Chapter 17 Water Service Connections

Chapter 17 WATER SERVICE CONNECTIONS

This chapter of the Design Standards and Guidelines (DSG) presents standards and guidelines for designing Seattle Public Utilities (SPU) water service connections. SPU manages both permanent and temporary water service connections to its water system. The primary audience for this chapter is SPU engineering staff. DSG standards appear as underlined text.

17.1 KEY TERMS

Abbreviations and definitions given here follow either common American usage or regulatory guidance.

17.1.1 Abbreviations

Abbreviation	Term
AVB	atmospheric vacuum breaker
AREMA	American Railway Engineering and Maintenance-of-Way Association
AWWA	American Water Works Association
DC	detector check
DR	Director's Rule
DCVA	double check valve assembly
DOH	Washington State Department of Health
DSG	Design Standards and Guidelines
DSO	Development Services Office
LOB	line of business
psi	pounds per square inch
PVBA	pressure vacuum breaker assembly
RPBA	reduced pressure backflow assembly
ROW	right-of-way
SDCI	Seattle Department of Construction and Inspections
SDOT	Seattle Department of Transportation
SMC	Seattle Municipal Code

Abbreviation	Term
SPU	Seattle Public Utilities
WAC	Washington (State) Administrative Code
WOSM	Water Operations System Maintenance
TEZ	tap exclusion zone

17.1.2 Definitions

Term	Definition
combination service	A 4-inch or larger water service that measures all water conveyed through the service, regardless of whether for domestic use or for fire suppression.
connection	A water service that measures all water conveyed through the service, regardless of whether the use is for domestic, irrigation, or fire suppression.
customers	Parcel owners, developers, or their agents.
detector check (DC) fire service	These services supply only fire flow. They have a single DC meter to show whether any water was registered on the meter during the recording period.
design engineer	Engineer who works on production of design drawings, technical specifications, calculations, and technical memoranda for any design discipline or specialty. Primarily SPU staff but may include consultants for large or specialty projects.
design guidelines	Advice for preparing an engineering design. They document suggested minimum requirements and analysis of design elements to produce a coordinated set of design drawings, specifications, or life-cycle cost estimates. Design guidelines answer what, why, when, and how to apply design standards and the level of quality assurance required.
design standards	Drawings, technical or material specifications, and minimum requirements needed to design a particular improvement. A design standard is adopted by the department and generally meets the functional and operational requirements at the lowest life-cycle cost. It serves as a reference for evaluating proposals from developers and contractors. For a standard: the word must refer to a mandatory requirement. The word is used to denote a flexible requirement that is mandatory only under certain conditions.
developer	A property owner, or a property owner's designee, who is building a structure to be supplied with water service on at least one legal parcel and will oversee the project and communicate with SPU and other interested parties.
direct service area	The retail service area served by the SPU water distribution system as defined by the most current SPU Water System Plan.
distribution water main	A water main that is not a feeder main or a transmission main and is defined as a standard distribution main, suitable distribution main, or obsolete distribution main.
domestic service	A water service intended to supply the domestic needs of a parcel (i.e., not for fire flow).
domestic water service header	A 2-inch pipe, less than 120 ft in length, supplying up to four 1-inch domestic water services or up to seven 3/4-inch domestic services.

Term	Definition
Feeder water main	Mains that convey treated water between storage/supply facilities and distribution water mains. Most feeder mains are a minimum of 12 inches in diameter. Feeder mains are not available for directly supplying new water services.
large service	Any water service larger than 2 inches in diameter.
master meter	A metered water service from an SPU-owned water main, serving more than one legal parcel or unit lot, including on-property distribution and submeters.
parcel	A tract or plot of land, including unit lot subdivisions.
right-of-way	Land dedicated for public travel.
roadway structure	An element in the right-of-way that supports travel ways, soil, or signage above ground. Includes (but not limited to) bridges, approach ramps, stairways, areaways, and retaining walls.
small service	Any water service 2 inches in diameter or smaller.
supply feeder	A water main that conveys water from one pressure zone through areas served by other pressure zones.
tap exclusion zone	A location where a distribution water main may not be tapped for water services.
transmission pipeline	A large diameter pipe, usually 36 inches in diameter or larger, that supplies water to the SPU direct service area and wholesale customers.
water availability certificate	The document SPU prepares for applicants that confirms SPU water infrastructure exists or of the requirements necessary to supply the parcel(s).
water availability certificate preparer	SPU staff person who administers the water availability certificate process and responds to customer water service inquiries.
water service	A system of pipes and related infrastructure that supplies and measures the flow of water from a distribution water main to a private water system.
water service plan	A plan that includes meter size, type, location, parts list, and tap information in Plan view and profile.

