



**Missoula City Public Works
Standards and Specifications Manual**

CHAPTER 4 – WATER SYSTEM

CHAPTER 4 – WATER SYSTEM

Table of Contents

4.1	Introduction	4-1
4.1.1	References	4-1
4.1.2	Appendices	4-1
4.1.3	Standard Modifications to MPWSS.....	4-1
4.1.4	Standard Drawings.....	4-1
4.2	General Requirements	4-1
4.2.1	Design Standards	4-2
4.2.2	Plan Requirements.....	4-2
4.2.3	Design Report	4-2
4.2.4	General Water Service Requirements	4-4
4.2.5	Wet Utility Main Best Practices	4-5
4.2.6	Public Infrastructure Review Stage Process	4-6
4.2.7	Utility Service Area.....	4-6
4.2.8	Latecomer's Agreement and Payment for General Benefit Facilities	4-6
4.2.9	Upsizing.....	4-6
4.2.10	Tie-ins to Existing System	4-6
4.2.11	Construction Documentation	4-7
4.2.12	Temporary Water	4-7
4.2.13	Abandonment or Reuse of Existing Water Service Lines.....	4-7
4.2.14	Requirements for Working Around Existing Services.....	4-8
4.3	Design Standards	4-9
4.3.1	Water Mains	4-9
4.3.2	Fittings and Bends.....	4-11
4.3.3	Valves.....	4-11
4.3.4	Fire Hydrants.....	4-11
4.3.5	Blow-Offs	4-11
	Table 4-1 – Blow-Off Size Required to Achieve Minimum Flushing Requirements	4-12
4.3.6	Manual Air-Relief Valves.....	4-13

4.3.7	Service Taps	4-13
4.3.8	Water Service Lines	4-13
4.3.9	Meter Pits	4-13
4.3.10	Cross-Connection/Backflow.....	4-13
4.3.11	Disinfection and Bacteriological Testing.....	4-13

CHAPTER 4 - WATER SYSTEM

4.1 Introduction

4.1.1 References

- A. *Montana Public Works Standard Specifications* (MPWSS), Seventh Edition, 2021 – by purchase only
- B. American Water Works Association (AWWA) / ANSI Standards – by purchase only
- C. [Montana Department of Environmental Quality Circular 1, Standards for Water Works \(DEQ-1\)](#)
- D. [2018 Uniform Plumbing Code \(UPC\)](#)
- E. [City of Missoula 2018 Water System Master Plan](#)
- F. [Frequently Asked Questions about Water & Sewer for Accessory Structures](#)

4.1.2 Appendices

- A. [Appendix 4-A – Cross Connection Backflow Program](#)
- B. [Appendix 4-B – Water Ditch Card Template](#)
- C. [Appendix 4-C – Allowable Non-Stormwater Discharges](#)

4.1.3 Standard Modifications to MPWSS

- A. Specifications not specifically contained herein related to water improvements shall be in conformance with the *Montana Public Works Standard Specifications* (MPWSS), Seventh Edition, 2021 and the following City of Missoula Modifications to the MPWSS, which are located in [Appendix 2-A](#):
 - 1. SECTION 01400 Contractor Quality Control and Owner Quality Assurance
 - 2. SECTION 02221 Trench Excavation and Backfill for Pipelines and Appurtenant Structures
 - 3. SECTION 02660 Water Distribution
 - 4. SECTION 02740 Pipe Casings and Appurtenances

4.1.4 Standard Drawings

Standard drawings related to water system improvements shall be in conformance with the 400-series of the City of Missoula Standard Drawings on the [Missoula City Public Works Standards and Specifications Manual](#) web page.

4.2 General Requirements

- A. The contractor or developer must contact Missoula Water during the subdivision or building permit process to determine whether there is a water main adjacent to the property. If there is no water main adjacent to the property, Missoula Water must determine whether a main extension will be required. If a main is required, it must be designed in accordance with this Manual and submitted under the City of Missoula [Public Infrastructure Review Process](#).
- B. Any reference to an AWWA standard contained within this Manual implies the latest edition of the standard.

