extend a minimum of 5' past each edge of the improvement, or a distance equal to the depth of pipe whichever is greater. The carrier pipe shall be supported by casing spacers, where casing length exceeds 10'.

Minimum clearance between bottom of rockery and top of pipe or casing shall be 2'. The trench shall be backfilled with crushed rock.

C. Water main depth of cover (measured from final grade):

	8" Diameter and Smaller (all locations)	10" Diameter and Larger		
		with Gate Valves	with Butterfly Valves	Without valves ¹
Minimum Depth of Cover ²	3'	4'	3'	3'
Maximum Depth of Cover ³	6'	6'	6'	6'

1. See W3-03 for minimum valving requirements.
2. See exception in W3-05.D below.
3. Where maximum depth shown is not feasible, deeper pipe may be approved at the discretion of the Utility. Mitigation to ensure access or redundancy may be required.

D. Building setback requirements:

- 5' minimum from covered parking to water main.
- 10' minimum from building (and retaining walls, vaults, etc.) to water main.
- 20' minimum easement shall be provided between buildings.
- When passing between buildings which are 25' apart or less, ductile iron pipe shall be installed with 2' of pipe cover (5' beyond the limits of each building).

E. All ductile iron pipe and adjacent fittings shall be encased in 8-mil polyethylene per AWWA C105.

F. All pipe, fittings and hardware immersed inside water reservoirs shall be stainless steel.

G. See W3-10 for service line casing requirements.

W3-06 CLEARANCES/OTHER UTILITIES

- A. All clearances listed below are from edge-to-edge of each pipe.
- B. Not Used.

- C. Check for crossing or parallel utilities. Maintain minimum vertical and horizontal clearances. Avoid crossing at highly acute angles (smallest angle measure between utilities should be between 45 and 90 degrees).
- D. At points where thrust blocking is required, minimum clearance between the concrete blocking and other buried utilities or structures shall be 5 feet.
- E. Horizontal clearances from water system:
- | | |
|-------------------------|-----|
| Cable TV | 5' |
| Gas | 5' |
| Power | 5' |
| Storm | 10' |
| Sanitary | 10' |
| Telephone, Fiber Optics | 5' |
- F. Vertical clearances from water system:
- | | |
|-------------------------|----|
| Cable TV | 1' |
| Gas | 1' |
| Power | 1' |
| Storm | 1' |
| Sanitary | 2' |
| Telephone, Fiber Optics | 1' |
- G. Not Used.
- H. Where water main crosses above or below sanitary sewer, one full length of water pipe shall be used with the pipes centered for maximum joint separation. Washington Department of Ecology criteria will also apply.
- I. Send letter and preliminary plan to existing utilities to inform them of new construction. Request record drawings and incorporate into plans. At a minimum the following utilities should be contacted:
- | |
|-------------------------|
| Cable Television |
| Natural Gas |
| Power |
| Sanitary Sewer |
| Storm Drainage |
| Telephone, Fiber Optics |
- J. Draft plans shall be sent to the above listed utilities to allow coordination of projects.
- K. Seattle Public Utilities Transmission Pipelines: See Appendix W-5, Water Works Reference Standards; *Standards for Utilities Installed in Proximity of Seattle Public*

Utilities Transmission Pipelines.

- L. If the minimum vertical distance between utility pipes is less than 6-inches and such installation is approved by the Utility, a pad shall be placed between the pipes. The pad shall be O.D. x O.D. x 2.5 inches thick minimum or as required to protect the pipes. Above O.D. is equal to the outside diameter of the larger pipe. The pad shall be a polyethylene foam plank (Dow Plastics Ethafoam™ 220) or approved equal. Additional measures may be necessary to ensure system integrity and may be required as evaluated by the Utility on a case-by-case basis.

W3-07 SLOPES

- A. Vertical bends shall be used when joint deflection would exceed one-half of pipe manufacturer's recommended maximum deflection.
- B. Pipe joints shall be restrained where slopes are 20% or greater. Joint restraint on slopes shall be Megalug™ restrainer for mechanical joint fittings and stainless-steel bell clamp assemblies for DI push-on joints, or other methods from approved materials list.

Anchor blocks per Standard Detail shall be used in conjunction with joint restraint where slopes are 20% or greater.

- C. Timber baffle/hill holders shall be required on unpaved slopes that exceed 20%, minimum spacing shall be 20 feet on center.

W3-08 CONNECTIONS TO EXISTING SYSTEM

- A. Connections to existing water mains shall be via a cut-in tee unless otherwise approved by the Utility.
- B. Where cut-in tee connection is made, two (2) in-line gate valves shall be installed, unless otherwise approved by the Utility.
- C. Water mains may be tapped using stainless steel, Mueller-type tapping tee, or ductile iron mechanical joint tapping tees with outlet flange, *when authorized in writing by the Utility*. If a "wet" tap is authorized, it shall be a minimum of one pipe size smaller than the existing main.
- D. Size-on-size tapping tees are not allowed, unless a shell cutter, one size smaller than the existing water main, is used.
- E. Tapping Tees or sleeves are not allowed in commercial and multi-family areas.
- F. In commercial and multi-family areas, 3-inch domestic service and fire service lines shall connect to the existing water main with 4-inch pipe and 4-inch gate valve sizes. No tapping tees or sleeves are allowed.

- G. Any property owner who plans to demolish or remove any structure connected to the public water system shall notify the Utility and complete a Utility Abandonment form prior to the commencement of such work. The Utility will determine whether the water service can be reused (if sufficiently sized for the new use). If the Utility determines that the water service cannot be reused, the property owner must pay for abandonment (2 inches or less in diameter) or upgrade of the water service (3 inches and larger) through a water service application or through a water system extension agreement for new site improvements. (Ord. 4751 3, 1995)
- H. Do not connect water system to private sewer pump stations.

W3-09 EASEMENTS

- A. Show easements on plans and identify width.
- B. Show easements on all private property. If easement is defined as a constant width on each side of water main, then show a segment of the easement and label as “Typical” (typ).
- C. All new easements shall be a minimum of 15 feet in width, unless otherwise approved or required by the Utility.
- D. A 20-foot minimum easement shall be provided between buildings.
- E. Also see Section W3-05D, “Building Setback Requirements”.
- F. Easement Documentation Requirements:

All easements shall be shown on the project plans and identified as “private” or “public”, together with the width dimension and utility use, e.g. *20’ Public Water Utility Easement*.

All documents for public easements shall conform to these Utilities Engineering Standards, will be provided on the City’s easement template and shall comply with King County Recorder’s Office formatting requirements. Include the King County tax parcel number(s), site address, owner names and site legal description. All pages must be numbered. Sheets shall be 8-1/2” by 11” or 8-1/2” by 14”. Margins and font size must conform to King County recording format requirements.

Easements shall be dedicated to and approved by the City prior to acceptance of a public utility system. The Grantee shall be the “CITY OF BELLEVUE, a Washington municipal corporation, its heirs, successors and assigns”. The City may require indemnification agreements to hold the City harmless where maintenance access across private property is deemed necessary.

The description contained within the easement document shall be prepared and stamped by a professional land surveyor licensed in the State of Washington. The

description shall be identified as an Exhibit, together with the title of the utility use, e.g. *Permanent Public Water Utility Easement*. The description shall be clearly written and referenced to the underlying property. The description shall be accompanied by an additional graphic Exhibit which depicts a scaled drawing of the easement location relative to the subject parcel.

Off-site easements shall be delivered to the Utility prior to issuing a Notification to Proceed with construction. Submittal of on-site easements may be delayed until completion of construction improvements.

Bills of Sale for all utility facilities appurtenant to public easements or tracts shall be given to the City.

W3-10 SERVICES

- A. Minimum allowable water service size is 1" x 1". Verify that minimum system pressure can be maintained when the service is operating at anticipated maximum flow. If friction losses are expected to reduce pressure below the minimum at the building, increase the service line size as needed.
- B. Show location of water services on plan and indicate size. Sizes shall be determined by the Developer per the International Plumbing Code. Water meter boxes and vaults shall not be designed or constructed in parking lot stalls, driveways or other locations where vehicles will park or unload or where maintenance access will be impaired as determined by the Utilities Department.
- C. For commercial and multi-family developments, fire and irrigation services shall each have a separate water main connection and service line. For single family dwellings, fire and irrigation services are not required to have separate water main connections.
- D. Static service pressures at ground floor elevation shall be determined at all lots/buildings to ensure compliance with system pressure standards (W3-01.3).
- E. Plan shall identify lots/buildings where builder/owner should install individual pressure reducing valves. Required on customer side of service lines (after water meter box) when service pressures exceed 80 psi.
- F. 3" through 8" domestic service installations shall include full-size bypass per Standard Details.
- G. For commercial and multi-family projects, all domestic and irrigation services 1 1/2" and larger shall connect to an existing water main with a cut-in tee and include a gate valve on each leg of the tee unless otherwise approved by the Utility. Tapping tees or sleeves are not allowed in commercial and multi-family areas unless otherwise approved by the Utility.
- H. All new mixed-use buildings shall have separate domestic meters for the multi-family portion and the commercial portion of the building.

I. If a property owner needs a larger size service, the property owner is responsible for up size and abandonment of existing connection(s).

J. Service lines shall be encased in a PVC casing when crossing under improvements where the ability to remove and replace service line without disturbance to the improvement is needed. PVC casings are required when:

- Crossing under rockeries or retaining walls

PVC casings shall extend a minimum of 2' past each edge of the improvement, or a distance equal to the depth of service line, whichever is greater.

Minimum clearance between bottom of rockery and top of casing shall be 2'. The trench shall be backfilled with crushed rock.

PVC casing sleeves shall be Schedule 40, sized minimum 2" nominal diameter larger than the service line size (e.g. 3" sleeve for 1" service line). Joints shall be threaded or glued.

K. If a property requests disconnecting of an existing water service for demolition, the existing service will be evaluated for potential reuse by O&M. Existing 3/4" services must be abandoned, and a new standard 1" x 1" service shall be installed under a water service permit. Reconnection to substandard service lines is not permitted. The existing meter size shall be evaluated by a licensed plumber.

W3-11 BACKFLOW PREVENTION

Per City Code 24.02.190, irrigation systems, fire sprinkler systems, and other water uses which may or will cause the contamination of the potable water supply by backflow, shall be required to install approved backflow prevention assemblies, and/or otherwise meet the requirements of the WAC 246-290-490 "Cross Connection Control Regulation in Washington State", and the recommendations of the PNWS-AWWA Cross Connection Control Manual, latest edition. Requirements may include premise isolation, point of use protection, or a combination. All backflow prevention assemblies installed shall be on the Washington State DOH list of approved backflow prevention assemblies, most recent edition at the time of installation, and shall be installed as approved by Washington State Dept. of Health and as shown in the Standard Details.

Reduced Pressure Principle Backflow Assembly (RPBA) installations that differ from the Standard Details W-46, W-47 and W-48 must be approved by the Cross Connection Program Administrator (425-452-5208), and will be reviewed on a case-by case basis to ensure current minimum requirements for installation and freeze protection are met.

Satisfactory testing shall be completed upon installation, repair, or relocation of all backflow assemblies, and annually thereafter. A completed test report must be submitted to the Utility or Plumbing Inspector of record prior to final acceptance.

Fire system connections to the Utility's water system shall be owned and maintained by the property

owner, beginning immediately downstream of the gate valve where the fire system connects to the Utility's water main.

The backflow prevention assembly on fire system connections shall be located as close to the serving water main as possible, no more than 50 feet from the water main without prior Utility approval, either on the owner's property or an easement dedicated to the owner's property. A Double Check Detector Assembly is required on all fire systems that are 3" and larger (applies to both interior and outside assemblies).

Interior backflow prevention, when permitted, must meet the International Plumbing Code requirements as administered by the Building Division, and must also meet the requirements of the Bellevue Utilities Department.

Premise isolation at the water meter by an approved air gap or a reduced pressure backflow assembly is required for all sites utilizing an auxiliary supply (i.e. on-site well, pond, lake-front home, etc.) regardless of whether or not there is a cross-connection between the auxiliary and potable water system.

All multiple use buildings are required to have a Reduced Pressure Backflow Assembly for premise isolation.

W3-12 LANDSCAPE WATER BUDGETING REQUIREMENTS

As required by Bellevue City Code, section 24.02.205 (Water Code), new or redeveloped landscapes shall comply with the following Landscape Water Budgeting Requirements methodology.

W3-12.1 General Irrigation Water Budgeting Information:

- A. Landscape Water Budgeting is a two-step process: First, the maximum amount of irrigation water the landscape can be designed to use must be determined. This is called the Irrigation Water Budget (IWB). Second, the total amount of irrigation water needed to sustain the landscape design must be estimated. This is called the Total Estimated Water Use (TEWU). The landscape design's TEWU may not exceed its IWB.
- B. The IWB must be reported on the Utilities Department's "Irrigation Water Budget Form". The TEWU must be reported on the "Total Estimated Water Use Form". These two forms, together with a copy of the "Water Efficient Landscape Design Certification" must be submitted to, and approved by, the Utility prior to installation of the landscape.

W3-12.2 Determining the Landscape's Irrigation Water Budget & Total Estimated Water Use

- A. A landscape design's IWB shall be calculated based upon the total square footage of the proposed landscape area, excluding retained native vegetation areas and

impervious surfaces, using the following formula:

$$IWB = ET \times AF \times LA \times CF$$

IWB: Irrigation Water Budget allowed.

ET: Evapotranspiration Rate of 14.49 inches (per irrigation season, see Section W3-12.3).

AF: Adjustment Factor of 0.8 (0.5/0.625 irrigation efficient).

LA: Landscape Area in square feet.

CF: Conversion Factor of 0.62 (inches to gallons per square foot).

- B. A landscape design's TEWU shall be calculated by determining the Estimated Water Use (EWU) for each hydrozone (reference Irrigation System Design requirements, Section I), and adding the EWU for all landscape hydrozones together. The sum of the EWU for all hydrozones is the landscape's TEWU. The following formula shall be used to determine the EWU for each hydrozone:

$$EWU = (ET \times PF \times HA \times CF) / IE$$

EWU: Estimated Water Use (for each hydrozone)

ET: Evapotranspiration Rate of 14.49 inches (per irrigation season, see Section W3-12.3).

PF: Plant Factor value for hydrozone (see Section W3-12.4).

HA: Hydrozone Area in square feet.

CF: Conversion Factor of 0.62 (inches to gallons per square foot).

IE: Irrigation Efficiency value for hydrozone (see Section W3-12.5).