17.2 GENERAL INFORMATION

SPU is the City of Seattle (City) department responsible for providing both temporary and permanent water services to new and redevelopment projects.

The City ensures that a level of service is met for each water service connection, as established in SPU's 2019 Water System Plan:

- Plan Summary
- 2019 Water System Plan – Volume I

The Washington State Department of Health (DOH) requires that the Water System Plan be updated every six years.

17.2.1 SPU Policy

The Washington Administrative Code (WAC) establishes the following minimum standards in pounds per square inch (psi) for SPU water service pressure, measured at the water meter:

- 20 psi for the existing distribution system during normal operations
- 30 psi for new distribution system construction

The following codes and policies direct water services as follows:

- Chapter 21.04: Water Rates and Regulations – January 7, 2021
- CS-105: Cross-Connection Control Program – May 18, 2006
- WTR-436.1: Connection Charge – May 1, 2019
- WTR-440: Requirements for Water Service – January 1, 2021
- WTR-450: Changes to Existing Water Services – June 23, 2021
- FIN-220.1: Customer Charges – October 1, 2018
- FIN-220.2: Development Charges – July 1, 2021
- FIN-220.3: Water Quality Analysis Laboratory Charges – January 1, 2023
- FIN-220.4: Real Property Charges – January 1, 2019

For SPU policies on water supply, including water mains, refer to *DSG Chapter 5, Water Infrastructure*.

17.2.2 Types of Water Services

The following types of water services are available from SPU:

- Small domestic services, such as single-family residences and small irrigation systems.
- Large domestic services, such as industrial, commercial, and apartment or condominium buildings.
- Detector check (DC) fire services, for fire protection systems.
- Combination meter services for both domestic and fire, typically for large buildings.

17.2.2.1 Small Domestic, DC Fire Service, and Irrigation (Single 2-Inch or Smaller)

Small domestic, DC fire, and irrigation services use single 2-inch or smaller water service connections. Meter boxes for small domestic, DC fire, and irrigation water service connections require a smaller footprint while vaults are required for other water service types.

17.2.2.2 Large Water Services

Large domestic, combination, and DC fire services use 4-inch and larger meters. The vaults for large water services should be located, when possible, with the access hatch in the planting strip portion of the right-of-way (ROW). Rotating vaults 90 degrees is acceptable, but the design engineer is responsible for accounting for the additional head loss from the additional pipe fittings. The design engineer may be required to redesign the connection if the standard water service plans cannot be applied.

17.2.3 DSG Design Resources

SPU standard water and fire service plans and details must be followed unless a deviation is approved by SPU Engineering. These standard plans and details are not part of the City Standards Plans and Specifications and are available only in the DSG:

- DSG standard drawings for large water service connections (Appendix 17A - Standard Water Service Plans)
- DSG standard drawing for small water service connection (Appendix 17B - Example Plans for Small Water Service)

17.3 GENERAL REQUIREMENTS

Water service connections to SPU water facilities must meet City, King County, Washington state, and federal standards. This section highlights **only** requirements for water service connections. For similar industry standards for other water system features, *see DSG Chapter 5, Water Infrastructure*.

Water and fire service design must follow American Water Works Association (AWWA) design manuals. Table 17-2 lists relevant AWWA design manuals for water service connections.