C. All contract documents must be completed and signed prior to the beginning of construction.

4.2.1 Design Standards

Water systems shall be designed, constructed, and tested in accordance with the current edition of Circular DEQ-1 – Montana Department of Environmental Quality – Standards for Water Works and the Montana Public Works Standard Specifications with the most current City of Missoula Standard Modifications, and City of Missoula Standard Drawings. The purpose of these standards is to establish the minimum requirements for the design and construction of municipal water facilities.

4.2.2 Plan Requirements

A. Water system improvement plans shall comply with the specific requirements of [Chapter 1 of Circular DEQ-1](#) and [Section 3.2](#) (Improvement Plans) of this Manual and include:

1. Location, size, materials, and slopes of existing and proposed water mains.
2. Location, size, and depth of other utilities in the vicinity of the proposed improvements, including sanitary sewers, storm drains, dry wells, gas facilities, and dry utilities. This shall include both mainlines and customer-owned service lines. Separation requirements from utilities are found in [Chapter 2, Section 2.7.5](#) and [Section 4.2.5](#) of this chapter.
3. Location of existing and proposed boulevard or street trees. Existing trees should be drawn to show the approximate measured drip line.
4. Dimensions between water mains and nearby sources of contamination (dry wells, sanitary sewers, etc.). These are particularly important where the separation distance is at or close to the minimum distances required in DEQ-1.
5. Where deviations will be required from DEQ-1 separation requirements, provide a detailed description of protective measures which will be employed to support the deviation request.
6. Detailed descriptions for all appurtenances to be installed, including stations, appurtenance name (e.g., 8-inch gate valve), connection types (mechanical joint, flanges, etc.), and related appurtenances (valve box, thrust block, etc.).
7. The length of the hydrant lead pipe. A plan and profile shall be included in the design plans for projects for standalone hydrants or where hydrant lead pipes cross one or more wet utility mains and shall indicate the depth of each facility.

B. The plans shall specify the bury depth of the hydrant based on the finished ground elevation at the hydrant bury line. Hydrant extensions are not allowed, so it is the responsibility of the engineer to call out an accurate bury depth for the hydrant assembly.

C. Profiles shall identify estimated depth of all utility crossings.

4.2.3 Design Report

A. All water main extensions and replacements shall require the engineer of record to submit a written, stamped report to the City addressing the fire, irrigation, and domestic flow requirements.

The engineering report shall meet all requirements of DEQ-1 Section 1.1 in addition to the requirements below.

B. Water Demands. Include estimated water demands based on projected land use, occupancy, and building type. The design engineer shall provide all relevant references, assumptions, and calculations for alternate methods of non-residential water demand estimation within the submitted report. Maximum day and peak hour peaking factors shall be included. Water demands shall be provided for the following conditions:

1. Average Daily Demand (GPM/connection)
 - a. The [*City of Missoula 2018 Water System Master Plan*](#) Table 3-19 recommended an average demand per single family residential connection of 140 gallons/capita/day and 2.3 people/single family residence. Based on that, residential projects can assume a demand of 0.22 gpm/single family residence.
 - b. The [*City of Missoula 2018 Water System Master Plan*](#) Table 3-19 recommended an average demand per employee of 63 gallons/capita/day. Average commercial demands can be estimated based on that average demand times the anticipated number of employees.
2. Maximum Daily Demand (GPM/connection). Maximum day demand shall be determined by multiplying average day demand by a 5.0 maximum day multiplier.
3. Peak Hourly Demand (GPM). Peak hour demand shall be determined by multiplying the maximum day demand by a 1.5 peak hour multiplier.
4. Required Fire Flow (GPM) and Duration (hours)
5. Irrigation Flow (GPM) for parks.

C. System Layout. Describe and show the proposed distribution system layout, including locations for connections with the existing water distribution system. Hydrant locations and fire flow requirements shall also be approved by the City Fire Marshall.

D. Conformance with Master Plan. Describe how the proposed water system improvements conform with the current [*City of Missoula 2018 Water System Master Plan*](#).

