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7. Distribution Facilities Design and Construction Standards

Table of Contents

7.1	Project Review Procedures	7-1
7.2	Policies and Requirements for Outside Parties	7-1
7.2.1	Developer Extension Agreement	7-1
7.2.2	Pipe Looping Requirements	7-3
7.2.3	Fire Flow	7-3
7.2.4	Other Requirements	7-3
7.3	Design Standards	7-4
7.3.1	Water Service Pressure	7-4
7.3.2	Pipeline Velocities	7-4
7.3.3	Pipelines	7-4
7.3.4	Storage Tanks	7-5
7.3.5	Booster Pumps	7-5
7.3.6	Pressure-Reducing Valve Stations	7-5
7.3.7	Valves	7-5
7.3.8	Hydrants	7-6
7.4	Construction Standards	7-6
7.4.1	Ductile-Iron Pipe	7-6
7.4.2	Polyvinyl Chloride Pipe	7-6
7.4.3	High-Density Polyethylene Pipe	7-7
7.4.4	Valves	7-7
7.4.5	Backflow Prevention Assemblies	7-8
7.4.6	Fire Hydrants	7-8
7.4.7	Pipe Laying	7-8
7.4.8	Connection to Existing Main	7-8
7.4.9	Water Service Connections	7-9
7.4.10	Fire Hydrant Installation	7-9
7.5	Construction Certification and Follow-Up Procedures	7-9
7.5.1	Hydrostatic Tests	7-9
7.5.2	Sterilization and Flushing of Water Mains	7-10
7.5.3	As-Builts	7-10
7.5.4	Notice of Completion	7-11

Tables

Table 7-1	Service Area Governing Fire Guidelines	7-4
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7. Distribution Facilities Design and Construction Standards

The Sammamish Plateau Water and Sewer District (District) facilities were built to meet the District's design standards, which are regularly reviewed and updated to incorporate new technology and products to ensure the installation of high-quality, efficient facilities. Staff members from each District department meet monthly to review the design standards and new products and installation techniques, as well as changes in the International Building Code, International Fire Code (IFC) and Uniform Plumbing Code. The District issues new design standards every five years (see Appendix F). This chapter provides a general description of the District's review procedure, policies and requirements, and design and construction standards.

7.1 Project Review Procedures

The District has a formal review process that is used to review all projects. When a project is submitted, District engineering staff reviews the documents (reports/drawings) for compliance with the District's technical specifications as well as with the standards of the Cities of Sammamish and Issaquah, and King County. Projects designed or prepared by District staff are reviewed by the Engineering Manager. After District staff review comments have been addressed and the documents have been found to be in compliance with the above-referenced standards, the Engineering Manager then conducts a final review of the documents. On completion of the final review, the General Manager signs and approves the project.

The District provides project reports and construction documents to DOH for review and approval prior to installation or construction of water system extensions or improvements (per WAC 246-290-110 and 246-290-120), except for distribution main related projects, for which the District requests exemption from the submittal requirements (per WAC 246-290-125, regarding project report and construction document submittal exemptions).

7.2 Policies and Requirements for Outside Parties

7.2.1 Developer Extension Agreement

This section presents a summary of the Developer Extension Agreement (DEA) procedure, from inception to completion. The District has a DEA Booklet that is available to developers and that is included in its entirety in Appendix I. The DEA is also located on the District's website, and the most up to date copy can be obtained on-line.

Preliminary Fee Phase. Once a DEA application has been submitted, the District calculates equivalent residential units (ERUs) and checks for compliance with the District's comprehensive plans. The developer is at that time responsible for paying the preliminary/certificate fees which include the partial General Facility Charges and the Development Services Deposit. The DEA is approved by the District Commissioners by

resolution. The developer may obtain completed Certificates of Water and/or Sewer Availability from the District following such approval.

Design Phase. After the preliminary fees have been paid, a predesign meeting is conducted to discuss the District's standards and the developer's preliminary design. The District reviews the submitted drawings for compliance with District technical specifications. The District also addresses the issues of fire flow, pipe looping, and other local or regional requirements. After the final plans are approved, the developer pays the remaining General Facility charges. The developer submits Mylar™ copies of the plans to be signed by the General Manager and submits four copies of the drawings to the District for use during construction and for submittal to permitting agencies. The District then submits the necessary copies to King County, the City of Sammamish or the City of Issaquah for a right-of-way permit, to the State Department of Ecology (DOE) and King County for sewer approval, and to DOH for water approval if the project is not exempt from DOH review.