Table 17-1
AWWA Design Manuals for Water Services

Designation	Title	Edition
M6	Water Meters: Selection, Installation, Testing, and Maintenance	Fifth
M14	Recommended Practice for Backflow Prevention and Cross-Connection Control	Third
M22	Sizing Water Service Lines and Meters	Second
M28	Rehabilitation of Water Mains	Second
M31	Distribution System Requirements for Fire Protection	Third
M41	Ductile-Iron Pipe Fittings	Second
M44	Distribution Valves: Selection, Installation, Field Testing, and Maintenance	Second

17.3.1 Regulations

This section describes **only** fire service requirements and backflow prevention specific to water service connections. See *DSG Chapter 5, Water Infrastructure*, for all City, Washington state, and federal regulations for other water service requirements.

17.3.1.1 Fire Service Requirements

The Seattle Fire Department (SFD) requires a fire service for certain types of structures. These fire service requirements are based on the Seattle Fire Code. The fire code establishes requirements for when fire protection systems are required, where the services may be located,

and minimum criteria for size of service and fire flow demands. It is the customer's responsibility to review the fire code and contact the SFD to obtain those requirements.

For SPU projects located outside the City, contact the local fire department or fire district. Table 17-3 lists the contact information for fire jurisdictions located outside of the City.

Table 17-2
Contact Information for Fire Jurisdictions

Fire Jurisdiction	Area Served	Main Telephone Number
Shoreline Fire Department	Cities of Shoreline and Lake Forest Park	206-533-6500
King County Fire District No. 2	Cities of Burien and Normandy Park, North Highline area	206-242-2040
King County Fire District No. 20	Skyway area	206-772-1430

Information for determining fire requirements and sizing fire services can be found in the Seattle Fire Code and AWWA M22 Design Manual. Chapter 9 of the Seattle Fire Code identifies which types of structures require a particular type of fire protection system (e.g., sprinkler, fire alarm, or chemical).

17.3.1.2 Backflow Prevention (Cross Connection Control)

A *cross connection* is any actual or potential physical connection between a public water system and the customer's on-property plumbing system and any source of non-potable liquid, solid, or gas that could contaminate the potable water supply by backflow. Backflow devices may be required based on the *type of facility* with the water service connection (e.g., hospital, laboratory, or sewage pump station) or by the *specific water use* (e.g., fire service, irrigation, or soda machine).

A. Requirements

Under state law (WAC 246-290-490) and Seattle Municipal Code (SMC 21-04.070), SPU is responsible for protection of the public water system from cross connections and may require backflow protection on the customer's service line or within the customer's plumbing system. Under the plumbing code, Public Health Seattle-King County, a public health department jointly managed by the City and King County, has authority for building plumbing and cross-connection control within that plumbing. SPU and Public Health Seattle-King County operate under a memorandum of understanding for coordination for preventing and controlling cross connections.

B. Roles and Responsibilities

The following is the general process for backflow prevention:

1. SPU utility service inspectors in the Water LOB set the requirements for backflow prevention based on state law, City policy, and industry standards.
2. Utility service inspectors review building design and inspect buildings under construction to ensure that these requirements are met. Inspectors then communicate any deficiencies to the Contractor.

3. Water Service customers purchase, install, own and test backflow devices. SPU inspects backflow device installations and tracks testing of assemblies on private projects.

Where water is provided to an SPU facility, a utility service inspector is responsible for setting the backflow prevention requirements and SPU is responsible for installing, operating, and maintaining the backflow device.

C. Types of Devices

The type and location of the backflow prevention devices depends on the degree of hazard of the cross connection. SPU determines the type during plan review or in the field if changes occur in design.

The following are backflow prevention devices (also referred to as backflow assemblies):

- Air gaps
- Reduced pressure backflow assembly (RPBA)
- Double check valve assembly (DCVA)
- Atmospheric vacuum breaker (AVB)
- Pressure vacuum breaker assembly (PVBA)

For more information on backflow prevention reference the resources in DSG section 17.6.

17.4 PLAN REVIEW AND DESIGN

17.4.1 Water Service Connection

This section briefly summarizes the current process for obtaining a water service connection from SPU. For specific information, refer to *DSG Chapter 18, Development Services*.

17.4.1.1 Roles

The following are the key departmental roles for setting up accounts and installing water services:

- **SPU DSO Plan Review staff** is the lead for the following:
  - Plan review of large water services
  - Location of services on water main extensions (refer to Standard Specifications and Plans)
- **SPU Project Requirements and Technical Coordination Team** are the lead for the Water Availability Certificate process.
- **SPU Development Services Project Coordinators** are the lead for all new service connections, applying and obtaining a Street Use Permit from Seattle Department of Transportation (SDOT), if required, and account setup.