E. Hydraulic Model. The City of Missoula typically performs a distribution system analysis, performed through hydraulic modeling with input from the design consultant, identifying any system impacts based on proposed demands and provide design solutions to ensure future water system growth, while maintaining appropriate system pressures and flow rates.

F. Sizing. Indicate the required sizing of the proposed distribution mains based on water demands.

G. Allowable Pressures. The City of Missoula requires a minimum normal working pressure of 45 psi and a maximum working pressure of 100 psi. Pressures outside this range need to be approved in writing by the City. The City prefers operating pressures in the range of 60-80 psi.

H. Other. Identify any special conditions, such as the presence of contaminated soils, conflicts with other utilities, unusual installation depths, or any requirements that require special provisions for construction.

4.2.4 General Water Service Requirements

- A. Service lines shall be installed perpendicular to the main unless otherwise approved by the City Engineer. Applicants wishing to install services parallel to the right of way must submit a Services-in-Right-of-Way Request, which is included in [Appendix 2-C](#) of this Manual.
- B. All water mains and service lines should generally be installed 10 feet from lip of curbs, sidewalks, storm drain inlets and pipes. There are more specific separation requirements for water mains in Section 4.3 of this chapter.
- C. Specific information for water service for accessory structures on a property can be found at [Frequently Asked Questions about Water & Sewer for Accessory Structures](#).
- D. For properties requiring a fire line, there should be separate connections to the main and separate shutoff valves for the fire line and domestic line.
- E. All new services shall be metered.
- F. All meters shall be Neptune™ meters and can be obtained at Missoula Water.
- G. Curb boxes shall be placed in a boulevard or immediately behind curb side sidewalk. These, and water services in general, should be installed at least 10 feet laterally from any existing tree.
- H. All new residential meters (up to and including triplexes) shall be installed in a meter pit located on private property not more than 5 feet outside the right-of-way line or dry utility easement (if present) as shown in [City of Missoula Standard Drawing 404A](#).
- I. Properties with a flat rate account or with inaccessible meters (such as in a crawl space, behind a wall, etc.), will be required to install a new meter pit at the edge of the property as part of any water service repair permit issuance. A new meter, either in a meter pit or in an accessible space in the building (not including crawl spaces), will also be required for any flat rate modifications that would require recalculation of the flat rate charges. Meter pits and curb boxes shall not be located where vehicles are expected to drive or park.
- J. All new commercial and multi-family meters (4-plex and greater) shall be installed in a mechanical room as shown in [City of Missoula Standard Drawing 403](#). Any exceptions to this requirement must be approved in writing by Missoula Water.
- K. Commercial services, irrigation services, and any service with a fire line or auxiliary water source (irrigation well, ditch, etc.) shall require backflow protection as described in [Appendix 4-A](#). In most instances, commercial and fire services require reduced pressure principle backflow prevention assemblies.
- L. Irrigation for commercial service lines should be metered separately to avoid sewer charges on the irrigation volumes. Irrigation meters are allowed to be installed either in a mechanical room or in a meter pit as shown in [City of Missoula Standard Drawing 412](#).
- M. Meters 1½ -inch and larger (except irrigation meters) require a bypass as shown in [City of Missoula Standard Drawing 403](#).
- N. Customers should consider individually metering food service components due to the difference in sewer billing rates for food service and general commercial uses.
- O. A separate shutoff valve accessible outside the building is required for each metered account.

- P. Connections to public water outside the city limits shall comply with the requirements established in [City of Missoula Resolution 8181](#).
- Q. All meters that are installed inside a building or inside a pit with a metallic lid shall have a transmitter installed remotely on an exterior building wall. A $\frac{1}{2}$ -inch PVC conduit shall be installed from the meter to the transmitter.

4.2.5 Wet Utility Main Best Practices

- A. The term “wet utility main” refers to water, sanitary sewer, or stormwater mains where applicable. These rules must be followed when designing wet utility mains. When the design engineer feels it is not practical to follow these rules, they must request a deviation to the rules with a written description as to why it is not practical to follow the rules. City staff will make a determination as to whether the deviation will be accepted or denied.