Preconstruction Phase. After receiving the necessary approvals and permits from the District and the applicable permitting agencies, the District conducts a preconstruction meeting with representatives from the District, the developer, and the general contractor. The preconstruction conference checklist is provided to all attendees. Offsite easements, material and equipment submittal list, certificate of insurance, and the performance guarantee are items required to be submitted and approved by the District prior to the preconstruction conference.

Construction/Final Acceptance Phase. The contractor must notify the District 48 hours before the start of construction. District inspectors visit the site regularly during the construction phase to ensure that the facilities are constructed in accordance with District standards and the District-approved plans. Where technically feasible, all new water system components are constructed separately from the District's existing system. Prior to connection to the District's existing system, the District's inspectors perform purity and pressure tests. Once those tests are completed successfully, the contractor connects the new facilities to the District's existing system under the condition of full-time District inspection. The District's inspectors provide a final inspection on the newly installed system, and provide the developer with a punchlist of items to be completed as part of the final inspection. The Developer Extension Construction Field Final document is completed by the District Inspector. After the work identified on the punchlist inspection report has been completed and approved, the project is deemed final. The developer is responsible for submitting the as-built drawings including contractor markups and survey as-built information. The developer is responsible for submitting the necessary easement documents and a copy of the development documents to be recorded with the applicable land use agency. The developer also must provide the District with the Bill of Sale and the Final Cost Summary for the project, pay the final acceptance fees, and provide a Maintenance Guarantee. After receiving the final acceptance fees, the District sends a letter to the County Health Department, Department of Developmental Services, the City of Sammamish or the City of Issaquah, stating District acceptance. The District's Project

Manager completes the “Construction Completion Report Form for Submittal Exception Process” and files it with the project.

Two-Year Post-Acceptance Warranty Phase. Approximately twenty-three months after the final inspection the District performs a Maintenance Guarantee Inspection. If final paving or other surface improvements have not been completed at the time of the District’s acceptance of the facilities for use, the Warranty Phase may extend for longer than two years. The two-year period will not start until the surface improvements have been completed. After completion of the inspection and the repair of any deficient items, the District releases the Maintenance Guarantee to the developer.

7.2.2 Pipe Looping Requirements

The District does not permit dead-end pipelines except in certain cul-de-sac streets. If dead-end pipelines are allowed, blow-offs are required at the end of the main. The District requires pipe looping for three primary reasons: water quality, distribution redundancy, and improved fire flow. Pipe looping assists in maintaining good water quality because the water does not become stagnant in the line. The distribution redundancy feature enables the District to limit the number of customers affected in cases of waterline breaks, emergencies, and shutdowns. The pipe looping configuration allows for increased fire flow to the area.

7.2.3 Fire Flow

The fire flow requirements within the District’s service area are based on the requirements of the local land use authority. Historically the county and cities (and in turn the fire districts serving those areas) referenced the Insurance Services Office (ISO) *Guide for Determination of Required Fire Flow*. Previously all the agencies followed the ISO publication, except for the King County Fire Marshal. In unincorporated King County, a modified ISO has been used with different hydrant and flow requirements. The county and cities have or are transitioning to the requirements of the 2015 IFC, Appendix B, *Fire Flow Requirements for Buildings*. A summary of the fire districts and their requirements are shown in Table 7-1.

7.2.4 Other Requirements

The District requires compliance with the current standards of the International Building Code (IBC), International Fire Code (IFC) and Uniform Plumbing Code (UPC), Washington State Administration Code (WAC), American Water Works Association (AWWA) Standards, Washington State Department of Transportation (WSDOT)/American Public Works Association (APWA) specifications, and DOH Guidelines.