- **SPU Operations and Maintenance Staff (Operations)** is the lead for installing the new water service to the property line (edge of ROW). **SPU DSO Plan Review staff** acts in an advisory role if there are conflicts found in the field with the standard water service plans.
- **Seattle Department of Construction and Inspections (SDCI)** is the lead for all development that occurs on private property.
- **SPU DSO and Utility Services Inspections staff** review and inspect installation of the water service from the right-of-way to the building.
- **Seattle Department of Transportation (SDOT) staff** are the lead for all development that occurs in the City right-of-the-way. All work conducted by Operations to install water services should be coordinated with SDOT.

17.4.2 Water Availability Certificates

Projects needing to apply for a new or changed water service must obtain an approved Water Availability Certificate. This document identifies requirements, system improvements, and conditions necessary to provide water service to the parcel. A Water Availability Certificate is required for most development projects in Seattle and in other jurisdictions within SPU's direct service area. Water Availability Certificates are issued based on the code requirements in effect upon application. Once a Water Availability Certificate has expired, a new certificate is required.

SFD or the local fire department/district may require additional improvements that are not included on the Water Availability Certificate.

17.4.2.1 Application Process

Visit Water Service for information on the application process.

17.4.3 Water Service Design Requirements

17.4.3.1 Water Main and Connection Location

New water services may only be supplied from standard or suitable mains fronting the parcel to be served. Suitability and frontage are determined by the DSO with consultation from the Water LOB. Refer to WTR-440 for requirements for water services.

If service size is the same size as the main (only allowed for looped fire services), the services must be a tee cut in and the main must be isolated or shut down (this is not a typical tap).

A water main must have adequate frontage to a parcel to supply it for new service. Full boundary frontage is defined as an adjacency of at least one of the parcel boundaries to a ROW containing a suitable water main and is subject to the following requirements:

- The water service must connect to the parcel perpendicularly.
- The water main and parcel must be located within the same water pressure zone.
- The tap location must not be located inside a tap exclusion zone. See Section 17.4.4, "Tap Exclusion Zones."

- The water main must not have tap restrictions preventing it from supplying the side of the street where the parcel is located.
- The water service must not cross from one roadway to another in a divided street. See Section 17.4.5, "Divided Streets and High-Volume Transportation Corridors."
- The tap location must not be located under or inside a roadway structure.

DSO must request a site-specific cost estimate from the Water LOB crew scheduling representative for services 4 inches and larger in diameter.

17.4.3.2 Water Meter Vault Location

Standard drawings for water services are shown in Appendix 17A - Standard Water Service Plans.

Meter boxes (for smaller services) or meter vaults (for larger domestic and combination services) must be installed in a location with safe access for SPU field staff. The clearances for Water LOB vaults are shown on Standard Plan 314B.

Large meter vaults must be located two feet behind the rear of the curb. They also must be located such that the union point is located a minimum of 2 feet outside of the vault and 2 feet from the property line.

The standard location for meter vaults is in the planting (or furniture) strip, with meter vault hatches located outside of the pedestrian clear zone. (See Seattle Streets Illustrated Chapter 3.) The designer can rotate rectangular meter vaults (for domestic or combination services) 90 degrees to facilitate installation, but analysis of additional head loss through the horizontal bends is the designer's responsibility. Fire service vaults may be rotated with approval from SPU.

If a meter vault is to be located on private property, the customer must apply for an easement procured through legislation by Real Property Services, with a corresponding standard charge. Approval for a meter vault to be located on private property must be determined through plan review.

17.4.3.3 Other Design Considerations

Other design considerations include:

- SPU crews may opt to direct-bury fire services, with no vault being required. The fire service vault still must be included in the large water service plan.
- In locations where existing site conditions prevent installation of a combination water service vault, the designer may want to consider installing separate domestic and fire services.
- Soil conditions supporting the vault structure.
- Critical areas, such as steep slopes.
- Hazardous materials issues, such as gases in vaults or contaminated soils.
- Vault flooding or water following service piping trenches and damage to customer property (i.e., water from the vault following along the service line and seeping into the building).