- B. All parcels desiring water or sewer service shall have a water and sanitary sewer main fronting a property line.

Exception: The Public Works & Mobility Department may consider a deviation for a single-family residential project if it determines that there is no reason to further extend the main in the future. The applicant needs to fill out the “Request for Permission to Install Private Utility Service in Public Right-of-Way” form ([Appendix 2-C](#)) and submit it to City Engineering.

- C. Wet utility mains should be installed all the way across all parcels being served. Latecomer’s Agreements can be created to collect proportional costs from other properties connecting service lines to the main.

Exception: Wet utility mains may be allowed to terminate at the midpoint of the last parcel being served if new asphalt, hardscape, or landscaping are not planned to be installed with the development beyond the midpoint of the parcel. If mains are not required to be extended all the way across the last parcel, easements or right-of-way must be provided such that the main could be extended in the future.

- D. Water and sanitary sewer mains should be extended such that each structure can be served with water and sanitary sewer services perpendicular to the main.

Exception: Water service lines and sanitary sewer service lines for adjacent residential parcels will be allowed in shared trenches provided that reciprocal easements are created near the shared property corner that will allow for future repair/replacement of the lines. This exception does not exempt the applicant from complying with subsection B above.

- E. Wet utility main alignments should parallel the street right-of-way to maximize right-of-way available for future utilities. Additional sanitary sewer and stormwater manholes will likely be required on curves.
- F. Sanitary sewer and stormwater mains should be situated such that manholes are installed in the centerline of the road or in the center of a driving lane.
- G. Street trees shall not be installed within 10 feet of wet utility mains, as measured from center of tree to center of pipe.

- H. Exception: Where stormwater mains are installed in the curb line separation requirement from trees may be waived with City Engineering approval. A minimum separation of 2.5 feet from the edge of the stormwater main to the center of 2" caliper trees must be maintained. Wet utility mains should be installed within the asphalt section of the road or alley prism.
- I. Wet utility mains should not be installed under curbs and sidewalks.
Exception: Where stormwater mains are installed, they may be installed under curbs with City Engineering approval.
- J. No sewer main shall be within 5 feet of the nearest point of any storm manhole, catch basin, or dry well. The distance to a dry well shall be measured to the edge of the structure.
- K. No water main shall be within 5 feet of the nearest point of any sanitary or storm manhole or dry well. The distance to a dry well shall be measured to the edge of the structure. Water mains closer than 10 feet from a dry well will require a deviation from MDEQ.

4.2.6 Public Infrastructure Review Stage Process

Water projects shall follow the City of Missoula [Public Infrastructure Review Stage Process](#).

4.2.7 Utility Service Area

The utility service area map is available on the City website under Missoula Maps and through this [link](#).

4.2.8 Latecomer's Agreement and Payment for General Benefit Facilities

Latecomer's fees are described in [Section 2.2.5](#) (Construction Within Right-of-Way) of this Manual.

4.2.9 Upsizing

Missoula Water may require larger water mains than the minimum main sizes required for a particular development, in order to serve other developments in the area. The rules for upsizing are described in [Section 2.2.4](#) (Construction Within Right-of-Way) of this Manual.

4.2.10 Tie-ins to Existing System

- A. It is imperative that all connections to Missoula Water's existing system be performed in an efficient and timely manner with minimal interruption to existing customers. All tie-ins to the existing system shall be overseen by Missoula Water personnel.
- B. **Operation of Existing Facilities.** All operation of existing system valves shall be performed by Missoula Water employees unless otherwise previously arranged.
- C. **Taps into Existing System.** All taps necessary to tie-in to Missoula Water's existing system will be performed by Missoula Water personnel unless otherwise previously arranged. Missoula Water requires that a [Tap Application Agreement](#) is filled out and signed and tapping fee is paid for each service or mainline tap on a Missoula Water main. The Contractor will provide the tapping saddle or sleeve. The contractor shall provide corporation stops for taps 2 inches and smaller and valves for all taps larger than 2 inches. A Agreement is required but no tapping fee will be charged for new main connections that will involve cutting in a new tee and the contractor will be required to provide the

tee and all other appurtenances. The contractor is responsible for providing a job site that meets all local, state, and federal laws, statutes, and regulations. A properly sloped trench or a trench box with adequate room to complete the tap is required.