W3-12.3 Evapotranspiration Data For The Puget Sound Lowlands Region

Landscape design's IWB, TEWU, and hydrozone EWU shall be based upon the following evapotranspiration (ET) data which represents historical monthly net irrigation requirements for turf grass typically used in commercial landscapes. The ET data is in inches per month for the Puget Sound Lowlands Region, and is based upon the 30-year average of National Weather Service data:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
.00	.00	.00	.00	1.59	3.13	4.46	3.51	1.77	.03	.00	.00	14.49

W3-12.4 Plant Factor Values For Hydrozone EWU Calculations

PF values represent the percentage of ET demand a particular plant species, or hydrozone, has in comparison to turf grass. In other words, if a particular plant species has only one-half the water demand per square foot that turf grass does, it would be assigned a PF value of 0.5.

- A. The PF values in Section W3-12.4.B shall be used for all plant species selected for use in a landscape. The landscape designer shall, based upon professional experience, assign a PF value to each plant species designed within a hydrozone. The PF for the hydrozone shall be that of the plant species with the highest PF within the hydrozone, accounting for:
1. Each plant species' typical water needs in an appropriate planting (i.e.: a plant which is best suited to sandy soils with partial shade and well suited to the Puget Sound climate and is in fact designed/planted in partial shade and sandy soil (appropriate plant placement) would typically be either a (select one) low, medium, or highwater use plant).
 2. Conditions which may decrease or increase a plants water needs, such as improper exposure, soil conditions, density of planting, adaptability to area's climate, etc.

B. **Plant Factor Chart**

Plant Factor values assigned shall reflect the plant species actual water demand as planted according to the final landscape design/plan.

EXAMPLE: A hardy rhododendron planted in a near native state (shade to partial shade, with rich, moist soils) could be assigned a PF of between 0.0 to 0.3. However, the same plant, if planted in poor soils, with full exposure to sun in the middle of a parking lot, should likely be assigned a PF between 0.7 and 1.0.

BASIC PLANT FACTOR CLASS	PF RANGE
Low water use plants	0.0 to 0.3
Medium water use plants	0.4 to 0.6
High water use plants	0.7 to 1.0
All irrigated turf grass	0.8 to 1.0

W3-12.5 Irrigation System Efficiency Values

Irrigation system efficiency values shall be assigned as follows in calculating the Estimated Water Use for each hydrozone of a landscape:

Type of Irrigation System Used in Hydrozone	Efficiency Value
Conventional Overhead Spray System: (i.e.: rotors and pop-up spray systems; most commonly used to irrigate turf, but also used in plant beds)	0.625
Low Volume or Drip Irrigation System: (i.e.: micro-spray, bubbler, drip, or other low volume systems which apply water below the ground surface, or directly to the plants root zone; most commonly used in plant beds)	0.925

W3-12.6 Landscape Water Budgeting Certification & Forms

The “Water Efficient Landscape Design Certification”, “Irrigation Water Budget Form”, and “Total Estimated Water Use Form” on the following pages shall be used in calculating and reporting the landscape’s IWB, TEWU, and EWU, and to certify that the landscape has been designed in compliance with the requirements of Bellevue City Code 24.02.205 and these Engineering Standards.

WATER EFFICIENT LANDSCAPE DESIGN CERTIFICATION

Project Name: _____

Project Address: _____

Project Owner
or Manager _____
(Company Name)_____
(Contact Name)_____
(Street Address)_____
(City, State, Zip)_____
(Phone)Landscape Design
Contact _____
(Company Name)_____
(Contact Name)_____
(Street Address)_____
(City, State, Zip)_____
(Phone)

The landscape design/plans for the above stated project have been verified by a qualified designer to be in compliance with Bellevue City Code 24.02.205 “Landscape Water Budgeting Requirements” (Water Code).

(Landscape Designer’s Signature)_____
(Approval Signature)_____
(Printed Name)_____
(Date)_____
Bellevue Utilities Department (Date)

IRRIGATION WATER BUDGET FORM

Project Name: _____

Project Address: _____

IWB Formula: $IWB = ET \times AF \times LA \times CF$

IWB: Irrigation Water Budget
ET: Evapotranspiration Rate (14.49")
AF: Adjustment Factor (0.8)
LA: Landscape Area (Square Feet)
CF: Conversion Factor (0.62)

IWB Formula in Simplest Terms: $IWB = 7.18704 \times LA$ Landscape Area: _____ Square Feet x 7.18704
=

IRRIGATION WATER BUDGET: _____ GALLONS

TOTAL ESTIMATED WATER USE: _____ GALLONS

Enter Total Estimated Water Use from Estimated Water Use Form. Total Estimated Water Use Form must accompany Irrigation Water Budget Form. Total Estimated Water use may not exceed Irrigation Water Budget.

TOTAL ESTIMATED WATER USE FORM

Project Name: _____

Project Address: _____

EWU Formula: $EWU = ET \times PF \times HA \times CF / IE$

EWU: Estimated Water use (per hydrozone)

ET: Evapotranspiration Rate (14.49")

PF: Plant Factor (as determined for hydrozone)

HA: Hydrozone Area (in Square Feet)

CF: Conversion Factor (0.62)

IE: Irrigation Efficiency (Either 0.625 or 0.925)

EWU Formula in Simplest Terms When IE = 0.625: $EWU = 14.374 \times PF \times HA$ EWU Formula in Simplest Terms When IE = 0.925: $EWU = 9.712 \times PF \times HA$

Hydrozone	HA in Square Feet	Hydrozone Average PF	Hydrozone Irr. Eff. 14.374 OR 9.712		EWU
_____	_____	_____	_____	=	_____
_____	_____	_____	_____	=	_____
_____	_____	_____	_____	=	_____
_____	_____	_____	_____	=	_____
_____	_____	_____	_____	=	_____
_____	_____	_____	_____	=	_____
_____	_____	_____	_____	=	_____
_____	_____	_____	_____	=	_____
_____	_____	_____	_____	=	_____
_____	_____	_____	_____	=	_____
TOTAL SF:	_____		TOTAL EWU:		_____

(Attach additional forms if necessary)

W3-13 IRRIGATION SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

The requirements of this section shall apply to all proposed new or re-developed irrigation systems that will be connected to the public water system, except that the requirements do not apply to the following:

- A. Single family residences, provided, that community area landscaping installed by the developer is not exempt.
- B. Any project with a total landscaped area of less than 500 square feet. If a project is phased, the total landscape area includes all phases.

W3-13.1 General Irrigation System Design Requirements Information

- A. Irrigation systems shall be designed and constructed in such a manner that separate hydrozones within the landscape can be irrigated according to the individual watering needs of the hydrozone. Hydrozones are groupings of plant species used in the landscape which have similar irrigation watering needs (reference “Landscape Water Budgeting Requirements” Section W3-12.2.B and W3-12.4.A & B). Hydrozones of turf grass shall always be irrigated separately from other landscape hydrozones.
- B. Irrigation systems shall be designed and constructed in such a manner that a minimum average distribution uniformity of 0.625 is achieved.
- C. Copies of the “Water Efficient Irrigation System Design Certification”, Irrigation Water Budget Form, and Total Estimated Water Use Form must be submitted to, and approved by, the Utility prior to construction of the irrigation system.
- D. An “Irrigation System Certification” must be submitted to, and approved by the Utility prior to Utility final acceptance of the project.
- E. Location Restrictions:
 - 1. Only low volume irrigation systems may be installed in landscape strips less than five feet wide or in any parking lot landscape.
 - 2. Irrigation systems shall not be installed in turf strips less than five feet wide; in areas of turf where slopes exceed 3:1; in landscape berms exceeding a slope of 1:1; or in turf areas in right-of-way medians, curb strips or parking lots, with the exception that in right-of-way medians and curb strips, up to five percent of the landscape may be irrigated turf so long as all other requirements are met and the turf provides a functional use for pedestrians.

W3-13.2 Irrigation System Design, Operation & Performance Requirements

- A. Irrigation systems shall be designed with provisions for winterization by providing either:
 - 1. Manual drains (automatic valves are not permitted) at all low points, or
 - 2. Means to blow out irrigation system pipes with pressurized air.
- B. Irrigation systems shall be designed to avoid runoff, low-head drainage, overspray, or other similar conditions where irrigation water flows onto adjacent property, non-irrigated areas, or impervious surfaces by:
 - 1. Considering soil type infiltration rates.
 - 2. Using proper irrigation equipment and schedules, including such features as repeat cycles and matched application and infiltration rates, and
 - 3. Considering special problems posed by irrigation on slopes, in median strips, and in narrow hydrozones.
- C. Irrigation system shall be designed to include an automatic rain shut-off device.
- D. Irrigation system designs shall include a written irrigation system management plan which includes:
 - 1. An irrigation system operating schedule based upon the Evapotranspiration Demand Curve, the Estimated Water use for each hydrozone, and the Total Estimate Water Use for the landscape (reference “Landscape Water Budgeting” Section W3-12.3 and W3-12.4.A & B.) And which details:
 - a. For each hydrozone (station) the run time in minutes per cycle and cycles per week for each week of the irrigation season (May 1st through October 31st)
 - b. The total weekly and annual amount of water to be applied by each hydrozone, and the total landscape, in gallons and in hundreds of cubic feet (CCF) (748 gallons = 1 CCF);
 - 2. Additional operating criteria such as avoiding irrigation during times of high winds, when raining, and/or in the middle of the day.

3. Regular maintenance activities necessary to:
 - a. Prevent, detect, and repair irrigation system damage, excess wear, and leakage.
 - b. Maintain a minimum average distribution uniformity of 0.625.
 - c. Activate the irrigation system for use in the spring.
 - d. Deactivate and winterize the irrigation system in the fall.
 4. Specifications for all irrigation system components originally used, and recommended for use when making repairs to, or replacing parts of the irrigation system to maintain.
 - a. A minimum average uniform irrigation efficiency of 0.625.
 - b. Good overall operational performance of the irrigation system.
- E. Manual watering is permitted provided it meets the intent of the irrigation system requirements and overspray is minimized.
- F. Should any of the above requirements not be met an Irrigation System Audit Certification performed by a qualified landscape professional will be required by the city prior to acceptance of the project.

W3-13.3 Irrigation System Design Certification

The “Irrigation System Design Certification” on the following page shall be used to certify that the irrigation system has been designed and installed in compliance with the requirements of Bellevue City Code 24.02.210 and the Utilities Engineering Standards.

IRRIGATION SYSTEM DESIGN CERTIFICATION

Project Name: _____

Project Address: _____

Project Owner
or Manager: _____

(Company Name) _____

(Contact Name) _____

(Street Address) _____

(City, State, Zip) _____

(Phone) _____

Irrigation System
Design Contact: _____

(Company Name) _____

(Contact Name) _____

(Street Address) _____

(City, State, Zip) _____

(Phone) _____

The landscape irrigation system for the above stated project has been installed in compliance with the Bellevue City Code 24.02.210 “Irrigation System Design and Performance Requirements” (Water Code).

(Landscape Designer’s Signature) _____ (Approval Signature) _____

(Printed Name) _____ (Date) _____ Bellevue Utilities Department _____ (Date) _____

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CHAPTER W4 - WATER MATERIALS**W4-01 GENERAL**

All materials shall be new and undamaged. The same manufacturer of each item shall be used throughout the work.

Where reference is made to other specifications, it shall be the latest revision at the time of construction, except as noted on the plans or herein.

All materials not specifically referenced shall comply with applicable sections of ANSI, ASTM, AWWA or the APWA/WSDOT Standard Specifications.

Approved manufacturers and model numbers of various materials are listed in Appendix W-4 of these Engineering Standards. When specific manufacturers or models are listed, no substitutions will be allowed without prior approval by the Utility.

W4-02 WATER PIPE

Water pipe shall be ductile iron pipe, minimum thickness Class 52, asphaltic coated, and cement-lined unless otherwise specified. Pipe, coating, and lining shall conform to ANSI/AWWA C151/A21.51 and ANSI/AWWA C104/A21.4.

Rubber gasket pipe joints to be push-on-joint (e.g. Tyton, Fastite) or mechanical joint (M.J.) in accordance with ANSI/AWWA C111/A21.11, unless otherwise specified.

Flanged joints shall conform to ANSI B16.1, class 125 drilling pattern, rated for 250 psi working pressure.

The Contractor shall furnish certification from the manufacturer of the pipe and gasket being supplied that the inspection and all of the specified tests have been made and the results thereof comply with the requirements of the above referenced standards.

W4-03 POLYETHYLENE ENCASEMENT

Polyethylene encasement shall be eight mil tube or sheet and shall be furnished with all ductile iron pipe unless otherwise specified. Materials shall comply with ANSI/AWWA C105/A21.5.

W4-04 FITTINGS

All water main fittings shall be ductile iron, short body, cement lined, and for pressure rating of 350 psi for mechanical joint fittings and 250 psi for flange joint fittings, unless otherwise noted. Mechanical joint fittings shall conform to ANSI/AWWA C153/A21.53. Flanged fittings shall conform to ANSI/AWWA C110/A21.10 with ANSI B16.1, class 125 drilling pattern. Asphaltic coating and cement lining shall conform to ANSI/AWWA C104/A21.4.

Rubber gaskets shall be SBR, NBR (Nitrile), or EPDM in accordance with ANSI/AWWA C111/A21.11.

Type of connections shall be specified as push-on joint (e.g. Tyton, Festite), mechanical joint (M.J.), plain end (P.E.), flanged (FL), and threaded.

W4-05 GALVANIZED IRON PIPE

Where galvanized iron pipe is specified, the pipe shall be Schedule 80, steel pipe per Standard Specification for black and hot-dipped, zinc-coated (galvanized) welded and seamless steel pipe for ordinary uses (ASTM A-120). Fittings shall be screwed malleable iron galvanized per ANSI B16.3. Galvanized pipe shall be used only for dry pipe in pressure relief and air valve assemblies.

W4-06 COUPLINGS

Flexible coupling and transition coupling cast components shall be ductile iron. Center rings and end rings shall be ductile iron in accordance with ASTM 536-80, Grade 65-45-12.

W4-07 ADAPTERS

All flange by mechanical joint (FL x MJ) adapters shall be ductile iron.

W4-08 BOLTS IN PIPING

Bolts, nuts, T-bolts, and washers shall be either type 316 stainless steel or high strength low alloy weathering steel conforming to ANSI/AWWA C111/A21.11. Bolts and nuts for flanged pipe and fittings shall conform to ANSI/AWWA C115/A21.15.

Shackle rods shall be type 316 stainless steel all thread.

W4-09 FLANGE GASKETS

Gasket Material shall be SBR, NBR (Nitrile), or EPDM in accordance with ANSI/AWWA C111/A21.11.

W4-10 GATE VALVE

The minimum requirements for all gate valves shall, in design, material, workmanship, have approximately 45 turns full open to full closed, and conform to the following Standards:

2" to 12" Cast Iron:	AWWA C-509
4" to 12" Ductile Iron:	AWWA C-515
14" to 24" Ductile Iron:	AWWA C-515
30" to 36" Ductile Iron:	AWWA C-515
42" to 48" Ductile Iron:	AWWA C-515

Buried gate valves shall be iron body, bronze mounted, resilient seat, and non-rising stem, suitable for installation with the type and class of pipe being installed. Ends to be as specified. Operating stems shall be equipped with standard two (2) inch operation nut, and O-ring stem seals. Valves not buried shall be as specified.