- Bridges and fire service:
  - SPU will install a fire service for a bridge structure at or below the bridge grade up to the bridge structure.
  - SPU will **not** install any piping on a bridge structure. The owner of the structure must do this.
- Owners must install their own plumbing starting at the union point--the point of connection between the SPU-owned water service and a customer's piping).
- Non-SPU fire hydrants must be painted red.

If there could be problems with shutting down the main to perform a tap, contact Water LOB crew scheduling representative. They will check the area and identify any customers that require continuous service. The shutdown may need to be scheduled around customer work hours, or temporary services may need to be provided if the main cannot be shut down. See DSG section 17.5 for sizing temporary water services.

Wherever possible, water services should be located away from natural drainage systems or green stormwater infrastructure facilities. If crossing a swale is the only available option, small services must be installed in casings. Water meters may not be placed in swales. See standard plan 301 and 302.

A. Standard Meter Plan

Per SMC Section 21.04.060(D), SPU may limit the size and number of service connections for any separate parcel. Generally, SPU allows only one domestic service per residential parcel. SPU generally allows multiple domestic and fire services for large commercial parcels to meet water needs.

When reviewing the large water service plan submitted by the customer, the design engineer must do the following:

- Check that the size of footprint for the vault matches the standard water service plan and required valves are shown.
- Check that an isolation valve is located between any two fire services that serve one building if they are on the same main line.
- Water service crossings under railroads (e.g., light rail) are required to be in pipe casings. For more detailed information, see American Railway Engineering and Maintenance-of-Way Association (AREMA) requirements.

B. Utility Conflicts

When location and special considerations have been evaluated with the standard water service plan, the design engineer must check for utility conflicts, access conflicts, and minimum clearance requirements. The design engineer should either move or rotate the vault to avoid utility conflicts. If that is not possible, the design engineer should modify the standard water service plan. Table 17-4 lists standard clearance requirements between water system elements and other items in the ROW.

Table 17-3
Standard Clearance Requirements

Standard Clearance Requirements	
Utility clearances	Standard Plans 286A and 286B and Standard Specifications 1-07.17 and 7-11
Meter vault	• Located where it will not block traffic or parking spots • Large (4 inches and larger) services in vaults Minimum of 2 feet of clearance between the top of the vault and the bottom of the sidewalk or pavement. Allows conduits to pass over vault
Standard clearances	Standard Plan 030: • Trees - 5 feet • Traffic, light, and power poles (standard style) - 6 feet • Traffic, light, and power poles (Chief of Seattle Base Style) - 6.5 feet
Railroad	Minimum depth 5 feet, 6 inches from the top of the railroad rail to the top of the pipe casing

17.4.4 Tap Exclusion Zones

Tap exclusion zones (TEZ) are created by water main grid junctions, both within and outside of intersecting public rights-of-way (ROW). New water service connections shall be made outside of the TEZ. The extents of a TEZ are determined by pipe junctions, bends, valves, and ROW boundaries.

17.4.4.1 ROW Intersections

New water service connections shall not be made on:

- Any length of water main within a ROW intersection (See Figure 17-1 and Figure 17-2)
- Any length of water main adjacent to a ROW intersection on which a new tap would result in a perpendicular water service crossing any part of the ROW intersection (See Figure 17-3)