4.2.11 Construction Documentation

- A. As-Built Drawings.** The engineer of record is required by the MDEQ approval to certify that the project is completed in substantial accordance with approved plans. As-builts should include surveyed data of actual facilities constructed at-grade or above grade. The engineer is also required to submit a complete set of as-built drawings to the MDEQ. In order to complete these tasks, the engineer is required to inspect construction of the facilities and to keep detailed notes in daily logs.
- B. Construction Photographs.** At a minimum, construction photos shall be taken at all fittings and valves. Photos shall be taken before the fitting is wrapped to create a record of the connections and after the tie downs and thrust blocks are in place for future reference as to size and construction. Additional photos shall be taken as necessary to document construction. Photos shall be clearly annotated for future identification of location and orientation using a whiteboard, noting the date, station and items pictured.
- C. Ditch Cards.** The contractor shall be required to complete a ditch card for each new, repaired, or replaced water service connection using the template included in [Appendix 4-B](#). The ditch card shall include a minimum of two horizontal dimensions from established locations such as valve boxes or house corners to curb box so that the curb box can be located in the field.
- D. Construction Test Results.** At a minimum, test results from the water main pressure test, bacti, and compaction tests shall be supplied.
- E. Detailed requirements for construction documentation submittals can be found in Stage 6 of the [Public Infrastructure Review Stage Process](#).**

4.2.12 Temporary Water

- A.** Under no circumstances shall temporary water be provided to a customer through another customer's connection, a fire hydrant, or other means unless specifically approved by Missoula Water personnel.
- B.** Should a temporary water system be necessary for construction or other purposes, it shall be tapped directly to an existing Missoula Water main, equipped with backflow, disinfected, tested for bacteriologic contaminants in accordance with this Manual, and pressure tested as approved by Missoula Water's water quality personnel and in accordance with all applicable MDEQ standards including DEQ 1, Section 8.15, Temporary Water Distribution.
- C.** No such systems shall be provided without prior approval by the City Utility Engineer.
- D.** Hydrants may be utilized as a source of temporary water provided they are also disinfected and tested for bacteriologic contaminants.

4.2.13 Abandonment, Repair, or Reuse of Existing Water Service Lines

- A. It shall be the responsibility of the owner of the new service line to abandon the old service at the main.
- B. Failure to abandon service lines not in use may result in termination of water service to the property.
- C. Services lines larger than 2 inches shall be abandoned by removing the existing tee or tapping sleeve and replacing it with a straight run of pipe. The new pipe shall be secured to the existing main with mechanically restrained couplers or other method approved by Missoula Water staff. Contractor to provide all labor, material, and appurtenances to complete the work.
- D. Service lines 2 inches and smaller shall be abandoned by removing the existing corporation stop and installing a repair clamp. Contractor to provide a Romac SS1, Ford FS1, Smith-Blair 261 repair clamp, or approved equivalent. Coordinate with Missoula Water who will remove the corporation stop and install the repair clamp.
 - 1. If the old service line is to be replaced with a new service line in the same location a new "Tap for Repair" clamp shall be installed. Contractor to provide the appropriately sized corporation stop, Romac SS1, Ford FS1, Smith-Blair 264 tapped repair clamp with C.C. threads, or approved equivalent. Coordinate with Missoula Water who will remove the existing corporation, install repair clamp and new corporation stop.
- E. Abandonment must be inspected by a Missoula Water employee.
- F. The contractor shall make every effort to minimize contamination of water service lines and prevent foreign material from entering the pipe. All materials installed in the service lines shall be disinfected with bleach solution.
- G. Repaired service lines:
- H. The Contractor shall shut the corporation stop for water service repairs. The water main will only be shut down or throttled down in exceptional circumstances as determined by Missoula Water.
- I. Any repaired service lines shallower than 6 feet shall be insulated sufficiently with blue board insulation to protect against freezing.
- J. The Contractor shall be required to complete a ditch card for each new, repaired, or replaced water service connection, including any time a service line or curb box is disturbed or relocated, using the ditch card template in the City of Missoula Public Works Standards and Specifications Manual, Appendix 4-B."
- K. Any existing service line that an applicant wishes to reuse, or on a property where a demolition permit has been requested, and that was installed prior to the year 2000, shall be required to be pressure tested before any permits will be issued for its reuse. Pressure testing of any line 2 inches and smaller requires that the line be excavated at the main and the corporation stop closed during the test.