**Table 7-1
Service Area Governing Fire Guidelines**

Fire District	Fire Flow Guidelines
Eastside Fire and Rescue	2015 IFC, Appendix B
Redmond Fire Department (King County Fire District #34)	2015 IFC, Appendix B
Fall City Fire Department (King County Fire District #27)	2015 IFC, Appendix B
Duvall Fire Department (King County Fire District #45)	2015 IFC, Appendix B
King County Fire Marshal	Transitioning from Modified ISO Publication Guidelines to 2015 IFC, Appendix B

7.3 Design Standards

The District has developed general standards of design (see Appendix F). This section summarizes the general standards associated with the design of water systems.

7.3.1 Water Service Pressure

The District strives to maintain a minimum pressure of 30 psi during peak hour demand conditions and normal operation. The minimum pressure shall be 20 psi during a fire flow emergency condition. The maximum service pressure at any meter shall be 115 psi during normal operating conditions. Exceptions to this maximum pressure may be approved on an individual project basis, particularly in response to developer requests.

7.3.2 Pipeline Velocities

The maximum pipeline velocity allowed by the District during peak hour demand operating conditions is five feet per second (fps). The maximum velocity allowed during a fire flow emergency shall be eight fps.

7.3.3 Pipelines

The minimum pipe diameter permitted by the District shall be 8 inches, although a 4-inch diameter pipeline may be allowed in certain cul-de-sac streets or in other similar circumstances. The exception to this is that no water main serving the City of Issaquah residents shall be less than 8 inches in diameter, in accordance with the City of Issaquah standards. For non-single family residential developments, the minimum line size shall be 12-inch diameter unless the requirement is waived by the District. Transmission mains shall be a minimum 12-inch diameter pipe. All pipes shall be cement-lined ductile iron, Class 52, wrapped with a polywrap material that conforms to

AWWA C-600. The cover over the top of the pipeline shall be a minimum of 36 inches. The minimum separation between the water main and the sanitary sewer shall be in accordance with the criteria set forth in DOE and DOH guidelines. Separation between the water main and storm sewer, underground power, gas, telephone, or cable shall be three feet horizontally.

7.3.4 Storage Tanks

The storage volume requirement shall be at a minimum in compliance with DOH standards. Storage requirements for fire protection are generally based on the standards established by the ISO. The required storage volume for fire suppression shall be stored above an elevation that will produce a minimum pressure of 20 psi at any place in the system.

7.3.5 Booster Pumps

Booster pump stations shall contain a minimum of two pumps each that are each capable of pumping the design flow for the pump station. A booster pump station with multiple pumps shall be capable of pumping the design flow for the pump station when the largest pump is out of service. The rate of pumping shall be sufficient to provide the required flow at the maximum day rate or fire flow, whichever is greater. A booster station required for primary water supply shall be provided with auxiliary power, unless a redundant power supply is provided.

7.3.6 Pressure-Reducing Valve Stations

Pressure-reducing valve (PRV) stations shall be sized for the greater of the maximum day demand or the required fire flow. When PRVs are located where storage is available, the settings should be set so that the PRV will open only in emergency situations. PRV stations shall be used to reduce the hydraulic gradient from one pressure zone to another within the District.

7.3.7 Valves

The District requires gate valves on all water mains less than 12 inches in diameter. Butterfly valves shall be installed on all water mains with a diameter of 12 inches or more. Valves shall be located at a minimum of every 800 feet in residential areas (500 feet in commercial areas), with full valve clusters provided on all major waterline intersections. The valves enable the District to serve waterlines from alternate directions in a looped system, while isolating a section of water main for maintenance, repair, or extension. The District requires blow-offs at the end of all dead-end mains, and 2-inch air/vacuum release valves shall be installed on pipelines with a diameter of 8 inches and larger at all high points in the system.

7.3.8 Hydrants

The District requires the standard 5-1/4-inch main valve opening fire hydrants approximately every 700 feet in rural areas, every 500 feet in urban areas, and every 300 feet in commercial areas. The King County Fire Marshal's Office, City of Sammamish or Issaquah Fire Marshal shall approve the location of the fire hydrants, and the Fire Marshal's approved print shall be submitted to the District. The fire hydrant shall be affixed with the required Storz fitting. The District allows up to 50 feet of 6-inch-diameter pipe run from the water main to the fire hydrant. If the pipe run is greater than 50 feet, the pipe diameter shall be increased to 8 inches. Hydrant guard posts shall be required wherever their installation does not violate the King County, City of Sammamish or City of Issaquah Road Standards for obstacle placement. A minimum of two, and a maximum of four, may be required for each hydrant.