W4-11 VALVE BOX

Valve Box shall be cast iron, two-piece, 8" or 18" slip type top section with flange located within 3" of top, with 24" bottom section (and extension, if required), equal to RICH - Seattle Type. Valve box lid shall be cast iron, 3 1/4" deep, with recessed lifting handle, and the word "WATER" or "WW" cast into it.

Valve box paving risers shall be cast iron suitable for H-20 traffic loading. The riser shall have four lugs or a flange around the perimeter and be sized to fit into a RICH - Seattle Type valve box top. Valve box adjusting sleeves (for use in unimproved areas) shall be cast iron, 12" long.

All castings shall be coated with asphaltic varnish.

W4-12 VALVE OPERATING NUT EXTENSION

Use where valves are installed more than 3' below finished grade. Extensions are to be a minimum of 1' with only one extension per valve. See Standard Detail.

W4-13 BUTTERFLY VALVE

Butterfly valves shall conform to ANSI/AWWA C504, Class 150B, and be approximately 45 turns full open to full closed. Valves in chambers shall have a manual hand wheel operation. Buried valves shall have a stem extension with AWWA 2-inch operating nut and suitable valve box.

W4-14 CHECK VALVE

Check valves shall be for 150 psi working pressure, unless otherwise specified. Valve shall have adjustable tension lever and spring to provide non-slamming action under all conditions unless otherwise specified.

W4-15 AIR AND VACUUM RELEASE VALVE ASSEMBLIES

The valves shall have minimum 1" NPT inlet and outlet connections and be able to withstand a working pressure of 300 PSI. The valve body and cover shall be cast iron with stainless steel float.

Combination Air Valves shall be of the single housing style that combine the operating features of both Vacuum Release and Air Release valves. A vacuum check valve shall be installed on top of the air release valve vent to prevent air from re-entering the water main under any vacuum conditions.

Air Release Valves shall automatically exhaust air during the filling of the pipeline and be fitted with

a vacuum check valve on the air release valve vent to prevent air to re-enter the pipeline when the internal pressure of the pipeline approaches a negative value due to column separation, draining of the pipeline, power outage, pipeline break, etc. Air Release valves shall automatically release small pockets of air from the pipeline while the pipeline is in operation and under pressure.

W4-16 PRESSURE REDUCING STATION

Unless otherwise shown on the construction plans, a standard pressure reducing station shall have a 6" pressure reducing valve with flanged ends and a bypass with a 2" pressure reducing valve with threaded ends. Pressure reducing valves shall have opening/closing speed controls, epoxy coated body, and valve position indicator. Pressure reducing valves and pressure relief valves shall be equipped with stainless steel trim (seat, stem, and cover bearing). Pilot controls shall be on the side of the pressure reducing valve facing vault interior. Each pressure reducing valve shall include two 3/8" test cocks located on the opposite side of valve body from the pilot controls (one at inlet and one at outlet end of valve).

Strainers shall be installed on the inlet side of each pressure reducing valve with bronze ball valve sized to correspond with the strainer blow-off outlet size. A 2" pressure relief valve with threaded ends shall be installed on the discharge side of the 2" pressure reducing valve line and vented to atmosphere as shown on the plans.

The pressure reducing valve shall maintain a constant downstream pressure regardless of varying inlet pressure. The valve shall be a hydraulically operated diaphragm-actuated, globe valve. The pilot control shall be a direct-acting, adjustable, spring loaded, normally open, diaphragm valve, designed to permit flow when controlled pressure is less than the spring setting. The control system shall include a fixed orifice.

The pressure relief valve shall maintain constant upstream pressure by by-passing or relieving excess pressure and shall maintain close pressure limits without causing surges. The main valve shall be hydraulically operated, diaphragm-actuated, globe valve. The pilot control shall be a direct acting, adjustable, spring loaded, diaphragm valve, designed to permit flow when controlling pressure exceeds spring setting. The pilot control system shall operate such that as excess line pressure is dissipated the main valve shall gradually close to a positive, drip-tight seating.

All diaphragm-actuated valves shall contain a resilient, synthetic rubber disc, having a rectangular cross-section, contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. The diaphragm assembly containing a valve stem shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. This diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. The diaphragm shall consist of nylon fabric bonded with synthetic rubber and shall not be used as a seating surface. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the valve or pilot controls. All necessary repairs shall be possible without removing the valve from the line.

Strainers 3 inches and larger shall be Cla-Val X43H "H" style strainers. Strainer shall feature bolted cover machined to hold screen securely in place and tapped F.I.P.T. for blow-off outlet.

. Pre-cast concrete vault exterior shall be coated with a single component, moisture curing urethane with micaceous iron oxide applied at 5 to 7 micron dry film thickness per coat, two coats minimum, Sherwin-Williams Corothane 1-Coal Tar, or equal. Vault interior shall not be coated.

W4-17 LIDS, HATCHES AND COVERS – SLIP RESISTANCE

Metal lids, hatches, access covers and exposed portion of frames greater than ½ inch wide in pedestrian access routes shall be constructed with a non-slip surface that has a Pendulum Test Value (PTV) that exceeds the below minimums, as measured using the hard rubber sole according to ASTM E 303 (2022 version) Pendulum DCOF Floor Slip Resistance Test or Road Skip Test or treated with a non-slip coating per approved materials in Appendix W-4.

1. Level or Slopes < 1:14 – Minimum PTV = 45
2. Slopes > 1:14 - Minimum PTV = 55

Portland cement concrete surface (flat work) shall receive a light broom finish unless otherwise specified by the Utility.

W4-18 INDIVIDUAL PRESSURE REDUCING VALVE (RESIDENTIAL)

Individual pressure reducing valve shall be direct-acting piston type with integral strainer and bypass. Valve body shall be bronze with threaded outlet end and integral union on inlet end. Valve shall be line-sized with spring range from 25 to 75 psi.

All other appurtenances shall be as shown in the Standard Detail.

W4-19 INDIVIDUAL PRESSURE REDUCING VALVE (MULTI-FAMILY OR COMMERCIAL)

Individual pressure reducing valve shall be equipped with a pressure relief valve at the discharge side, unless otherwise shown in the plans. Unless otherwise directed by the engineer, the contractor shall construct the pressure reducing valve assembly in accordance with the Standard Detail. Individual pressure reducing valve shall be direct-acting piston type with integral strainer and bypass. Valve body shall be bronze with threaded outlet end and integral union on inlet end. Valve shall be line-sized with spring range from 25 to 75 psi.

The pressure relief valve shall be a 3/4" hydraulically or pneumatically operated, diaphragm actuated globe valve. It shall be direct-acting, adjustable, spring loaded and designed to permit flow when pressure exceeds the spring setting. Spring range shall be from 20 to 200 psi.

All other appurtenances shall be as shown in the Standard Details.

W4-20 FIRE HYDRANT

Fire Hydrants shall have a minimum valve opening of five and one-quarter (5-1/4") inch "O" ring stem seal, two - two and one half (2 - 2 1/2") inch N.S.T. hose nozzle connections, and one-four (1-4") inch pumper connection with City of Seattle standard threads. The shoe connection, foot valve connection, and all joints between shall be six-inch mechanical joints with lugs. The operating and

port cap nuts are one and one-quarter (1-1/4") inch pentagonal. Hydrants shall be as shown in the approved materials list. All hydrants shall be of the "Traffic Model" type with approved break-away features and brass to brass sub-seat. Shackle rods are not permitted on hydrant pipe runs.

The portion of the **public** fire hydrant that is above ground shall be painted with two (2) coats of Rust-Oleum, Krylon, or Sherwin-Williams Safety Yellow paint.

The portion of the **private** fire hydrant that is above ground shall be painted with two coats of Rust-Oleum, Krylon, or Sherwin-Williams Red paint as set forth by the City of Bellevue Fire Department.

W4-21 FIRE HYDRANT GUARD POSTS

Fire hydrant guard posts shall be 6" diameter concrete filled ductile iron pipe class 52, and a minimum of 6 feet long. The post shall be set not less than 3 feet deep in a concrete footing of not less than 15-inch diameter. The portion of the post that is above ground shall be painted with two (2) coats of Rust-Oleum, Krylon, or Sherwin-Williams Safety Yellow paint.

W4-22 METER SETTER

Meter setters shall have dual purpose couplings, unless otherwise specified, and angle meter valve with drilled wings for padlock, twelve (12") inches high. The angle copper setter for the size meter to be installed, see Standard Details.

1 1/2" meter setters shall have vertical inlet and outlet tees with 1" lateral bypass, flanged ball meter valves on inlet and outlet, ball valve on bypass, and padlock wings on all valves, see Standard Details.

2"-meter setters shall have vertical inlet and outlet tees with 1" lateral bypass, flanged ball meter valve on inlet and outlet, ball valve on bypass, and padlock wings on all valves, see Standard Details.

W4-23 CORPORATION STOP

Corporation stops shall be brass in accordance with AWWA Standard C800 with AWWA tapered thread (CC) inlet by compression fitting for copper outlet, complete with coupling nut for copper service.

Corporation stops for 1", 1 1/2" and 2" tap shall be ball valve type.

W4-24 METER BOX

Cast iron, steel and plastic composite meter boxes with non-slip ductile iron lid as specified in the Standard Details. Meters shall be centered in box.

W4-25 COPPER SERVICE PIPE

All copper pipe for underground water service 2 inches or less shall be seamless conforming to ASTM B88 (ANSI H33.1) Type "K" annealed tubing.

Copper service pipe larger than 2 inches shall be Type K hard drawn, 20' lengths.

Water service lines larger than 2 inches in diameter shall be Class 52 ductile iron pipe.

See W3-10 for service line casing requirements.

W4-26 PRE-CAST CONCRETE VAULTS

Minimum design structural loading shall be H-20 loading and comply with ASTM C-857 and ASTM C-890. All precast concrete products need to be manufactured by an NPCA-certified plant. Vaults (risers, bases, and lids) shall be constructed in accordance with ASTM C-858 and ASTM C-913. Reinforcing steel bars shall conform to ASTM A-615. Welded wire fabric shall conform to ASTM A-1064. Gasket material shall conform to ASTM C-443. End walls for water pipe penetrations shall be cast without knock-outs. All riser, base and lid penetrations shall be core drilled or integrally cast. Vaults shall consist of 1) a lid and integrally cast base and riser unit; or 2) individually cast base, riser and lid sections. All vaults shall be watertight and be free of any visible leaks. The repair of any leaks shall be in accordance with the vault manufacturer's written recommendations.

A Manufacturer's Certification of Compliance with these requirements shall be provided for each type of product furnished for installation.

W4-27 PIPE INSULATION

All pipe for above ground service shall have 2-inch-thick foam insulation with an aluminum jacket. Foam insulation and aluminum jacket shall conform to the following:

Foam insulation shall be closed cell polystyrene foam manufactured by extrusion process. Foam insulation shall be odorless, chemically inert, with no food value and shall be resistant to ground chemicals and microorganism. Foam insulation shall conform to the following properties:

PROPERTIES	ASTM TEST	AVERAGE
Thermal Conductivity "K" Factor BTU HR./SQ. FT./+F/IN. Mean Temp. 40+	C518-70 & C177-63	0.23
Moisture Resistance Water Absorption % By Volume	D2842-69	0.8
Water Vapor Transmission (Perm-Inch)	C355-64	0.9
Physical Density (lb./cu. ft.)	C303-56	1.8
Compressive Strength (PSI) Perpendicular to Board Face (5% Deflection or Yield)	D1621-64	40

Aluminum jacketing shall be manufactured from Type 3003 or 5005 alloy; temper of H-14 gauge 0.016.

W4-28 CONCRETE BEDDING & BLOCKING

Bedding, blocking, encasement, or slope anchor concrete shall be mixed from materials acceptable to the Engineer and shall have a 30-day compressive strength of not less than 2,500 psi. The mix shall contain five (5) sacks of cement per cubic yard and shall be of such consistency that the slump is between 1 inch and 5 inches. All concrete shall be mechanically mixed. Blocks shall be left open for inspection.

W4-29 JOINT RESTRAINT

Joint restraint methods shall be as per the Approved Materials list. Where shackle restraint is used, all shackle rods shall be stainless steel (All Thread 316SS), along with 316SS stainless steel hardware. Stainless steel shackle restraints do not require painting.

W4-30 REDUCED PRESSURE BACKFLOW ASSEMBLY

All Reduced Pressure Backflow Assemblies (RPBA) shall be as listed on the most current copy of "Backflow Prevention Assemblies Approved for Installation in Washington State", published by Washington State Department of Health (D.O.H.). The assembly shall include a tightly closing resilient seated shut-off valve on each end of the body and each assembly shall be fitted with four properly located resilient seated test cocks.

All other appurtenances shall be as shown in the Standard Detail.

W4-31 REDUCED PRESSURE DETECTOR ASSEMBLY

This assembly shall include a line-sized D.O.H. approved (listed on the most current copy of "Backflow Prevention Assemblies Approved for Installation in Washington State" published by Washington State D.O.H.) Reduced Pressure Backflow Assembly with a parallel 3/4" meter and 3/4" D.O.H. approved Reduced Pressure Backflow Assembly. Each assembly shall include a tightly closing resilient seated shut-off valve on each end of the body and each assembly shall be fitted with four properly located resilient seated test cocks.

All other appurtenances shall be as shown in the Standard Detail.

W4-32 DOUBLE CHECK VALVE ASSEMBLY

All Double Check Valve Assemblies shall be as listed on the most current copy of "Backflow Prevention Assemblies Approved for Installation in Washington State" published by Washington State D.O.H. The assembly shall include a tightly closing resilient seated shut-off valve on each end of the body and each assembly shall be fitted with four properly located resilient seated test cocks.

All other appurtenances shall be as shown in the Standard Detail.

W4-33 DOUBLE CHECK DETECTOR ASSEMBLY

This assembly shall include a line sized D.O.H. approved (listed on the most current copy of "Backflow Prevention Assemblies Approved for Installation in Washington State" published by Washington State D.O.H.) Double Check Valve Assembly with a parallel 3/4" meter and 3/4" D.O.H. approved double check Valve Assembly. Each assembly shall include a tightly closing resilient seated shut-off valve on each end of the body and each assembly shall be fitted with four properly located resilient seated test-cocks.

All other appurtenances shall be as shown in the Standard Detail.

W4-34 BACKFLOW ASSEMBLY RESILIENT SEATED SHUT-OFF VALVES

Each valve shall be marked with model number with designation of resilient seat; such as "RS" or "R", which must be cast, molded, or affixed onto the body or bonnet of the valve. All ferrous-bodied valves shall be coated with a minimum of 4 mils of epoxy or equivalent polymerized coating. 2" and smaller R.P.B.A.s and D.C.V.A.s shall use ball valves, and all 2-1/2" and larger R.P.B.A.s and D.C.V.A.s shall use resilient seated gate valves for domestic supply and resilient seated O.S. and Y. valves for fire lines.