4.2.14 Requirements for Working Around Existing Services

A. Water Services

- 1. Property owners own their water service from the corporation stop at the water main to the house, with the exception of the meter. Repairs or modifications to water services shall be

performed as directed by the property owner in accordance with Missoula Water specifications for service line installations.

2. The Contractor shall shut the corporation stop for water service line repairs. The water main will only be shut down or throttled down in exceptional circumstances as determined by Missoula Water.
3. If a lead gooseneck or lead service line is found, Missoula Water shall be immediately notified. Work shall not recommence until Missoula Water staff is onsite to witness the repairs and to assist in flushing and sampling the service line.

4.3 Design Standards

4.3.1 Water Mains

A. Sizing and Location

1. Main sizes shall be determined based on the results of hydraulic modeling performed by Missoula Water.
2. Mains in residential areas shall be a minimum of 8 inches in diameter and mains in commercial and multifamily areas shall be a minimum 12 inches in diameter unless otherwise approved.

B. Products

1. For boring projects, DR11 HDPE pipe with DIPS dimensions manufactured to the requirements of ASTM F714 and AWWA C906-15 will be allowed. The engineer of record will be required to submit a detailed specification for the project, which shall include a requirement that the persons performing heat fusion have a current certification within the last two years from a training provider that meets ASTM F3190 and follows the guidelines in ASTM F2620. HDPE pipe must be one size larger than adjacent ductile iron mains.
2. Bury depths less than six feet or horizontal distance of less than six feet from unheated structures, such as stormwater and sewer manholes, telecommunication vaults, tunnels, and irrigation culverts shall require insulation conforming to [City of Missoula Modification to MPWSS Section 02724](#) and [City of Missoula Standard Drawing 500](#). Insulation thickness shall be designed by the engineer of record and identified on the plans to properly protect the pipe from freezing.

C. Installation

Where water and sewer mains or services must cross and cannot meet main vertical separation requirements specified in this chapter, both shall be installed in accordance with [City of Missoula Standard Drawing 402](#).

D. Separation of Water Mains and Sanitary Sewer or Stormwater Facilities

1. **Horizontal separation between water, sewer, and stormwater mains.** Where water mains, sanitary sewer, or stormwater mains are shown to run parallel on the plans, they shall be separated by a minimum horizontal distance of 10 feet as measured from the edges of the pipe (outside wall of the mains). Water mains shall also be separated a minimum of 10 feet

from the edge of storm drain sumps. If the minimum separation cannot be maintained, a deviation request must be approved by MDEQ. All installations must be performed in accordance with the conditions set forth in the deviation approval.

2. **Horizontal separation between water mains and dry wells.** Dry wells shall not be installed within 10 feet from a water main, measured between the outer walls of the water main and dry well barrel. If that separation cannot be maintained, the water main shall be protected with flowable fill and/or insulation as described below.
 - a. If the installation involves installing or exposing the water main, the water main should be encased in a minimum of 6 inches of flowable fill above and below the main, extending 10 feet along the water main in both directions from the location not meeting separation requirements. If the sump rock is less than 6 feet from the water main, a 4-foot x 8-foot x 2-inch-thick sheet of insulation should also be installed vertically at the edge of the dry well excavation nearest the water main. The long dimension of the insulation should be in the vertical direction.
 - b. If the installation does not involve the water main being installed or exposed, a 4-foot x 8-foot x 2-inch-thick sheet of insulation should also be installed vertically at the edge of the dry well excavation nearest the water main. The long dimension of the insulation should be in the vertical direction.