Figure 17-1
Four-Leg Row Insertion

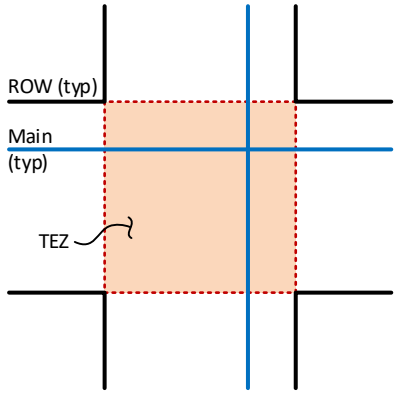


Figure 17-2
Three-Leg ROW Intersection

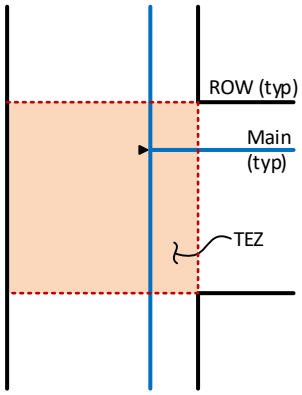
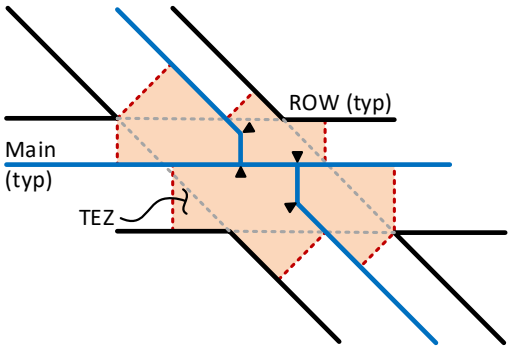


Figure 17-3
Diagonal ROW Intersection



17.4.4.2 Pipe Junctions (Tees and Bends)

Where pipe junctions (tees and bends) are present, TEZ boundaries are the largest zone created by the following elements:

- Laterally, 6 feet from the outside edge of a tee (Figure 17-4)
- 4 feet from the outside edge of a valve attached to a tee (Figure 17-5)
- Laterally, 4 feet from the outside edge of a horizontal bend (Figure 17-6)
- ROW extents as described in 17.4.4.1 above

The boundaries may be established by an individual element or combination of multiple.

Note: *New water service connections shall not be made on any length of water main with an alignment nonparallel to the street alignment.*

Figure 17-4
TEZ is the Largest Area Created by the Tee and Projected ROW

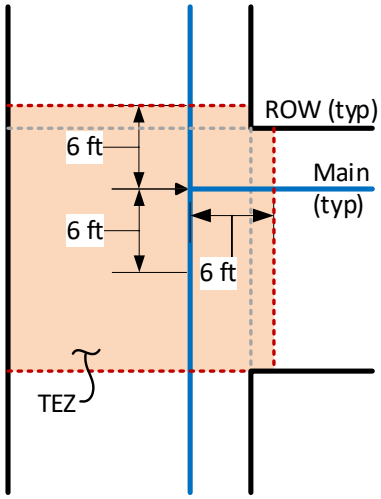


Figure 17-5
TEZ is the Largest Area Created by Valves and Project ROW

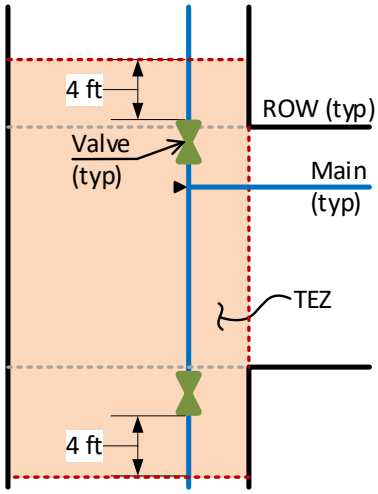
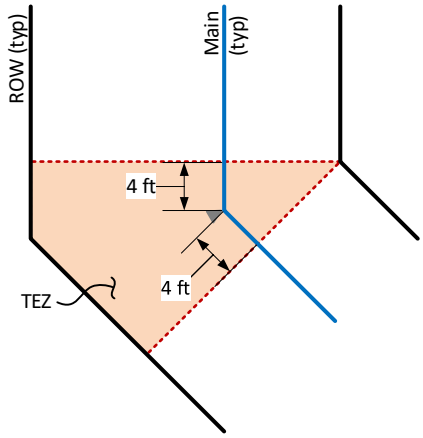


Figure 17-6
TEZ Created by a Bend



17.4.4.3 Vertical Bends

The tap location must not be located between vertical angle points.

17.4.4.4 Exceptions

Exceptions may be allowed on a case-by-case basis when there is no other feasible way of serving a parcel. In these cases, SPU may require that a valve be installed with the service for the purpose of isolating it from the intersection.