The minimum requirements for all resilient seated gate valves shall, in design, material and workmanship, conform to the standards of AWWA C509.

W4-35 BARRIER FENCE

Barrier Mesh shall be manufactured from Low Density Polyethylene, stabilized against UV degradation, and with a special selection of pigments to ensure optimum visual performance under harsh weather conditions. Barrier Mesh shall be corrosion-free and resistant to salt water and most chemicals.

Barrier Mesh shall present a visual target area of approximately 0.5 square meter per square meter of mesh.

W4-36 BEDDING AND BACKFILL**W4-36.1 Pipe Bedding Materials**

For all water pipe, bedding material shall be in accordance with Section 9-03.12(3) Gravel Backfill for Pipe Zone Bedding or Section 9-03.9(3) Crushed Surfacing of the Standard Specifications.

In unpaved areas outside of the right-of-way, the Contractor may request to use excavated material as pipe zone bedding and must demonstrate to the Engineer that the suitable excavated material conforms to Section 9-03.12(3) Gravel Backfill for Pipe Zone Bedding of the Standard Specifications, and proper compaction levels can be achieved.

For ductile iron water main pipe outside of the right of way, the Contractor may request to use excavated material as pipe zone bedding and must demonstrate to the Engineer that the suitable excavated material conforms to Section 9-03.12(3) Gravel Backfill for Pipe Zone Bedding of the Standard Specifications and proper compaction levels can be achieved.

W4-36.2 Trench Backfill Materials

For transverse trenches (perpendicular to the roadway centerline) in paved areas, trench backfill conforming to Section 9-03.9(3) Crushed Surfacing of the Standard Specifications shall be used as trench backfill for pipe.

For longitudinal trenches (trenches parallel to the centerline of the roadway) in paved areas, backfill material (8 feet and deeper below finished grade) shall conform to Section 9-03.14(1) Gravel Borrow of the Standard Specifications. The Contractor may request to use excavated material as trench backfill and must demonstrate to the Engineer that the suitable excavated material conforms to Section 9-03.14(1) Gravel Borrow of the Standard Specifications and proper compaction levels can be achieved. Admixtures and/or additives may not be used to modify the moisture content in order to meet compaction specifications.

In paved areas, the top 8 feet of longitudinal trenches shall be backfilled with trench backfill conforming to Section 9-03.9(3) Crushed Surfacing of the Standard Specifications.

In unpaved areas, trench backfill material shall conform to Section 9-03.14(1) Gravel Borrow of the Standard Specifications. The Contractor may request to use excavated material as trench backfill and must demonstrate to the Engineer that the suitable excavated material conforms to Section 9-03.14(1) Gravel Borrow of the Standard Specifications and proper compaction levels can be achieved.

W4-36.3 Structure Backfill Materials

In paved areas, backfill material (8 feet and deeper below finished grade) shall conform to Section 9-03.14(1) Gravel Borrow of the Standard Specifications. The Contractor may request to use excavated material as structure backfill and must demonstrate to the Engineer that the suitable excavated material conforms to Section 9-03.14(1) Gravel Borrow of the Standard Specifications and proper compaction levels can be achieved.

In paved areas, the top 8 feet around structures shall be backfilled with structure backfill conforming to Section 9-03.9(3) Crushed Surfacing of the Standard Specifications.

In unpaved areas, structure backfill material shall conform to Section 9-03.14(1) Gravel Borrow of the Standard Specifications. The Contractor may request to use excavated material as structure backfill and must demonstrate to the Engineer that the suitable excavated material conforms to Section 9-03.14(1) Gravel Borrow of the Standard Specifications and proper compaction levels can be achieved.

W4-36.4 Foundation Gravel Materials

Foundation gravel for structures shall consist of one of the following aggregates as set forth

in the Standard Specifications:

Ballast	9-03.9(1)
Shoulder Ballast	9-03.9(2)
Gravel Backfill for Foundations (Class A or B)	9-03.12(1)
Foundation Material Class A and Class B	9-03.17

W4-36.5 Controlled Density Fill Materials

Controlled density fill (CDF, aka flowable fill) shall be a mixture of Portland Cement, admixture (optional), Fly Ash, aggregates, and water. It shall be proportioned to provide a slurry, non-segregating, free flowing, self-consolidating and excavatable material that will result in a non-settling fill which has measurable unconfined compressive strength.

Materials testing shall be with unconfined compressive test cylinders. Test data may be either laboratory trial batch test data or field test data.

Alternate mix designs may be required at the Engineer's discretion.

CDF shall be designed to have a minimum 28-day compressive strength of 50 psi and maximum 28-day strength not to exceed 300 psi. The CDF consistency shall be flowable (approximate slump 3 to 10 inches).

Materials shall meet the requirements of the following sections of the Standard Specifications:

Portland Cement	9-01.2(1)
Fine Aggregate for Portland Cement Concrete	9-03.1(2)
Chemical Admixtures for Concrete	9-23.6
Fly Ash	9-23.9
Water for Concrete	9-25.1

Controlled density fill shall meet the following requirements:

Controlled Density Fill

<u>Ingredients</u>	<u>Amount per Cu. Yd.</u>
Portland Cement	50 lb.
Aggregates Class 1 or 2	3300 lb.
Air Entrainment Admixture	Per Manufacturer's recommendations
Fly Ash Class F	300 lb.
Water	300 lb. (maximum)

If requested by the Contractor, the proportions may be adjusted with the approval of the Engineer.

W4-36.6 Recycled Materials

HMA grindings, recycled glass cullet and steel furnace slag shall not be used as backfill in, around,

above or below any facility to be owned and operated by the Utility. Additionally, such recycled materials shall not be placed on any tract, property or easement for which Utility has any ownership rights or maintenance responsibilities.

Recycled concrete rubble shall not be used as bedding in the pipe zone, as trench backfill or as backfill above the projected neat-line trench above a pipe or structure.

Recycled concrete rubble may be used except under the following conditions:

- Below the original ground line of the project
- On slopes exposed to precipitation or on unstable slopes
- Within two (2) feet of the water table
- Within 10 feet of a property line
- Less than 100 feet from a water well or critical groundwater recharge area
- Within any wetland or wetland buffer
- Less than 100 feet from a stream, creek, river, pond or lake
- Within 50 feet of Low Impact Development drainage BMP's; and
- As backfill around any structure that has an underdrain system

W4-36.7 Portland Cement-Treated Soils

Portland cement-treat soils shall not be used as backfill in, around, above or below any facility to be owned and operated by the Utility. Additionally, Portland cement-treated soils shall not be placed on any tract, property or easement for which Utility has any ownership rights or maintenance responsibilities.

W4-37 STEEL CASING

Steel casing shall be black steel pipe conforming to ASTM A53. Before installation, coat casing exterior with shop-applied anticorrosive coating conforming to AWWA C210. Minimum coating thickness shall be 16 mils dry film thickness (DFT); however, thickness shall not exceed manufacturer's recommended thickness. Coating type shall be a polyamide epoxy-coal tar equal to Tnemec Hi-Build Tnemec-Tar, Series 46H-413.

Casing wall thickness shall be 0.250 inch for casings 24 inches or less in diameter and 0.375 inch for casings over 24 inches in diameter.

Carrier pipe for water shall be Ductile Iron, Class 52.

W4-38 CASING SPACER

Casing spacer shell shall be manufactured in two pieces from heavy gauge T-304 stainless steel or 14 gauge hot rolled pickled steel joined with ribbed flanges. The shell shall be lined with a PVC liner 0.090-inch thick with 85-90 durometer.

Carbon steel casing spacer shell and risers shall be coated with a heat fused Polyvinyl chloride coating, or hot-dip galvanized.

Polyvinyl Chloride Coating Specifications:

Durometer - Shore A2 (10 Sec.) (ASTM D-1706-61T)	-	80
Maximum operating temperature (constant)	-	150° (65°C)
Electrical properties (ASTM D-149-61) (short time .010")	-	1380 V/Mil
Resistance:		
Salt spray (ASTM B-117)	-	Excellent
Acids	-	Good
Alkalies	-	Good

All nuts and bolts shall be 18-8 stainless steel.

Runners shall be supported by risers made from heavy gauge T-304 stainless steel or 12 gauge hot rolled pickled steel. Runners shall be ultra-high molecular weight polymer with high resistance to abrasion and sliding wear.

TYPICAL DATA			
PROPERTY	ASTM METHOD	UNITS	VALUE
Specific Gravity	D-792	gm/cc	.934
Tensile Strength (Break)	D-638	PSI	3500
Elongation (Break)	D-638	%	380
Izod Impact	D-256	Ft-lbs./in. of notch	No break
Hardness	D-2240	Shore D	67
Coefficient of Friction	D-1894	-	0.11 - 0.13
Heat Distortion Temp.66 PSI	D-648	C	88
Coefficient of Thermal Expansion	D-696	F-1	5.5 x 10-5

ABRASION CHARACTERISTICS

Taber Abrasion	D-1044	Mg/loss	N
Sand Slurry *			7

- * Sand slurry condition - 7 hours in one-part sand/ one part water slurry at 1725 RPM.
Carbon steel - 100, Hifax - 15. The lower the value, the more resistant to abrasion.

Casing spacers shall be "center positioning" type. Height of risers and runners combined shall be sufficient to keep the carrier pipe bell, couplings, or fittings at least 0.75" from the casing pipe wall at all times and provide at least 1" clearance between runners and top of casing wall, to prevent jamming during installation.

W4-39 INSERTION VALVES

The minimum requirements for all insertion valves shall, in design, material, and workmanship conform to the following Standards:

AWWA C509/C515
NSF 61 certification
ANSI 372 certification

Buried gate valves shall be iron body, bronze mounted, resilient seat, and non-rising stem, suitable for installation with the type and class of pipe being installed. Operating stems shall be equipped with standard two (2) inch operation nut, and O-ring stem seals. Insertion valves shall be mounted on concrete support blocking.

The following valves are approved with the pipe listed:

Team Industrial Service Insert Valve (4 to 12-inch dia.)	DI, CI, AC and PVC
Hydra-Stop Insta-Valve 250 Patriot Series (4 to 12-inch dia.)	DI, CI, AC and PVC
Romac Quik Valve (4 to 8-inch dia.)	AC only
Advanced Valve Technologies AVT EZ System Valve (4 to 12-inch dia.)	DI, CI (temp line stop only).

Note: The use of insertion valves may be approved on a case-by-case basis by the Utility. Specific written authorization is required before installation.

W4-40 WATER METERS

The following water meters are approved. The use of alternate meter manufacturers, models, and configurations may be approved on a case-by-case basis by the Utility. Specific written authorization is required before installation.

METER SIZE	MFG & MODEL	MANUFACTURER PART #
¾" x 7.5"	KAMSTRUP FLOWIQ 2100	MFG PART# 02U-23-C-08-8EP CONFIG# 01-002-000-2-3-5-8-3 EO CODE: Z EXTENDED ALARM: Y

1" x 10.75"	KAMSTRUP FLOWIQ 3101	MFG PART# 03U-23-C-0S-8EP CONFIG# 01-002-000-2-3-5-8-3 EO CODE: Z EXTENDED ALARM: Y
1.5" x 13"	KAMSTRUP FLOWIQ 3101	MFG PART# 03U-23-C-0J-8EP CONFIG# 01-002-000-2-3-5-8-3 EO CODE: Z EXTENDED ALARM: Y
2" x 17"	KAMSTRUP FLOWIQ 3101	MFG PART# 03U-23-C-0K-8EP CONFIG# 01-002-000-2-3-5-8-3 EO CODE: Z EXTENDED ALARM: Y
3"	SENSUS OMNI+ C2	C3X3XS6FXWXXXND
4"	SENSUS OMNI+ C2	C4X3XS6FXWXXXND
6"	SENSUS OMNI+ C2	C6X3XS6FXWXXXND
7"	SENSUS OMNI+ C2	C8X3XS6FXWXXXND
8"	SENSUS OMNI+ C2	CAX3XS6FXWXXXND

END OF CHAPTER W4

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CHAPTER W5 - WATER METHODS OF CONSTRUCTION**W5-01 GENERAL CONSTRUCTION REQUIREMENTS**

The improvements shall be constructed as shown on the plans and in accordance with these Standards, Standard Details, and Standard Specifications. Manufacturer's equipment shall be installed in compliance with specifications of the manufacturer, except where a higher quality of workmanship is required by the plans and specifications. All materials and work shall be in strict accordance with any applicable regulations of the State, County and local authorities. The Contractor shall arrange for such inspection by these agencies as may be required and shall submit evidence of their approval, if requested by the Engineer.

W5-01.1 Alignment & Staking

All work done under a Project shall be to the lines shown on the plans or to approved revisions.

W5-01.2 Inspections & Tests

- A. The Engineer shall, at all times, have access to the work for the purpose of inspecting and testing, and the Contractor shall provide proper facilities for such access and such inspection and testing.
- B. If any work is covered up without approval or consent of the Engineer, it must, if required by the Engineer, be uncovered for inspection.
- C. Before a performance test is to be observed by the Engineer, the Contractor shall make whatever preliminary tests are necessary to assure that the material and/or equipment are in accordance with the plans and specifications.
- D. Written notice of deficiencies, adequately describing the same, shall be given to the Contractor upon completion of each inspection and the Contractor shall correct such deficiencies within seven days of the notice and before final inspection will be made by the Engineer, unless otherwise approved.

W5-02 SURFACE WATER QUALITY

The Contractor is required to implement water pollution controls and maintain these until the project is accepted by the City. The Contractor shall be familiar with the requirements of the Department of Ecology and other regulatory agencies having jurisdiction over such matters.

The following list of requirements is a summary of the construction activity requirements of the Department of Ecology and is provided as a guide to the Contractor. The Department of Ecology may have additional requirements with which the Contractor shall comply.

W5-02.1 Chlorine Residual from Water Main Flushing or Disinfection

Water with chlorine residual shall be disposed of through sanitary sewers, storing and aerating/treating or percolation into the ground. Water containing a chlorine residual shall not be disposed of into the storm drainage system or any waterway.

W5-02.2 Oil and Chemical Storage and Handling

Storage area shall be diked. No disposal of oil products or waste on the site, including oil filters. The Contractor shall provide a waste oil disposal tank, if needed.

W5-03 LAYING DUCTILE IRON PIPE

Work shall be accomplished in accordance with AWWA Standard C600 and the manufacturer's recommendation.