3. **Vertical Separation between water mains and sanitary sewer, or stormwater mains.**

Unless otherwise shown on the plans, water mains shall be adjusted in burial depth so as to cross over sanitary sewer or stormwater mains. The bottom of the water main shall be at least 18 inches above the top of the sewer and stormwater main. Where burial depth is inadequate over water mains or where it is shown on the plans that the water main must pass below the sewer or stormwater main, the vertical separation between the top of the water main and the bottom of the sewer main shall be at least 18 inches.

4. When water, sewer, or stormwater pipe is installed, lengths shall be centered at the point of crossing so as to maximize the distance that all pipe joints are from the crossing. No pipe joints shall be allowed at the point of crossing.

E. Abandonment of Water Lines. Where existing water lines are to be abandoned in place, the Contractor shall install a water-tight cap or plug.

F. Dead End Mains. Water mains shall be looped where possible. Permanent dead-end mains should be less than 500 feet long unless otherwise approved in writing by Missoula Water. All dead-end mains shall terminate with a blowoff sized in accordance with [Section 4.3.5](#) of this chapter or with a fire hydrant. Automatic flushing devices may be required on long dead ends.

G. Main Stubs for Future Extension

1. Water main stubs intended for future extension should include a valve that will allow the new main to be installed without draining mains serving customers. The stub should also include a blowoff on the end a minimum of 18 feet from the valve and no services shall be installed between the valve and blowoff. If the isolation valve is not flanged to a tee or

cross, the valve should be thrust blocked as described in Section 4.3.3 of this chapter, and there should be no unrestrained joints within 36 feet of the blow-off.

2. Piping connections shall be made in all streets where feasible and main extensions shall be stubbed out in all streets to the property line for future extensions. No blind flanges or caps are allowed on tees, and blowoffs on stubs shall be at least 5 feet from tees.

4.3.2 Fittings and Bends

Use mechanical joint fittings unless otherwise approved by City Utility Engineer.

4.3.3 Valves

- A. Valve spacing shall be a maximum of 800 feet and at the end of each block in residential areas and 500 feet in commercial and industrial areas.
- B. Valves shall also be placed near the end of mains planned for extension in the near future (i.e., at phase boundaries in multi-phased developments), such that no customers are out of water when the main is extended.

4.3.4 Fire Hydrants

- A. The hydrant shall be positioned with the bury line on the hydrant set to finished grade with a minimum bury depth of 6 feet.
- B. Bends may be used to get the fire hydrant to finished grade.
- C. Fire hydrants shall be located in the street right-of-way as shown on the plans unless otherwise specified. Locate them as far from the street as practical to minimize snow burial.
- D. Fire hydrant spacing and maximum distance to a building is dictated by the currently adopted International Fire Code – Chapter 5 and Appendix C, and the Authority Having Jurisdiction. All new fire hydrant locations shall be approved by the Authority Having Jurisdiction.
 1. Maximum distance along the street frontage from a building to a fire hydrant should be:
 - a. In existing neighborhoods:
 - 1) 400 feet for commercial buildings
 - 2) 600 feet for residential buildings
 - b. In areas of new construction:
 - 1) 250 feet for all buildings
- E. No fire hydrant shall be set in a concrete sidewalk or concrete curbing unless specifically indicated on the project plans. Unless conditions otherwise dictate, hydrants shall be a minimum of 2 feet behind curb, sidewalk, or edge of asphalt.
- F. Lead pipe shall be sized to assure minimum flow loss to the hydrant.

4.3.5 Blow-Offs

A. Installation

1. Blow-offs shall be installed at the end of each dead end main to allow for proper flushing and maintenance both during and after installation.

2. A minimum of 5 feet shall be maintained between the blow-off and other system appurtenances including, but not limited to, tees, valves, and service taps.
3. A minimum of 5 feet shall also be maintained between blow-offs and any concrete curbs and sidewalks.
4. Blow-offs shall be sized as shown in Table 4-1 to achieve the minimum flushing requirements of 3 feet/second.