A. Three-Leg Intersections

New water service connections may be made within three-leg intersections (i.e., T- and Y-intersections) when the length of water main fronting a parcel occupies the following spaces:

- Non-travel areas
- Curbside parking lanes
- The outermost travel lane of a four-lane (or more) roadway

To qualify for this exception, the water main shall be directly adjacent and parallel to the parcel requiring water service. Water mains diverging away from the parcel in a different alignment from the street fronting the parcel do not qualify. See Figure 17-7 and Figure 17-8.

Figure 17-7
T-Intersection

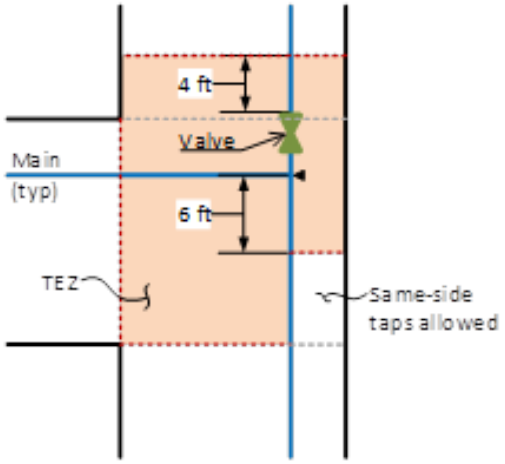
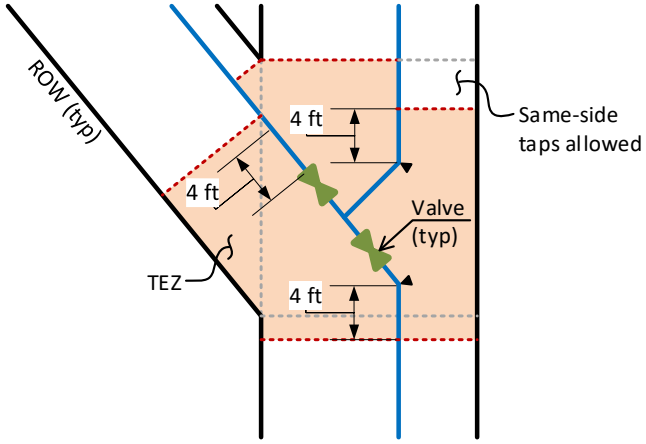