The bottom of the trench shall be finished to grade in such a manner that the pipe will have bearing along the entire length of the barrel. Bolts on mechanical pipe and fittings shall be tightened uniformly with a "Torque" wrench which measures the torque for mechanical joints shall be as follows:

2" - 3" pipe sizes 5/8" Bolts	40 - 60 ft-lbs torque
4" - 24" pipe size 3/4" Bolts	60 - 90 ft-lbs torque

Installation of push-on joint (e.g. Tyton, Fastite) pipe shall be in accordance with the manufacturer's instructions. All buried ductile iron pipe and adjacent valves and fittings shall be encased with 8-mil polyethylene.

Pipe shall not be located below soil nails or other retaining wall reinforcement. If the pipe is located above a soil nail or other retaining wall reinforcement, a minimum of 5 feet of vertical and horizontal clearance is required.

W5-04 POLYETHYLENE ENCASEMENT

Installation of Polyethylene Encasement shall be in accordance with the latest AWWA Standard C105. All Ductile iron pipe and fittings shall be wrapped except as specifically excluded on the plans or in these specifications.

W5-05 LAYING GALVANIZED IRON PIPE

The galvanized iron pipe, valves and fittings shall be threaded.

Joints shall be made in accordance with good plumbing practice. Threads shall be coated with Teflon tape before connecting.

Pipe shall not be located below soil nails. If the pipe is located above a soil nail, a minimum of 5' of clearance is required.

W5-06 FIRE HYDRANT INSTALLATION

Fire hydrants shall be set as shown in the Standard Details and AWWA Standard C600. Hydrant and the gate valve must have lugs. The tee on the main line shall not be considered as part of the assembly. The hydrant run shall be restrained with MEGALUG restrainer at M.J. end on hydrant and gate valve. If more than one pipe is required on hydrant run, connect pipes with mechanical joint sleeve and MEGALUG restrainers, restrained pipe joints or stainless steel bell clamps.

When fire hydrants are located in parking lots, or other areas where permitted speed limits do not exceed five miles per hour, hydrant guard posts shall be installed.

Hydrant guard posts shall be installed in areas where the hydrant is not protected by a cement concrete curb on all sides where vehicles may have access. Guard posts shall be installed according to the minimum dimensions shown in the Standard Details.

Where a hydrant is being installed, reset, moved or reconnected, a blue raised pavement marker (Type 2) shall be installed perpendicular to each hydrant in the interior channelization of the outside lane, unless one already exists. Install the lane marker one foot off of the channelization line, toward the hydrant.

W5-07 VALVE INSTALLATION

Before installation, valves shall be cleaned of all foreign material. Such blocking as the Engineer may deem necessary shall be provided. The valve and valve box shall be set plumb with the valve box centered on the valve. The top of the valve box shall be set with all valves except auxiliary valves for hydrants. Where valve operating nut is more than three feet below finished grade, a stem extension conforming to the Standard Detail must be installed. Tapping valves shall be water tested prior to tapping water main.

The top of the valve box base section shall be located a minimum of 6" and maximum of 9" below finished grade. A polyethylene sheet, 8-mils thick, shall be placed between the top and base valve box sections to prevent metal to metal contact where the sections overlap.

Valve box top sections shall be adjusted flush with the finished pavement and, in those areas to be excavated for future roadway grades, enough adjustment shall be provided in the valve box to allow the top of the box to be adjusted to the required grade.

W5-08 AIR AND VACUUM RELEASE VALVE INSTALLATION

Installation shall be as shown on the Standard Detail. See the Approved Materials List in Appendix W-4 for acceptable valves.

Iron Piping and fittings shall be galvanized. Location of the air release valves as shown on the plans is approximate. The installation shall be set at the high point of the line. The water main must be constructed so the air release valve may be installed in a convenient location.

W5-09 VALVE BOX MARKER INSTALLATION

Concrete marker posts, painted with two coats Rust-Oleum No. 2766 Hi-Gloss white paint, shall be set for all valves, where needed. The marker shall be set on a line through the valve at right angles to the center line of the road. The marker shall generally be set on the property line unless the Engineer decides another location is safer or more conspicuous. Distance to the valves shall be neatly stenciled on the post with 2-inch numerals. Valve markers shall be installed only in unimproved or unpaved areas.

W5-10 SERVICE LINES**W5-10.1 New Service Installations**

Service installation shall be as shown on the Standard Details.

Tapping of polyethylene encased ductile iron pipe shall be performed by wrapping three layers of polyethylene compatible adhesive tape completely around the pipe to cover the area where the direct tapping machine and chain will be mounted.

Where a saddle is used in lieu of direct tapping, make a cut in the taped area large enough to accommodate the gasket directly in contact with the ductile iron pipe. Make necessary repair for damaged encasement.

The existing polyethylene encasement shall be field cut and replaced after the tap is installed.

All service lines larger than 2" in diameter are subject to disinfection and bacteriological sampling requirements of the public water mains.

W5-10.2 Reconnecting Existing Services

Install service connections as shown on the Standard Detail and plans. Install services under paving by boring. Bore or tunnel under sidewalks and curbs. Damages shall be repaired by Contractor. Provide 30" minimum cover on service lines. Install service at 90 degrees horizontally to the main to intercept the existing meters. A deviation of not more than 3 degrees will be allowed. Flush the service line thoroughly prior to connection to meter.

Install meter setter and boxes as shown on the Standard Detail and where directed by the Engineer.

Service connections shall not be transferred to the new main until it has been flushed, disinfected and satisfactory test result has been received. When transferring services from the existing main to the new main, the Contractor shall take sanitary precautions to protect the potable water supply in both the existing and new mains.

The Contractor shall submit for approval a sketch and a list of proposed bushings, adapters, etc. The sketch shall show proposed fittings, (by brand name) for single meter hookups, and connection to existing copper and plastic pipe of various diameters.

Multi-meter service connections are not allowed. When an existing multi-meter service connection is encountered, the Contractor shall convert it to single service connections as shown in the Standard Details.

No reconnection to sub-standard service lines shall be allowed.

W5-11 PRESSURE REDUCING STATION

The pressure reducing valves, strainers, pressure relief, pipes and fittings shall be constructed in accordance with the applicable AWWA and uniform plumbing code requirements. Pressure reducing valves, 6" and larger, shall be supported by a pipe stanchion. Stanchion shall be bolted to vault floor.

Pressure relief discharge pipe shall be placed in location that will not be subject to damage or erosion during discharge of water.

W5-12 INDIVIDUAL PRESSURE REDUCING VALVE

Exterior individual pressure reducing valve assembly shall be installed on the discharge side of the existing water meter, and shall be contained inside a new water meter box. Each pressure reducing valve shall be installed, as shown in the approved plans and Standard Detail, in accordance with the plumbing code, and as described in these Standards or as directed by the Utility.

W5-13 CONCRETE BLOCKING

All bends and tees and valves shall be blocked in accordance with the Standard Details. All poured in place blocking shall have a minimum measurement of twelve inches (12") between the pipe and the undisturbed bank. The Contractor shall install blocking which is adequate to withstand full test pressure as well as to continuously withstand operating pressures under all conditions of service. All concrete shall be mechanically mixed.

W5-14 CONNECTION TO EXISTING WATER MAIN

Points of connection to existing water mains shall be exposed prior to trenching of the new line, and not less than 48 hours prior to the anticipated connection time. The Contractor shall request a shut-down from the Utility at least 21 calendar days excluding holidays in advance of the need of any water main shut-down or connection. Water main shut-downs shall occur during non-holiday weekdays unless otherwise specified herein or as agreed to by the Utility. Water main shut-downs shall not be scheduled to take place on Fridays, or on the five days before nor one day after a City holiday, unless otherwise approved by the Utility. The Utility shall determine when the water main shut-down may take place and reserves the right to reschedule due to

unforeseen conditions outside the control of the Utility.

The Contractor shall notify impacted water customers in writing not less than 72 hours (3 calendar days excluding weekends and holidays) in advance of interruption of water service. The Engineer will provide the written notice to customers for the Contractor to distribute.

Connection to the existing main shall take place only after the new main is pressure tested, flushed, disinfected, and satisfactory bacteriological test results are obtained. All connections to the existing water system and all testing of the new line must be with the authorization of, and in the presence of, the Utility or Utility-authorized representatives. Opening and closing of valves on the Utility's water system, will be done only by the Utility.

The Utility's preference is to install connections to existing water mains for extensions, branch lines, or service lines larger than 2-inches via cut-in tee assemblies. Tapping tees are of second option and may be installed upon written approval by the Utility.

Connections may be made to existing pipes under pressure with a tapping machine by determining the size and type of pipe and installing tapping tee to fit complete with tapping gate valve. Tapping tees shall be installed as shown on the Standard Details.

Where cut-ins are required to be made on existing pipes, the work shall be conducted at such a time and in such a manner as to minimize the interruption of service. The Contractor shall ensure that the existing fittings are in accordance with the approved plans and that the connection can be made in accordance with the approved plans. The Contractor shall immediately notify the Engineer if the connection cannot be made in accordance with the plans in order that the connection detail may be revised.

Necessary pipe, fittings and gate valves shall be assembled at the site ready for installation prior to the interruption of water service. Once the water service has been interrupted, the work shall be prosecuted vigorously and shall not be halted until service is restored.

The interiors of all pipe and fittings to be used in final connection shall be swabbed or sprayed with a 1% available chlorine solution.

Water main shut-offs shall not occur in the five (5) weekdays preceding or the day after the major holidays listed below:

- Memorial Day
- Juneteenth
- Fourth of July
- Labor Day
- Thanksgiving
- The Day After Thanksgiving
- Christmas Day
- New Year's Day

Due to the needs of various water customers in the project vicinity, water shut-down periods are limited to the times set forth below:

<u>Days</u>	<u>Hours</u>
Monday	8:30 AM to 3:00 PM
Tuesday	8:30 AM to 3:00 PM
Wednesday	8:30 AM to 3:00 PM
Thursday	8:30 AM to 3:00 PM
Friday	DO NOT SCHEDULE
Saturday	DO NOT SCHEDULE
Sunday	DO NOT SCHEDULE
City Holiday	DO NOT SCHEDULE

The Utility, at its sole discretion, may adjust these shut-down periods to address specific project circumstances and customer needs.

W5-15 ORDER OF CONSTRUCTION

- Contractor shall fill the new main from potable source designated by the Utility through an approved and certified backflow assembly. Contractor shall add chlorine if not already in pipe per disinfection procedures.
- The new water main shall be allowed to disinfect for 24-48 hours.
- After disinfecting, Contractor shall hydrostatic test the new water main with a test pump at 200 psi for 15 min, less than 10 psi drop, in the presence of the Utility.
- Confirm the integrity of all valves by re-pressurizing the system to check each valve.
- Contractor shall test fire lines at 200 psi for 2 hours with no pressure loss, in the presence of the Utility.
- If passing the hydrostatic test, Contractor shall flush the new water main with potable water, in the presence of the Utility.
- After flushing, the Utility will take sample(s) of water from new line and deliver to a certified laboratory for bacteriological testing.
- After satisfactory lab results are received by the Utility, the utility will perform the water main shutdown to make final connection to existing water system.
- The Utility will execute the water main shutdown while the Contractor makes the physical connection to the existing water system.
- The Utility will open the valve on the existing system to refill the new water main.
- The Utility will purge the air from the main and flush the new main to remove residual water from the tie-in operation.
- While under line pressure, the Utility will inspect the exposed tie-in piping and fittings for leaks.
- Contractor shall backfill and compact the tie-in point after the inspection is complete.
- The new water main is ready for service.

W5-16 HYDROSTATIC TESTS

Prior to the acceptance of the work, the installation shall be subjected to a hydrostatic pressure test of 200 psi for 15 minutes at the high point in the line and any leaks or imperfections developing under said pressure shall be remedied by the Contractor before final acceptance of the work. No air will be allowed in the lines. The mains shall be tested between valves, with a maximum length of 1,500 linear feet to be tested. Insofar as possible, no hydrostatic pressure shall be placed against the opposite side of the valve being tested. Test pressure shall be maintained while the entire installation is inspected.

The Contractor shall provide all necessary equipment and shall perform all work connected with the test. The Contractor shall assure that the equipment to be used for the pressure test is adequate and in good operating condition, and the air in the line has been released before requesting the Engineer to witness the test.

The backflow preventer and supply hose must be disconnected during hydrostatic pressure testing of new main.

Insofar as it is practical, tests shall be made with pipe joints, fittings and valves exposed for inspection. For approval, pressure shall not drop more than 10 psi for 15 minutes. The Engineer shall witness the test; if the installation does not pass inspection for any reason, additional inspection required to witness the test shall be done at the Contractor's sole expense.

Pressure tests shall be made after all valved connections have been made. At unvalved connection points, a temporary plug (or 2" blow-off assembly on pipelines without hydrants) shall be installed at the end of the new main. This shall include concrete blocking necessary to withstand pressures encountered during the hydrostatic test.

Once the new main is successfully tested and disinfected, the plug (blow-off) shall be removed and the connection to the existing main completed.

The Contractor shall provide special plugs and blocking necessary in those locations where it would be necessary to test against butterfly valves to ensure that the pressure ratings of these valves is not exceeded during testing.

Fire Line testing shall be in accordance with the City's Fire Code and National Fire Prevention Association (NFPA) Standard #13 and #25, with no loss for two hours.

W5-17 DISINFECTION & FLUSHING OF WATER MAINS

Disinfection of water mains shall be accomplished by the Contractor in accordance with the requirements of the Washington State Department of Health, consistent with the most recent version of the AWWA Standard C651, and in a manner satisfactory to the Utility. Pipe segments will ordinarily be disinfected between adjacent valves unless, in the opinion of the Engineer, a longer section may be satisfactorily handled.

The Contractor shall use an approved backflow assembly when obtaining potable water from the municipal water system while filling or flushing any portion of the water system or new water system components. In accordance with Washington State Administrative Code 246-290-490(7)(b)(A), the Contractor shall have an approved backflow assembly (DCVA or RPBA) tested and certified upon installation, repair, reinstallation, or relocation of the assembly. A copy of the backflow assembly test result shall be provided to the Utilities Inspector.

The Contractor shall provide all required tools, equipment and materials needed to disinfect and flush the water system including but not limited to:

- Potable water hoses that are NSF/ANSI 61 Compliant
- Disinfectant that is NSF/ANSI 60 Compliant
- Double Check Valve Assembly (DCVA) or Reduced Pressure Backflow Assembly (RPBA)
- Sodium Ascorbate or Ascorbic Acid
- Dechlorinating diffuser
- 0.5 oz. Measuring implement
- Personal Protective equipment (goggles, gloves, etc.)
- Calcium hypochlorite granules/tablets or 5-15% sodium hypochlorite (method-dependent)
- Emergency eyewash kit
- Thermometer
- Sampling spigot(s)
- Air gap assembly for flush water discharge to sanitary sewers

One of two methods of disinfection shall be used, as described below. Where AWWA recommendations are in conflict, the more stringent criteria shall apply:

1. Tablet/Granule Method, per AWWA Standard C651 and as follows:
Granulated chlorine (dry calcium hypochlorite at 65% - 70% chlorine) shall be placed in the pipe to yield a dosage of not less than 25 ppm. The number of ounces of 68% granular calcium hypochlorite required for a 20-foot length of pipe equals $0.004d^2$, in which "d" is the diameter in inches. If calculating in grams, the number of grams of 68% granular calcium hypochlorite required for a 20-foot length of pipe equals $0.1134d^2$. If tablets are used, the number of 5-gram calcium hypochlorite tablets required for a 20-foot length of pipe equals $0.024d^2$, rounded to the next higher integer. The line shall be left undisturbed for 24 hours.