7.4 Construction Standards

The District's construction standards are in accordance with, and as recommended in, the applicable AWWA specifications; and/or the latest edition of the WSDOT/APWA (Washington State Chapter) Standard Specifications for Road, Bridge, and Municipal Construction; and/or the 10 States Standards; and the King County Road Standards; and according to the recommendations of the material or equipment manufacturer. A complete set of construction standards is presented in Appendix F.

7.4.1 Ductile-Iron Pipe

Ductile-iron pipe shall conform to AWWA C151, Thickness Class 52. The pipes shall have cement mortar lining conforming to AWWA C104. The joints shall be mechanical joints or push- on joints and shall conform to AWWA C111.

Ductile-iron and cast-iron fittings shall conform to AWWA C110 and all fittings shall be cement mortar lined in conformance with AWWA C104. Flanged joints shall conform to ASA Standard B-16.1, Class 152 with ductile-iron followers. If restrained joints are required, the restrained joint pipe shall conform to AWWA C151, Thickness Class 52. The pipe shall be cement mortar lined in accordance with AWWA C104 and the push-on restrained joints shall conform to AWWA C111.

The District requires all ductile-iron pipes to be polywrapped. The polywrap shall conform to ANSI/AWWA A21.5/C105 (see AWWA C600).

7.4.2 Polyvinyl Chloride Pipe

Polyvinyl chloride (PVC) pipe for water service shall be used only when crossing a gas pipeline easement. The pipe shall conform to WSDOT/APWA 9-30.1(5) and any PVC pipe 4 inches or larger in diameter shall also conform to AWWA C900, Class 150.

7.4.3 High-Density Polyethylene Pipe

The District requires the use of high-density polyethylene (HDPE) pipe for water service lines. HDPE pipe shall be manufactured from a high density, extra high molecular weight pipe resin polyethylene defined by ASTM D3350 having a cell classification of 345464C as polyethylene type III, grade PE34 (PE3408). Water Service lines shall have an iron pipe size (IPS), ID ASTM D2239, with a DR 7 and have a pressure class of 250 psi.

The District also allows use of HDPE pipe for installation of water distribution piping using trenchless installation methods. The pipe material shall be high density, extra high molecular weight pipe resin polyethylene defined by ASTM D3350 having a cell classification of 345464C as polyethylene type III, (PE4710 or higher). The specified pipe must be rated for a testing pressure at least 1.5 times the working pressure. The pipe dimension ratio will be calculated for each individual project based on working pressures and installation methods.

7.4.4 Valves

Gate valves shall be epoxy coated, resilient seated with a non-rising stem. The gate valve shall have a minimum working pressure of 150 psi with a standard 2-inch operating nut and standard counterclockwise opening rotation. The District requires all gate valves to conform to AWWA C509.

Butterfly valves shall conform to AWWA C504, be rubber seated, epoxy coated, and have stainless steel bolts. The valves shall be Class 150, with O-ring type shaft seals, with a standard 2-inch operating nut and standard counterclockwise opening rotation.

Air and vacuum relief valve assemblies shall be APCO No. 143-C for 1-inch assemblies and APCO No. 145-C for 2-inch assemblies, or an approved equivalent, and equipped with a brass plug on the top service port. The valves shall conform to WSDOT/APWA 9-30.3(7).

Blow-off assemblies shall conform to the District Standard Details for Type I and II Blow-Off Assembly shown in Appendix F. All pipe and pipe fittings shall be brass (to minimize corrosion) up to the isolation valve, then galvanized piping is used between the valve and the cane assembly (to minimize risk of theft and reduce replacement cost).

Pressure reducing valves (PRVs) shall conform to the District Standard Details for PRVs shown in Appendix F. The District requires that a PRV vault meet the current District standards. For example, a 6-inch PRV station would include a 6-inch fire flow valve and a 3-inch bypass valve and be in a vault. The District requires all pipe fittings less than 6 inches in diameter to be brass and all bolts inside the vault shall be hot-dipped galvanized.