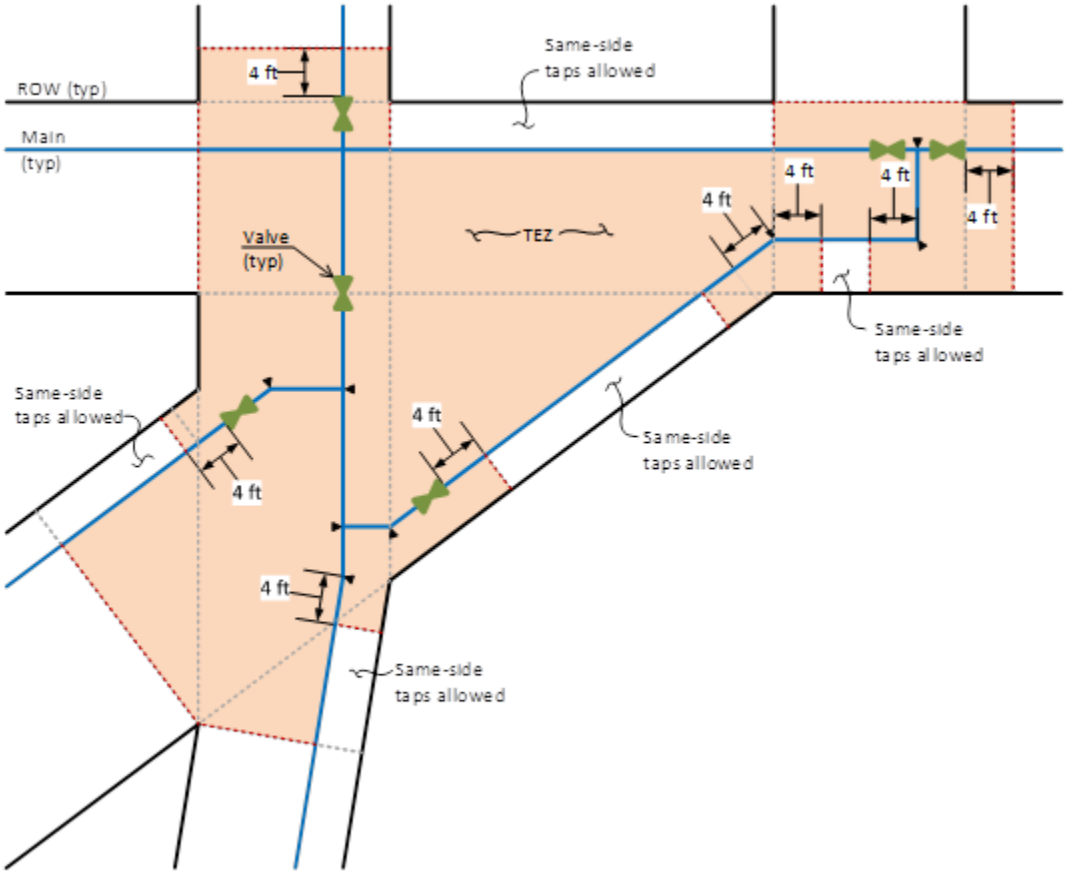
Figure 17-8
Y-Intersection



B. Skewed Intersections and Diverging Streets

Exceptions may be allowed within complex, skewed intersections created by diverging streets. The same conditions as those listed in 17.4.4.4.A above must be present to make new water service connections to a length of water main fronting a parcel. See Figure 17-9.

Figure 17-9
Skewed Intersections



17.4.5 Dual Water Main Requirements for Divided Streets and High-Volume Transportation Corridors

17.4.5.1 Divided Streets and High-Volume Transportation Corridors

Dual water mains shall be required in a divided street and high-volume transportation corridor when the following conditions exist:

- Retaining walls, rockery, railroad transportation lines, or other structures exist between the divided roadways; or
- The slope between the roadways is greater than 40 percent as calculated from the centerline of the upper roadway to the centerline of the lower roadway; or
- The elevation difference between the roadways is greater than 10 feet, regardless of slope; or
- The space between the roadways is a greenbelt; or
- The space between the roadways is a Seattle Parks and Recreation boulevard and is used for stormwater impoundment.

A parcel with frontage to a divided street or high-volume transportation corridor shall only be required to install a water main in the roadway directly adjacent to the parcel in the occasion that a change to the existing water service is requested.

17.4.5.2 High-Volume Transportation Corridors Without Physical Barriers

Dual water mains shall be required in high-volume transportation corridors that are not physically divided by a barrier when the following conditions exist:

- The corridor is a designated state highway; or
- The corridor has an Average Weekday Daily Traffic (AWDT) volume greater than 20,000, and is not a one-way street; or
- The corridor has existing water mains on both sides that would serve as the starting point for future water main extensions.

In the case of state highways, principal city arterials, and streets occupied by railroad tracks, complete interruption of traffic flow should be avoided when possible. Sizing Temporary Water Service for Construction

Construction activities requiring the removal of water main(s) from service may require the installation of temporary water service connections to maintain services to customers. Project designers should consult the Seattle Fire Code requirements to determine whether a temporary water main must provide sufficient water for fire flow. Designers should follow the design guidelines for sizing water service lines in the AWWA Manual M22 – Sizing Water Service Lines and Meters, which includes instructions on how to size the service to meet fire flow requirements.

Because the construction period tends to be short, and the risks relatively low if there are water outages, the design engineer should consult with SFD, who may choose to institute a fire watch (i.e., stand watch to ensure no fire occurs during the water outage) as an alternative.

17.5 RESOURCES

Documents

- AREMA Railway Crossing Requirements
- AWWA Design Manual M22 Meter Sizing
- WAC 246-290-490
- Recommended Practice for Backflow Prevention and Cross-connection Control (M14) AWWA
- Cross-connection Control Manual, AWWA Pacific Northwest Section
- Manual of Cross-Connection Control, Foundation for Cross-connection and Hydraulic Research, University of Southern California

Websites

DOH cross-connection information