If the supplying water temperature is less than 41F (5C), the water shall remain in the pipe for at least 48 hours.

A detectable free chlorine residual (≥ 0.2 mg/L) shall be found at each sampling point after the 24- or 48-hour period.

2. Slug Method, per AWWA Standard C651:
The method consists of completely filling the main to eliminate air pockets; flushing the main to remove particulates; then slowly flowing through the main a slug of water dosed with 6% or 12.5% sodium hypochlorite to a free chlorine concentration of 100

mg/L. The slow rate of flow ensures that all parts of the main and its appurtenances will be exposed to the highly chlorinated water for a period of not less than 3 hours. If at any time the chlorine concentration of the slug drops below 50 mg/L, the flow shall be stopped, and chlorine shall be applied to restore the concentration to not less 100 mg/L.

The Contractor shall exercise special care in flushing to avoid damage to surrounding property and to conform with **Section W5-01 WATER QUALITY**.

When collecting water samples for chlorine and bacteriological testing, samples must be taken from a dedicated temporary sample spigot. Samples must be taken at the flushing/fill hydrant, beginning and end of the water main and every 500 feet of pipe. Chlorine samples must be taken using a DPD free chlorine colorimeter and chlorine level should be a minimum of 0.20 mg/L. Bacteriological samples shall be taken and sent to lab for analysis.

All lab samples shall also have HPC analysis completed.

Sampling shall be done 16 hours after initial flushing, and then additional second sample(s) must be taken 15 minutes after original sample was collected.

Following disinfection and the required contact time, water samples shall be taken by the Engineer and provided to a certified laboratory for testing. All bacteriological testing results must be provided to the Water Quality Senior Engineering Technician within 5 business days from when test results are received. All bacteriological test results must return as “Satisfactory” (free of coliform bacteria prior to placing the water main in service. If any bacteriological testing results as “Unsatisfactory” the Engineer will notify the Contractor and Water Quality Senior Engineering Technician immediately.

The Contractor shall be responsible for the treatment and disposal of chlorinated water flushed from mains and at no time shall untreated chlorinated water from a water main be discharged to receiving waters. This includes wetlands, lakes, rivers, streams, storm drainage systems. Disposal of chlorinated water and other waters flushed from mains may be made to any available sanitary sewer provided the rate of disposal will not overload the sewer, when authorized by the Utility.

W5-18 NOT USED

W5-19 UNDERGROUND UTILITIES

The plans show the approximate locations of various existing utilities, such as gas lines, water mains, storm drainage, power lines, telephone lines, television cables, and other obstructions. This information is not guaranteed to be accurate, and the Contractor shall check for interferences and obstructions.

The Contractor shall request field locates and notify the owners of underground facilities about the scheduled commencement of excavation through a one-call number (1-800-424-5555), or 811, 72 hours before construction for utility locations.

If a utility is not included in the one-number locator service, notice shall be provided individually to those owners of underground facilities known to or suspected of having underground facilities within the area of proposed excavation.

Notice shall be made to owners of underground utilities not less than two (2) business days or more than ten (10) business days prior to scheduled date of commencement of excavation.

The excavator shall excavate around and under service pipes with special care and shall support and maintain them in service. Where it is necessary to cut, move or reconnect any service lines, arrangements shall be made with the respective utility operator.

If a water main has been field marked as unlocatable and cannot be located by hand-digging or hydro-excavator, the excavator must contact Water Utility personnel at (425) 452-7840 to arrange for an on-site meeting. Water Utility personnel will assess risk of damage and create a mitigation plan.

W5-20 CONSTRUCTION ON EASEMENTS

All work on easements shall be performed strictly in accordance with easement provisions. Easements shall be restored equal to or better than original condition. The Contractor shall do no work on easement areas until specifically authorized by the Engineer. A signed and written release from the easement grantor shall be furnished to the Utility Inspector prior to permit sign-off.

W5-21 DUST CONTROL

The Contractor shall implement dust control measures. If water is used to control dust, it shall be kept to a minimum and shall not produce runoff from the site. On paved streets, if dust becomes a nuisance, the Contractor shall vacuum sweep the streets.

W5-22 BARRIER FENCE

Where indicated on the Plans, a bright orange safety fence shall be placed parallel to the silt fence, 2 feet nearer to the construction activity. Minimum fence material height shall be 3.5 feet.

The barrier fence shall be supported as recommended by the manufacturer.

W5-23 TRENCH EXCAVATION

Trenches shall be excavated to the line and grade shown on the approved plans and in accordance with the Standard Details. The trench width at the top of the pipe shall be 30 inches for pipe up to and including 12-inch inside diameter and the outside diameter of the pipe barrel plus 16 inches for pipe larger than 12-inch inside diameter. Where higher strength pipe or special bedding is required because of excess trench width, the Contractor shall furnish the necessary materials.

The trench shall be kept free from water until joining has been completed. Surface water shall be

diverted so as not to enter the trench. The Contractor shall maintain sufficient pumping equipment on the job to ensure that these provisions are carried out. Unsuitable material below the depth of the bedding shall be removed and replaced with satisfactory foundation materials as determined by the Engineer.

Trenching operations shall not proceed more than 100 feet in advance of pipe laying except with written approval of the Engineer.

When trenching operations take place in the public right-of-way, the pavement, and all other improvements, shall be restored as required by the Right-of-Way Use Permit.

W5-24 SHEETING & SHORING

The Contractor shall provide and install sheeting and shoring as necessary to protect workmen, the work and existing utilities, and other properties in compliance with OSHA and WISHA requirements. All sheeting and shoring shall be removed prior to backfilling.

All trenches and excavations more than 4 feet in depth shall be shored in compliance with applicable Federal and State regulations. Shoring shall be required in all street excavation. Sloping to the angle of repose will be permitted only in non-critical off-street areas.

Removal of the sheeting and shoring shall be accomplished in such a manner that there will be no damage to the work or to the other properties.

W5-25 TRENCH DEWATERING

When water is encountered to a degree that a successful trenching and pipe laying operation is hampered, the trench shall be dewatered to facilitate proper installation. . Determination of the method to be used to dewater trenched areas will be the responsibility of the Contractor, but any method used must be in accordance with the specifications and requirements of the Washington State Department of Ecology and the Local Jurisdiction.

W5-26 BEDDING, BACKFILL AND COMPACTION

W5-26.1 Pipe Bedding Construction Requirements

Pipe bedding shall conform to Section 7-08.3(1)C Bedding the Pipes of the Standard Specifications as modified herein in order to provide uniform support along the entire pipe barrel, without load concentration at joint collars or bells.

Bedding disturbed by pipe movement, by removal of shoring, or by movement of trench shield or box, shall be reconsolidated prior to placing backfill.

Pipe bedding shall be placed in loose layers and compacted to 90% maximum dry density. Lifts not more than 6 inches in thickness shall be placed and compacted along the sides of the pipe to a height of at least 6 inches above the top of the pipe. Material

shall be carefully worked under the pipe haunches and then compacted.

Jetting is not an allowable method to compact the bedding materials.

W5-26.2 Trench Backfill Construction Requirements

Backfilling shall be accomplished in accordance with Section 2-09 Structure Excavation of the Standard Specifications as modified herein:

In paved areas and areas within the right of way, trench backfill material shall be compacted to 95% maximum dry density per Section 2-03.3(14)D Compaction and Moisture Control Tests of the Standard Specifications.

In unpaved areas outside of the right of way, trench backfill material shall be compacted to at least 90% maximum dry density per Section 2-03.3(14)D Compaction and Moisture Control Tests of the Standard Specifications.

The Contractor shall arrange for compaction testing to be performed by a certified technician. The Contractor shall provide the Engineer with one copy of the compaction test report within 24 hours of the completion of the test.

Compaction tests shall be made at a maximum of 4-foot depth increments with a minimum of one test for any backfilling less than 4 feet in depth. The maximum space between tests shall not exceed 100 linear feet.

For mechanical compaction methods ("hoe pack," vibratory roller, static roller, etc.), the maximum backfill lift shall not exceed 2 feet between the application of compaction equipment.

For manual compaction methods (all walk-behind equipment, "jump jack," etc.), the maximum backfill lift shall not exceed 1 foot between the application of compaction methods.

Jetting is not an allowable method to compact the trench backfill.

Surface restoration shall be as specified in the Right-of-Way Use Permit and as shown on the approved plans.

See Appendix W-1 for trench backfill Standard Details.

W5-26.3 Structure Backfill Construction Requirements

Backfilling shall be accomplished in accordance with Section 2-09 - Structure Excavation of the Standard Specifications as modified herein:

In paved areas and areas within the right of way, backfill material shall be compacted to 95% maximum dry density per Section 2-03.3(14)D - Compaction and Moisture Control Tests of the Standard Specifications.

In unpaved areas outside of the right of way, backfill material shall be compacted to at least 90% maximum dry density per Section 2-03.3(14)D - Compaction and Moisture Control Tests of the Standard Specifications.

The Contractor shall arrange for compaction testing to be performed by a certified technician. The Contractor shall provide the Engineer with one copy of the compaction test report within 24 hours of the completion of the test.

Compaction tests shall be made at a maximum of 4-foot depth increments with a minimum of one test for any backfilling less than 4 feet in depth. At least one (1) compaction test shall be performed at each backfilled structure or for every 50 CY of backfill placed. If the structure (e.g. manhole, catch basin or inlet) is part of a pipeline trench, then trench compaction testing frequency governs.

For mechanical compaction methods ("hoe pack," vibratory roller, static roller, etc.), the maximum backfill lift shall not exceed 2 feet between the application of compaction equipment.

For manual compaction methods (all walk-behind equipment, "jump jack," etc.), the maximum backfill lift shall not exceed 1 foot between the application of compaction methods.

Jetting is not an allowable method to compact the structure backfill.

Surface restoration shall be as specified in the Right-of-Way Use Permit and as shown on the approved plans.

W5-26.4 Foundation Gravel Construction Requirements

Foundation gravel under manholes, catch basins, inlets, vaults, and other precast concrete structures shall be placed in layers not more than 6 inches thick and compacted to provide a firm and level base on which to place the structure. Unless shown otherwise on the

Contract Plans, the minimum thickness of foundation gravel under precast concrete structures is 6 inches.

W5-26.5 Controlled Density Fill Construction Requirements

Controlled Density Fill (CDF) shall be proportioned to provide a slurry, non-segregating, free flowing, self-consolidating and excavatable material that will result in a non-settling fill which has measurable unconfined compressive strength. Desired flowability shall be achieved with the following guidelines:

Low Flowability	3 - 6-inch slump
Normal Flowability	6 - 8-inch slump
High Flowability	8 - 10-inch slump

CDF shall be placed by any reasonable means into the area to be filled.

CDF mixing and placing may be started if weather conditions are favorable, when the temperature is at 34 degrees F and rising. At the time of placement, CDF must have a temperature of at least 40 degrees F. Mixing and placing shall stop when temperature is 38 degrees F or less and falling. Each filling stage shall be as continuous an operation as is practicable. CDF shall not be placed on frozen ground.

Trench section to be filled with CDF shall be contained at either end of trench section by bulkhead or earth fill.

When used to support existing asbestos cement (AC) pipe, the flowable CDF shall be brought up uniformly to the bottom of the AC pipe, as shown in the Standard Details, or as directed by the Engineer.

Contractor shall provide steel plates to span utility trenches and prevent traffic contact with CDF for at least 24 hours after placement or until CDF is compacted or hardened to prevent rutting by construction equipment or traffic.

W5-27 TRENCHLESS EXCAVATION

The use of trenchless excavation methods such as pipe bursting and horizontal directional drilling shall be considered by the Utility on a case-by-case basis under the following conditions:

- A. Romac 501 transition couplings are required at both ends.
- B. The installed pipe must be electronically located and marked on the ground for measurement in order to prepare record drawings.
- C. The pipe must be video inspected following installation, with water running. The video inspection must be provided to the Utility Inspector to approve the installation or require corrections.
- D. Pipe bursting is not allowed on another person's property or public right-of-way without the appropriate permission, such as an easement, or right-of-way use permit.

W5-28 ADJUST EXISTING STRUCTURE TO GRADE

W5-28.1 Vault Cover Adjustment

Existing vault covers affected by a pavement overlay, or adjustment in surface grade, shall be adjusted to final grade within seven (7) calendar days excluding weekends and holidays.

W5-28.2 Valve Box Adjustment - Pavement Overlays and Sidewalks

Valve box covers shall be exposed and accessible immediately after placement of paving materials.

- A. Raising the existing valve box cover less than 2" shall be accomplished by adjusting the existing top section of the valve box.

- B. Raising the existing valve box cover 2" or more, shall be accomplished by either adjusting the existing top section or by inserting a valve box paving riser into the existing valve box top. The paving riser shall be epoxied to the valve box.
- C. If the valve box base section needs to be extended, the contractor shall install a 4" diameter cast iron soil pipe, with bell-end of the soil pipe inserted over the top of the existing valve box base section. The spigot-end of the soil pipe shall be located a minimum of 6" and maximum of 9" below finished grade. The valve box top section shall be slipped over the soil pipe and adjusted to final grade. A polyethylene sheet, 8 mils thick, shall be placed between the valve box and soil pipe to prevent metal to metal contact where the sections overlap.

Final box adjustment shall leave the top of the valve box no higher than final grade, and no lower than 0.5" below final grade.

In asphalt concrete pavement overlay areas, excavation of the valve box to be raised shall be accomplished by saw cutting or neat-line jackhammering the pavement a minimum of 12" around the perimeter of the valve box.

Final adjustment of valve boxes shall be made within seven (7) calendar days following the final overlay.

W5-28.3 Valve Box Adjustment - Unimproved Areas

Adjustment of valve box covers located outside paved areas or sidewalks can be accomplished using a 12-inch valve box adjusting sleeve inserted into the existing valve box top section.

W5-29 ABANDONING FACILITIES

W5-29.1 Abandoning Pipe In-Place

The Contractor shall plug the open ends of all pipes, fittings, etc. to be abandoned with end cap coupling on asbestos cement or steel pipe, with mechanical joint cap or plug on cast or ductile iron pipe.