7.4.5 Backflow Prevention Assemblies

The District will only allow backflow prevention assemblies that are approved by DOH. The District also requires a Backflow Prevention Assembly Test Report to be conducted by a certified Washington State Tester prior to acceptance of the system. The backflow prevention assemblies shall adhere to WAC 246-290-490 and to District Resolution 3340, which regulates the District's Cross-Connection Control Program.

7.4.6 Fire Hydrants

Fire hydrants shall comply with AWWA C502. Fire hydrants shall have the following characteristics:

- 5-1/4-inch main valve opening with brass on brass or brass on stainless steel seating as specified for 36-inch trench
- Flanged at the ground line
- 6-inch mechanical restrained joint connections
- Two 2-1/2-inch hose connections, National Standard Thread
- 4-inch pumper connection with Seattle Standard Thread and 5-inch, 125-5 Storz fitting, except within the Fire District 27 boundary where a 4-inch Storz fitting is required
- Operating nut shall be 1-1/4-inch pentagon that opens counterclockwise
- Constructed in a fashion that the pumper connection faces the roadway
- Traffic-type dry barrel hydrant with flange construction
- Minimum of two and a maximum of four hydrant guard posts may be required for each hydrant.

7.4.7 Pipe Laying

The construction standards for laying ductile-iron and PVC pipe are as follows:

- **Ductile-Iron Pipe.** Pipe laying of ductile-iron pipe shall conform to AWWA C600 and manufacturer's recommendations. The pipe shall not be rolled or dragged, and the pipe shall be handled in such a way to avoid damaging ends, coatings, and linings.
- **PVC Pipe.** PVC pipe shall be bedded by hand with material containing no organic matter and no rocks larger than 3/4-inch. The District may require that the bedding material be imported and conform to WSDOT/APWA classification of bedding material, Section 9-03.16.

7.4.8 Connection to Existing Main

Connection to an existing water main can be made in three ways: end of mainline connection, tee connection by wet tap, and cut-in. All connections to the District's existing system are to be conducted with full-time District inspection and appropriate

disinfection techniques to ensure public health and safety.

- **End of Mainline Connection.** For the connection of a new main to the end of an existing main the District requires a mainline valve, sized the same as the mainline. Exceptions shall be considered where there is an existing valve in close proximity to the new connection.
- **Tee Connection by Wet Tap.** A wet tap of the main under pressure shall be used for connection where the tee connection has the same diameter as the main being tapped and the main is ductile iron, or the tee connection has a smaller diameter than the main being tapped.
- **Cut-in.** Cut-in connections shall be performed in cases where wet taps are not used or where crossing under an existing AC water main. The cut-in connection consists of a ductile- iron tee, valving, two 10-foot lengths of ductile-iron pipe (one on each side of the tee), and fittings to connect the ductile-iron pipe to the existing pipe.

7.4.9 Water Service Connections

Water service connections shall be installed with double-strap-type pipe saddles. The District does not allow splices or couplings in service lines. The installations of the service connections are shown in the District Standard Details in Appendix F.

7.4.10 Fire Hydrant Installation

Hydrant installation shall conform to AWWA C600 unless specifically contradicted by the detail for Fire Hydrant Assembly shown in the District's Standard Details in Appendix F. Hydrants shall be covered with a sack until operational.

7.5 Construction Certification and Follow-Up Procedures

Construction inspection procedures for District water systems include hydrostatic tests and sterilization and flushing of the water mains.

7.5.1 Hydrostatic Tests

Water main installations shall be subjected to a hydrostatic pressure test of 250 psi for a minimum of 15 minutes before leakage measurement starts. This pressure shall be held without pumping, and any leaks or imperfections found under said pressure shall be remedied by the contractor before final acceptance of the work. Leakage shall be measured by approved means in the presence of a District representative. The tests shall be made after corporation stops and service lines have been installed. All valves within the section being tested shall be open. Butterfly valves shall be tested to a pressure that is 150 psi greater than the static water pressure, with a maximum pressure of 250 psi.