Table 4-1 – Blow-Off Size Required to Achieve Minimum Flushing Requirements

Pipe Diameter (inches)	Size of Blow-off (inches)*
8	3
10	3
12	3
14	4
16	4
20	6
24	6
30	8

*Based on pressure of 80 psi in main

4.3.6 Manual Air-Relief Valves

A. Installation

1. Manual air-relief valves shall be installed at all apparent high points along a newly installed water main and in any location during repairs or other activities where an apparent high point has been created per [City of Missoula Standard Drawing 410](#).

4.3.7 Service Taps

A. Installation

1. Before a tapping sleeve or saddle is installed, the exterior of the main to be tapped shall be thoroughly cleaned and the interior surface of the sleeve shall be sprayed with sodium hypochlorite solution.
2. Tapping sleeves are used to avoid shutting down the main to be tapped. After the tap is made, it is impossible to disinfect the annulus without shutting down the main and removing the sleeve. The space between a tapping sleeve and the tapped pipe is normally 1/2 inch, more or less, so that as little as 100 mL of sodium hypochlorite per square foot will provide a chlorine concentration of over 50 mg/L.

4.3.8 Water Service Lines

A. Installation

1. Service lines shall be installed per [City of Missoula Standard Drawing 416](#).
2. Service lines should be installed at least 10 feet laterally from any existing tree.
3. Minimum vertical separation of 0.5-ft shall be maintained where service lines cross wet utilities.
4. Service stubs shall stop 5 feet inside of the property line or easement and shall be no closer than 10 feet from the building.

4.3.9 Meter Pits

A. Installation

1. A minimum 4-foot radius clear area around the meter pit must be maintained to allow access by Missoula Water personnel for maintenance of the meter.
2. Meter pits must not be buried nor access obstructed by fences or landscaping materials.
3. Plastic meter pits shall not be installed in areas with vehicle traffic nor in permanent walkways such as sidewalks. Meter pits shall never be installed in locations with vehicle traffic.

4.3.10 Cross-Connection/Backflow

Missoula Water's complete Cross-Connection/Backflow program can be found in [Appendix 4-A](#).

4.3.11 Disinfection and Bacteriological Testing

A. Overview

1. This standard presents essential procedures for disinfecting new and repaired water infrastructure. All new water mains, wells, tanks, and equipment that can convey or store potable water shall be disinfected before they are placed in service. New mains must also be disinfected and tested for bacteria prior to pressure testing.
2. All water mains taken out of service for inspecting, repairing, or other activity that might lead to contamination of water shall be disinfected before they are returned to service.
3. Disinfection of water mains shall be in accordance with the guidelines set forth in the [City of Missoula Standard Modifications to MPWSS Section 02660](#) and with AWWA C651.

B. Forms of Chlorine. The forms of chlorine that may be used in the disinfection operations are sodium hypochlorite solution and calcium hypochlorite granules or tablets.

1. **Sodium Hypochlorite.** Sodium hypochlorite is available in liquid form in glass, rubber-lined, or plastic containers of 5 gallons. Larger sizes may be available in some areas. Sodium hypochlorite contains approximately 5% to 15% available chlorine, but care must be used in control of conditions and length of storage to minimize its deterioration. (Note: Available chlorine is expressed as a percent of weight when the concentration is 5% or less and usually as a percent of volume for higher concentrations. Percent x 10 = grams of available chlorine per liter of hypochlorite.)
2. **Calcium Hypochlorite.** Calcium hypochlorite is available in granular form and contains approximately 65% available chlorine by weight. Calcium hypochlorite tablets are not allowed to be used. The materials should be stored in a cool, dry, and dark environment to minimize its deterioration. Calcium hypochlorite should not come into contact with any oily substances as this could lead to spontaneous combustion.

C. Basic Disinfection Procedure. The basic disinfection procedure consists of:

1. Preventing contaminating materials from entering the water main during storage, construction, or repair.
2. Removing by flushing or other means those materials that may have entered the water main.
3. Chlorinating any residual contamination that may remain and flushing the chlorinated water from the main.
4. Determining the bacteriological quality by a certified laboratory test after disinfection.