W5-29.2 Abandoning Structures

Abandonment of structures shall be completed only after piped systems have been properly abandoned. Structures within the public right-of-way, a public easement or which are part of the publicly owned and maintained system must be:

- removed completely according to Section 3-02 of the Standard Specifications; or
- abandoned according to Section 7-05.3(2) of the Standard Specifications provided no conflicts with new utilities or improvements arise.

W5-29.3 Abandoning Gate Valves In-Place

Abandoned valves shall be removed and a blind flange installed on the tee. When an abandoned valve cannot be removed, as determined by the utility, the valve shall be closed, a blind flange installed and a piece of 2" diameter by 2-foot-long white PVC pipe shall be placed over the operating nut.

W5-29.4 Abandonment of existing water services

Abandonment of existing water services (2 inches and less in diameter) shall be accomplished as follows:

- a. Remove existing service saddle from water main and replace with new stainless steel repair band, Romac SS2, Ford Service Saddle FC101, CC threaded saddle and a CC thread brass plug, or approved equal (will not be required when water main is to be abandoned).
- b. Remove and dispose of existing setter and meter box.
- c. Cap or crimp (if copper) existing service line to be abandoned in place, each end.
- d. Return existing meter to Utility Inspector.

Abandonment of existing water services larger than 2 inches in diameter, shall be accomplished as follows:

- a. Remove the water service line from the easement or right of way up to the gate valve on the water main.
- b. After the water main has been shut down, remove the gate valve from the flanged tee on the water main and install a blind flange.
- c. If the joint on the tee is a mechanical joint, remove the valve and install a mechanical joint plug with concrete blocking.
- d. The meter vault shall be abandoned per W5-29 herein.

W5-30 LAWN REMOVAL AND REPLACEMENT

Any lawn damaged by the Contractor outside of limits shown on the plan shall be restored to conditions existing prior to construction. Contractor shall take care to limit the area of disturbance.

When lawn removal and replacement is called for, a sufficient width (at least 2' wider than outside width of backhoe wheels or tracks) of lawn turf shall be removed prior to beginning excavation so that heavy equipment does not run over the lawn.

The area of the sod to be removed shall be laid out in squares or strips of such size as to provide easy handling and matching. The sod shall then be carefully cut along these lines to a depth of four (4) inches, taking care to keep cuts straight and strips of the same width. After the sod has

been cut vertically, it shall be removed to a uniform depth of approximately three (3) inches with an approved type of sod cutter.

This operation shall be performed in such manner as to ensure uniform thickness of sod throughout the operation.

Prior to installation of new sod, the scalped area shall be carefully shaped to proper grade and be thoroughly compacted. Wherever the construction operations have resulted in the placement of unsuitable or poorer soils in the area to be re-sodded, the surface shall be left low and covered with top soil.

The finished grade, after shaping and compacting the top soil, shall be thoroughly dampened prior to and immediately before replacing the sod. The sod shall be replaced to the required grade, taking care to butt each piece tightly against the adjacent one. Upon completion, the sod shall be dampened and rolled with a lawn roller.

All tools used shall be of the type specially designed for the work and be satisfactory to the Engineer.

Sod shall be a commercially available 4-way blend of Ryegrasses or equivalent approved by the Engineer.

W5-31 BORING UNDER ROOTS

Boring under the root systems of trees (and plants) shall be accomplished by excavating a trench or pit on each side of the tree dripline and then hand digging, hydro-excavating or pushing the pipe through the soil under the tree dripline.

W5-32 HIGHWAY AND RAILROAD CROSSINGS

Interstate, state, or county highway and railroad crossings require the placing of steel, cast iron or concrete pipe casing by jacking or tunneling and laying the carrier pipe within the casing.

W5-33 BORING AND JACKING STEEL CASING

The Contractor shall verify the vertical and horizontal location of existing utilities. If required to avoid conflicts and maintain minimum clearances, adjustment shall be made to the grade of the casing.

The pipe shall be bored and jacked where indicated. The Contractor shall remove or penetrate all obstructions encountered. If groundwater is found to be a problem during boring operations, the Contractor shall do all that is necessary to control the flow sufficiently to protect the excavation, pipe and equipment so that the work is not impaired. Any pipe damaged during the boring and jacking operation shall be repaired by the Contractor in a manner approved by the Engineer.

Special care shall be taken during the installation of the bored and jacked pipe to ensure that no

settlement or caving be caused to the above surface. Any such caving caused by the placement of the pipe shall be the Contractor's responsibility and shall repair any area so affected as directed by the Engineer.

During the jacking operations, particular care shall be exercised to prevent caving ahead of the pipe which will cause voids outside of the pipe. If voids exist, the Contractor shall drill through the wall of the casing pipe and fill the voids with a pumped cement grout. All voids shall be filled to the satisfaction of the Engineer.

The carrier pipe shall be installed in the casing as shown on the drawings. The Contractor shall support carrier pipe with casing spacers as shown in the Standard Detail. The casing pipe shall not be backfilled with sand and grout. The casing ends shall be sealed with manufactured rubber end seal devices.

Boring pits shall be backfilled with suitable excavated material and compacted to 95% maximum dry density as determined by ASTM D-1557. The contractor shall provide sufficient trench backfill material to make up for the rejected material.

All disturbed ground shall be restored to its original condition or better.

W5-34 WORKING WITH ASBESTOS CEMENT PIPE

When working with asbestos cement pipe, the Contractor is required to maintain workers' exposure to asbestos material at or below the exposure limit as prescribed in WAC 296-62-07705. The Contractor shall provide all personal protective equipment, tools and materials. In addition, when requested, the Contractor shall provide their safety plan that demonstrates the processes and procedures the Contractor employs to ensure asbestos exposure limits are not exceeded.

W5-35 ASBESTOS CEMENT WATER MAIN CROSSINGS

Where new utility line crosses below an existing AC main, the AC pipe shall be replaced with DI pipe to 3 feet past each side of trench as shown on the Standard Detail. Alternatively, where directed by the Engineer, the trench shall be backfilled with controlled density fill (CDF, aka flowable fill) from bottom of trench to bottom of the AC main.

W5-36 VAULT INSTALLATION

Vaults for water facilities (pressure reducing station, water service, backflow assembly, etc.) shall be constructed at the locations shown on the approved plans. It shall be constructed as shown on the approved plans, Standard Details and as directed by the Engineer.

The excavation shall have minimum one (1) foot clearance between the vault outer surfaces and the earth bank. The vault shall be placed on compacted foundation gravel. The vault shall be plumb and watertight. The access cover shall be seated properly to prevent rocking and shall be adjusted to match the finished grade. Vault shall have coal tar coating of 5 to 9 mils applied to the exterior.

Vault floor shall drain to daylight, or to location shown on the plan. Drain pipe shall be minimum 4" diameter.

Where knockout locations for pipe do not coincide with locations of pipe penetrations into the vault, the Contractor shall core drill openings for pipe.

W5-37 INSERTION VALVE INSTALLATION

Before installation, insertion valves shall be cleaned of all foreign material. Such blocking as the Engineer may deem necessary shall be provided. The insertion valve and valve box shall be set plumb with the valve box centered on the valve. The top of the valve box shall be set with all valves except auxiliary valves for hydrants. Where valve operating nut is more than three feet below finished grade, a stem extension conforming to the Standard Detail must be installed.

The top of the valve box base section shall be located a minimum of 6" and maximum of 9" below finished grade. A polyethylene sheet, 8-mils thick, shall be placed between the top and base valve box sections to prevent metal to metal contact where the sections overlap.

Valve box top sections shall be adjusted flush with the finished pavement and, in those areas to be excavated for future roadway grades, enough adjustment shall be provided in the valve box to allow the top of the box to be adjusted to the required grade.

END OF CHAPTER W5

**CHAPTER W6 – SUMMARY OF UNDERGROUND FIRE SYSTEM INSTALLATION
REQUIREMENTS FOR COMMERCIAL/MULTI-FAMILY PROJECTS
(FOR SERVICES GREATER THAN 2 INCHES IN DIAMETER)**

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CHAPTER W6 – SUMMARY OF UNDERGROUND FIRE SYSTEM INSTALLATION REQUIREMENTS FOR COMMERCIAL/MULTI-FAMILY PROJECTS (FOR SERVICES GREATER THAN 2 INCHES IN DIAMETER)

W6-01 GENERAL

Listed below is a summary of the requirements for the installation of underground fire lines in commercial and multi-family projects. A detailed listing of requirements can be found in Section 6-7, “Automatic Fire Sprinkler and Standpipe Systems” of the Fire Department’s Construction Guidelines and the Utilities Department’s Engineering Standards – water works section.

W6-02 PERMITTING

Installation of a dedicated fire service line from the municipal water main to: 1) an exterior backflow assembly, or 2) within 5 feet of the building foundation for interior backflow assemblies, shall be accomplished under a permit issued by the City of Bellevue Utilities Department. All other dedicated fire service lines and appurtenances shall be accomplished under a permit issued by the fire jurisdiction.

W6-03 INSTALLATION

Contractor must be a Level “U” or Level III licensed contractor in accordance with RCW 18-160 and WAC 212-80 to install any portion of the fire sprinkler underground piping. Developer shall submit proof of Contractor’s Certificate of Competency Holder and fire sprinkler system licensing prior to permit issuance. State law does not allow a licensed contractor to subcontract fire sprinkler system installation to an unlicensed contractor.

W6-04 INSPECTIONS

Utility Inspectors will inspect and test the underground fire lines:

(1) DCVA - Inside the Building – from the municipal water main to within five (5) feet of the building foundation; and

(2) DCVA - Outside the Building – from the municipal water main to the downstream flange on the DCVA.

Interior DCVA’s, wall-mounted PIV’s, FDC’s, FDC swing check valves, private fire hydrants, private fire distribution mains, fittings, joint restraint, and blocking, building pipe penetrations and tamper switches will be inspected by the Fire Department under a separate permit.

Connections and fittings shall not be backfilled prior to inspection.

Pressure test – 200 psi for two hours, or 50 psi in excess of working pressures, whichever is greater, with no loss between the gate valve on the municipal water main and the floor flange.

Bag Flush – In the presence of the Fire Inspector, first charge the fire service line from a fire

hydrant equipped with a backflow assembly (Standard Detail W-9) through the FDC and flush out the floor flange. Next, flush the entire fire line out at the floor flange.

The flush must be witnessed by the Fire Inspector. The fire line shall be flushed for a minimum of 15 minutes at scouring velocities unless otherwise directed by the Inspector. If debris is detected in the bag, additional test(s) shall be performed until the debris has been cleared from the fire line.

Disinfection and Flushing – See Utilities Engineering Standards Section W5-17.

Inspection processes and approved materials may be different outside the Bellevue city limits (e.g. Clyde Hill, Medina, Hunts Point, etc.). New backflow assembly test reports from outside of Bellevue city limits must be submitted to Bellevue Utilities, 425-452-5208.

W6-05 MATERIALS & CONSTRUCTION REQUIREMENTS

W6-05.1 General

Minimum depth of cover for underground fire lines is 3 feet.

Maximum depth of cover for underground fire lines is 6 feet.

W6-05.2 Pipe

Ductile Iron Pipe, Class 52, cement mortar lined or epoxy coated. See Utilities Engineering Standards Section W4-02.

Polyethylene encasement, 8 mil minimum thickness. See Utilities Engineering Standards section W4-03.

All pipe shall have restrained joints (See Utilities Engineering Standards section W4-29).

Casings are required under walls and footings. See Utilities Engineering Standards section W4-37 and W4-38.

W6-05.3 Fittings

Ductile Iron, Class 52, compact type, cement mortar lined or epoxy coated. See Utilities Engineering Standards Section W4-02.

All fittings shall have restrained joints (See Utilities Engineering Standards Section W4-29) and concrete thrust blocking. Dual restraint is required on all changes in direction.

Cement concrete blocking is required at all changes in direction (Standard Details W-1, W-2, and W-3).

W6-05.4 Double Check Valve Assembly (DCVA)

Assembly must be installed in the orientation approved by the Washington State Department of Health. See Utilities Engineering Standards Section W4-32 and Standard Detail W-45.

W6-05.5 (Not Used)

W6-05.6 Post Indicator Valve (PIV)

Location – PIV shall be set on the fire service line between the easement/property line and the point of connection of the FDC on the fire service line.

Clearance – 3 feet from obstructions, vegetation, fencing, structures, curb line, and edge of sidewalk; 5 feet from protective bollards.

PIV – Listed for fire protection service, rated for 200 psi test pressure.

Paint – 2 coats of Rust-Oleum Regal Red over primer or approved equal.

W6-05.7 Bollards

Bollards are required when the PIV or FDC may be subject to vehicular damage. Install 6-inch diameter minimum, Schedule 40 iron pipe or Class 52 DI pipe, filled with Class 3000 concrete.

Height – equal to or higher than the height of the FDC or PIV.

Embedment – 3-foot depth in a 15-inch diameter concrete footing.

Spacing – sufficient to protect the FDC or PIV spaced not more than 4 feet apart.

Paint – 2 coats of Rust-Oleum Regal Red over primer or approved equal.

W6-05.8 Tamper Protection

Tamper (supervisory) switches shall be installed on PIV's and DCVA's.

Electrical conduits penetrating vault walls shall be neatly cored or drilled and the annular space grouted, inside and out, to prevent seepage.

A vault drain (gravity to storm drain or sump pump – no dry wells) is required if tamper switches and wiring are not waterproof.

Tamper protection will be inspected by Fire Department under the fire sprinkler permit (FB).

END OF CHAPTER W6

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APPENDIX W-2

DRAFTING STANDARDS

City of Bellevue Auto CAD Standards Manual and Auto CAD Templates are available by contacting the City at: Utilities@bellevuewa.gov

APPENDIX W-3

SAMPLE TITLE BLOCK

City of Bellevue Sample Title Block is available by contacting the City at:
Utilities@bellevuewa.gov

APPENDIX W-4**WATER APPROVED MATERIALS LIST**

The following manufacturers have been approved for use for water works construction. Where specific manufacturers are listed, no other manufacturer may be used without prior approval by the Utility.

DUCTILE IRON PIPE

All manufacturers that meet the performance requirements specified under the material section of the Standards.

DUCTILE IRON FITTINGS

All manufacturers that meet the performance requirements specified under the material section of the Standards.

GALVANIZED IRON PIPE

All manufacturers that meet the performance requirements specified under the material section of the Standards.

JOINT RESTRAINT SYSTEMS

American Ductile Iron Pipe (Flex-Ring)

American Ductile Iron Pipe (Amarillo Fast-Grip Gasket) – Only to be used with FASTITE JOINT pipe manufactured by American. Gaskets must be provided in yellow color.*

Cooper B-Line B3132–Stainless Steel or Heavy Duty Hot Dipped Galvanized pipe clamps (embedded in concrete blocks)

EBAA Iron (MEGALUG 1100 Series)

EBAA Iron (MEGAFLANGE 2100 Series)

Romac (Grip Ring), 600 Series, RomaGrip

Romac (Bell Restraint) 611 with 316SS stainless steel nuts and bolts

Star National Products (Shackle Products) - All rods and hardware shall be 316SS stainless steel.