The allowable leakage (in gallons per 15 minutes per 1,000 feet of pipe) during

hydrostatic tests for various sizes of pipe is shown below:

2-inch – 0.06 gallon	8-inch – 0.24 gallon	14-inch – 0.42 gallon
4-inch – 0.12 gallon	10-inch – 0.30 gallon	16-inch – 0.48 gallon
6-inch – 0.18 gallon	12-inch – 0.36 gallon	18-inch – 0.54 gallon

7.5.2 Sterilization and Flushing of Water Mains

Water mains are flushed to clean and sterilize them. Cleaning includes flushing at a velocity and volume that will remove rocks and debris from the main.

Sterilization of water mains shall be accomplished in accordance with the requirements of DOH, AWWA C601 and D105, or DOT/APWA Section 7-11.3(12) and in a manner satisfactory to the District. During pipe installation, the contractor shall install chlorine granules per manufacturer's specifications to achieve a chlorine concentration of not less than 50 parts per million (ppm). When a chlorine concentration of not less than 50 ppm has been established throughout the line, the valves shall be closed and the line left undisturbed for 24 hours. The line shall then be thoroughly flushed and water samples taken for approval by the local health agency.

If water in the main fails to pass purity tests, the following procedure shall be carried out. The section to be sterilized shall be thoroughly flushed at maximum flow prior to chlorination. Flushing shall be done in the presence of a representative from the District. Sections will ordinarily be sterilized between adjacent gate valves unless, in the opinion of the District, a longer section can be sterilized satisfactorily. Chlorine shall be applied by solution feed at one end of the section, with a valve or hydrant at the opposite end opened sufficiently to permit a flow through the section during chlorine application. The chlorine solution shall be fed into the pipeline already mixed by an automatically proportioning applicator so that it provides a steady application rate of not less than 60 ppm chlorine. Hydrants along the chlorinated section shall be opened while the chlorine is being applied until the presence of chlorine has been detected. When a chlorine concentration of not less than 50 ppm has been established throughout the line, the valves shall be closed and the line left undisturbed for 24 hours. The line shall then be thoroughly flushed and water samples taken for approval by the local health agency. Chlorination shall be repeated until water samples test satisfactory. The contractor shall exercise special care in flushing to avoid damage to surrounding property.

The contractor shall be responsible for disposal of the treated water that is flushed from the mains and shall neutralize the wastewater for protection of the aquatic life in the receiving waters before disposal of the wastewater into a natural drainage channel.

7.5.3 As-Builts

All surface features of the water system, together with the staked location of water main bends, shall be field-surveyed during construction and the information used to prepare the As-Built drawings. The surveyed locations of all features shall be shown

on the draft as-built drawings (point-plot map), and shall be in accordance with the local projection of Washington State Plane North HARN, NAD 1983, Feet. If the original design drawings were prepared in digital format using AutoCAD or other automated drafting/design software, the revisions during construction shall be incorporated onto the as-built record drawings digitally. The drawings shall be on a minimum 4-mil Mylar™ format, clearly marked in the lower right-hand corner as "As-Built". If the "As-Built" record drawing is not on the original District Approved plan, a Mylar™ of the original District approved plan shall also be provided.

The details of construction for water systems shall include, but not be limited to, the following:

- Bends—Location of bends used, or deletion of bends shown on the plans and not used.
- Meter Boxes—Changing the meter box location from one lot corner to another.
- Service Line Locations—Route the service line follows, if other than perpendicular to the street, from the main to the meter box. This is especially important in cul-de-sacs or bubbles.
- Valves—Actual constructed location of all valves.
- Fittings—Any changes to the fitting callouts on the design plans should be noted.
- Other Utilities—Crossings of other utilities and detailed locations of other utilities where they run parallel to the water main and are closer than 3 feet horizontally.
- Deep Bury of Lines—Areas where the line depth exceeds 6 feet below finished grade should be noted. The District requires that as-built drawings include profiles of the installed water facilities showing the actual depth of the water facilities throughout the project.

7.5.4 Notice of Completion

A Notice of Completion is prepared by District staff for each Developer Extension Agreement or Capital Improvement Project with water improvements. The Notice of Completion is placed in the project file for inspection by DOH as requested.

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