Uni-Flange Corporation Series 1400, or Series 1450 with 316SS stainless steel nuts and bolts

US Pipe (TR FLEX, HDSS)

US Pipe (FIELD LOK 350) – Only to be used with TYTON JOINT Pipe manufactured by US Pipe. Gaskets must be provided in red color.*

*Restraint gaskets shall not be used in unburied installations, diameters exceeding 18”, or within casings.

REPAIR CLAMPS

Romac Industries, Models SS1 and SS2

COUPLINGS

Romac (Alpha, Macro HP, 400, and 501 Series), Smith-Blair (Rockwell), Mueller MaxiFit, Mueller MaxiStep

CASING (COATING FOR STEEL CASING)

Tnemec Hi-Build Tneme-Tar, Series 46H-413

CASING SPACERS

Pipeline Seal and Insulator Co.:

- 8" band, carbon steel with fusion-bonded coating, Model C8G-2
- 12" band, carbon steel with fusion-bonded coating, Model C12G-2

Cascade Waterworks Mfg. Co.:

Stainless Steel or hot-dip galvanized carbon steel Casing Spacers
(catalog number depends on size)

Advance Products & Systems, Inc.:

- 8" band, stainless steel, Model SSI8
- 12" band, stainless steel, Model SSI12
- 8" band, carbon steel with fusion-bonded coating, Model SI8
- 12" band, carbon steel with fusion-bonded coating, Model SI12

CASING END SEALS

Pipeline Seal and Insulator Co.:

- Standard Pull-on (Model S)
- Custom Pull-on (Model C)

Cascade Waterworks Mfg. Co.:

CCES End Seal

Advance Products & Systems, Inc.

Molded End Seal, Model AM

GATE VALVES

All manufacturers that meet the performance requirements specified under the material section of the standards.

INSERTION VALVE Team Industrial Service Insert Valve (4 to 12-inch dia.)

DI, CI, AC and PVC

Hydra-Stop Insta-Valve 250 Patriot Series (4 to 12-inch dia.)

DI, CI, AC and PVC

Romac Quik Valve (4 to 8-inch dia.)

AC only

Advanced Valve Technologies AVT EZ System Valve (4 to 12-inch dia.) DI, CI (temp line stop only).

PRV STATION

- PRESSURE REDUCING VALVES

CLA-VAL 90G-15ABCSVKC }

6" Provide stainless steel trim on disk guide, seat, and cover bearing. Provide copper and brass tubing and fittings. Provide ball valves on all body ports. For 2" PRV, provide stainless steel disk retainer.

CLA-VAL 90G-15ABCSVKC }

2"

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- STRAINERS

Cla-Val X43H}	6"	Mesh openings 0.059 inch
Cla-Val X43H }	4"	Mesh openings 0.059 inch

- PRESSURE RELIEF VALVES

CLA-VAL 50G-01BKCX}	2"	Provide stainless steel trim on disk guide, seat, and cover bearing. Provide ball valves on all body ports. Provide stainless steel disk retainer.
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INDIVIDUAL PRESSURE REDUCING VALVES (Residential)

ZURN/WILKINS 600XL-HLR-SC or equal (Lead-Free with sealed cage, internal bypass and strainer)

INDIVIDUAL PRESSURE REDUCING VALVES (Commercial)

- PRESSURE REDUCING VALVES

ZURN/WILKINS 600XL-HLR-SC or equal (Lead-Free with sealed cage, internal bypass and strainer)

- PRESSURE RELIEF VALVES

CLA-VAL 55F

SERVICE SADDLES

1" tap: Ford FC101 (4" to 8" mains), epoxy-coated saddle with stainless steel strap
Smith-Blair 315, epoxy-coated saddle with stainless steel strap
A.Y. McDonald 4835A series, epoxy-coated saddle with stainless steel strap
Romac 101NS, nylon-coated saddle with stainless steel strap

1 1/2" & 2" tap: Ford FC202 and FCD202, epoxy-coated saddle with stainless steel strap(s)
Smith-Blair 317, epoxy-coated saddle with stainless steel strap
A.Y. McDonald 4845A or 4855A, epoxy-coated saddle with stainless steel strap(s)
Romac 202NS, nylon-coated saddle with stainless steel strap(s)

CORPORATION STOPS

1" size: Ford Ballcorp FB1000-4-NL
Mueller No. P-25008N
A.Y. McDonald 4701-22, 4701B-22

1 1/2" size: Ford Ballcorp FB400-6-NL
Mueller Oriseal No. H-9968N

A.Y. McDonald 4701B-22, or 3128B (with FIPT by pack joint coupling 4754-22)

2" size: Ford Ballcorp FB400-7-NL
Mueller Oriseal No. H-9968N
A.Y. McDonald 4701B-22, or 3128B (with FIPT by pack joint coupling 4754-22)

ANGLE METER VALVES

1 1/2" Irrigation: Ford FV13-666W-NL
Mueller 1 1/2" H-14286N
A.Y. McDonald 4604B

2" Irrigation: Ford FV13-777W-NL
Mueller 2" H-14286N
A.Y. McDonald 4604B

VALVE BOXES

Olympic Foundry Inc.: #VB045 Lid, Top and Base Section
RICH (VanRich Casting Corp.): Top section and lid #045 with RICH Standard Base

BUTTERFLY VALVES

All manufacturers that meet the performance requirements specified under the material section of the Standards.

AIR RELEASE WITH VACUUM CHECK VALVES

Val-Matic Model 15A.3 with vacuum check valve
Crispin Model PL10 with vacuum check valve
APCO Model 50A with vacuum check valve

AIR AND VACUUM RELEASE WITH VACUUM CHECK VALVES

APCO No. 143-C with vacuum check valve on the air release valve
Val-Matic No. 201C with vacuum check valve on the air release valve
Crispin UL10 with vacuum check valve on the air release valve

FIRE HYDRANTS

Waterous Pacer
East Jordan WaterMaster 5CD250
M&H 129 SS

BRASS WATER SERVICE FITTINGS AND VALVES

Approved manufacturers of brass fittings and valves up to 2" sizes include Ford, Mueller, James Jones Company (except James Jones meter setters, which are not approved), and A.Y. McDonald Manufacturing Co. The items supplied shall be equal to the models listed in these Standards.

METER SETTERS

1" x 1" (horizontal): Ford VBB74-12W-11-44-NL
Mueller 1" No. 390B2404----00N with multi-purpose connection No.

H-14222 A.Y. McDonald 20-412WWDD44

- 1" x 1" (vertical): Ford VV74-84-12W-11-44-NL
A.Y. McDonald 39-412WW2D44 (inlet coupling is MIPT by pack joint, 4753-22)
- 1 1/2" Domestic: Ford VBB86-12B-11-66-NL
A.Y. McDonald 20B612WWFF665 Vertical Meter Setter with Valve Rotated 90°
- 2" Domestic: Ford VBB87-12B-11-77-NL
A.Y. McDonald 20B712WWFF775 Vertical Meter Setter with Valve Rotated 90°

METER BOXES

- 1" Services: Landscape: Carson 1527-18 BCF box. Composite cover with 2" AMR recess (Carson, Fibrelyte FL1527, or Nicor B65).

Sidewalk/Vehicular traffic: Olympic Foundry SM30 Box and Cover
- 1 1/2" and 2" Services: Landscape: Carson 17730-18 BCF box. composite cover with 2" AMR recess (Carson, Fibrelyte FL36, or Nicor B36).

Sidewalk/Vehicular traffic: Olympic Foundry SM30 Box and Cover
- 2" Blow-Off Assembly: Landscape: Carson 1730-18 BCF box. Flush composite or ductile iron cover (Carson, Fibrelyte FL36, or Nicor B36).
- 1" Air Release Valve Assembly: Landscape: Carson 1527-18 BCF box. Flush composite or ductile iron cover (Carson, Fibrelyte FL 1527, or Nicor B65).
Sidewalk/Vehicular traffic: Olympic Foundry SM30 Box and Cover
- 1" Pressure Reducing Valve Assembly (Residential): Landscape: Carson 1527-18 BCF box. Flush composite or ductile iron cover (Carson, Fibrelyte FL 1527, or Nicor B65).
Sidewalk/Vehicular traffic: Olympic Foundry SM29 Box and Cover
- 1" Pressure Reducing Valve Assembly (Multi-Family or Commercial): Landscape: Carson 1730-18 BCF box. Flush composite or ductile iron cover (Carson, Fibrelyte FL36, or Nicor B36).

Sidewalk/Vehicular traffic: Olympic Foundry SM#) Box and Cover

1 ½" and 2"

pressure Reducing

Valve Assembly: Landscape: Carson 1730-18 BCF box. Flush composite or ductile iron cover (Carson, Fibrelyte FL36, or Nicor B36).

Sidewalk/Vehicular traffic: Olympic Foundry SM30 Box and Cover

REDUCED PRESSURE BACKFLOW ASSEMBLIES

As approved on the most current Department of Health list for cross connection assemblies.

DOUBLE CHECK VALVE ASSEMBLIES

As approved on the most current Department of Health list for cross connection assemblies.

RESILIENT SEATED SHUT-OFF VALVES

All manufacturers that meet the performance requirements specified under the material section of the Standards.

NEOPRENE FOAM PAD (FOR CUSHION BETWEEN ADJACENT PIPES)

DOW Plastics Ethafoam™ 220

LADDER-UP

Bilco, Model LU-2 (steel safety post, hot dip galvanized) or approved equal.

VAULT HATCH/DOOR AND NON-SLIP TREATMENT

L.W. Products Company, Inc., Models HHD and HHS (rated for H-30 Vehicle Loading) or approved equal.

Hatches shall include recessed padlock hasp sized to accept City of Bellevue Water Utility padlocks.

Non-Slip Treatment

Metal lids, hatches, access covers, and frames (> ½ inch wide) in pedestrian access routes shall be constructed with a gray non-slip treatment by one of the approved products below:

Manufacturer

LW Products

SlipNOT Metal Safety Flooring

IKG Industries

Grating Pacific LLC

Product*

Thermion Arc Metal Spray

SlipNOT Grip Plate, Grade 3

MEBAC #1 (Metal Bonded Anti-Slip Coatings)

ALGRIP Safety Floor Plates

*Manufacturer/applicator shall certify that the applied non-slip treatment meets all ADA requirements.

LINK SEAL

Vault wall pipe penetration seals shall be Link Seal Model S-316 (EDPM) with stainless steel hardware.

EXPANSION ANCHOR BOLTS INTO CONCRETE

Expansion anchor bolts shall be wedge style “Power Stud”, “Power Bolt” Hilti KB3-HPG in stainless steel or galvanized steel.

APPENDIX W-5**WATER WORKS REFERENCE STANDARDS****Standards for Utilities Installed in Proximity of Seattle Public Utilities Transmission Pipelines:**

Seattle Public Utilities (SPU) operates several major water transmission pipelines within King County. These pipelines supply nearly all the domestic water to the communities in western King County. In some cases these pipelines are located within SPU's fee-owned right of way, within easements on private property or within the city streets, county road or state highways.

Vibrations, heavy loads, and other construction activities can damage these pipelines. If a pipeline is damaged there could be substantial collateral damage. For this reason SPU needs to review plans and apply standard pipe protection procedures for any project in close proximity to, or that will cross these pipelines.

Written approval and conditions must be obtained from SPU (SPU_CIP_Review@Seattle.gov).

In order to review any such project SPU will need:

- 3 copies of scalable plans that show the proposed improvements as they are located in relation to SPU facilities or electronic plans in pdf format.
- Names, addresses, and telephone numbers for the appropriate contact persons of the entity(ies) responsible for the work, including a contact person whom can be reached 24 hours a day.
- SPU's Record Plans can be obtained from the City of Seattle Vault which is located at 47th floor of the City of Seattle Municipal Tower, 700 5th Ave., Seattle, 98124. Phone: 206-684-5132.
- <https://www.seattle.gov/utilities/construction-resources/records-vault>

SPU's General Design Requirements:

- <https://www.seattle.gov/utilities/construction-resources/standards-and-guidelines/standard-specs-and-plans>
- When crossing SPU's pipelines the installed "facility" should be at a right angle to SPU's pipeline or parallel with the centerline of a controlling road.
- When crossing SPU's pipelines the vertical separation between the installed facility and SPU's pipelines should be 18 inches for a sewer line and 12 inches for all other facilities over the pipelines. The separation should be a minimum of 24 inches for all facilities installed under the pipelines.
- When crossing SPU's pipelines with a water or sewer main of ductile iron pipe (d.i.p.), one (18 to 20 foot) section must be centered on SPU's pipeline so that the section joints are not over or under any portion of SPU's pipeline. The joints must be pressurized and tested for leaks.
- When crossing SPU's pipelines, if the installed facility is not made of ductile iron pipe, the facility must be installed in a steel casing with walls at least 1/4 inch thick.

- When crossing SPU's pipelines if the facility is installed within SPU fee-owned right-of-way, the steel casing must be installed the entire width of the right of way. If the facility is installed within a street right of way, the steel casing must extend at least 10 feet on each side of the pipeline.
- SPU's pipelines are set in a bed of pea gravel. Construction must be performed in a manner that will not allow the pea gravel to escape from under the pipeline.
- Construction methods must be employed to support the pipeline during excavation.
- "Trenchless" construction methods must be approved on a site by site basis due to the high probability of substantial collateral damage if one of SPU's pipelines is damaged.
- Cathodic pipe protection methods may be required.
- For parallel installations, SPU would like 10 feet of separation on each side of its pipelines.
- Shallow curb inlets can be closer than 10 feet if ductile iron is used and the drain line diverts the water to a catch basin at a remote location.
- Special protections or bridging methods may be required to protect the pipeline due to the width and/or depth of trenching in the vicinity of SPU pipelines.
- If SPU's pipeline is exposed, SPU wants to inspect the pipe prior to back filling.
- Special fill and/or compaction may be required depending on the method and depth of excavation.
- Overhead wire installations typically require a minimum of 25 feet of vertical clearance from the ground.
- Vibrations could damage some of SPU's pipelines; therefore, pile driving, blasting and other vibration producing work may be restricted.
- Heavy loads could damage some of SPU's pipelines. Therefore, pipe protection may be necessary if heavy equipment crosses the pipe. Typical protection would include temporary bridging using timbers and steel plate.

SPU Operations requirements:

- Notify SPU at least 48-hours' notice prior to construction. Locating SPU's pipeline by potholing must be supervised. Call SPU's Lake Youngs Operations at 206-684-3933.
- Any work in close proximity to SPU's pipeline (including locating by potholing) must be supervised by SPU. Call SPU's Lake Youngs Headquarters at 206-684-3933 at least 72 hours in advance.