

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

CHAPTER 5 – SEWER SYSTEM

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CHAPTER 5 - SANITARY SEWER SYSTEM

5.1 Introduction

5.1.1 References

- A. *Montana Public Works Standard Specifications* (MPWSS), Seventh Edition, 2021 – by purchase only
- B. *2021 Uniform Plumbing Code* (UPC)
- C. [Montana Department of Environmental Quality \(MDEQ\) Circular-2: Design Standards for Public Sewage Systems \(DEQ-2\)](#)
- D. [Montana Department of Environmental Quality \(MDEQ\) Circular-4: Montana Standards for Subsurface Wastewater Treatment Systems \(DEQ-4\)](#)
- E. City of Missoula [2019 Wastewater Facility Plan](#)
- F. [Frequently Asked Questions about Water & Sewer for Accessory Structures](#)

5.1.2 Appendices

- A. [Appendix 5-A – 2021 City of Missoula STEP Manual](#)
- B. [Appendix 5-B – FOGs Control Section Program](#)
- C. [Appendix 5-C – Grease Interceptor Sizing Worksheet and Variance Form](#)
- D. [Appendix 5-D – Sewer Ditch Card Template](#)

5.1.3 Standard Modifications to MPWSS

Missoula has adopted standard modifications to specific sections of *Montana Public Works Standard Specifications* (MPWSS), Seventh Edition, 2021. Any specifications not specifically contained within these standard modifications shall be in conformance with MPWSS. Missoula Standard Modifications can be found in [Appendix 2-A](#).

5.1.4 Standard Drawings

Standard drawings related to sanitary sewer system improvements shall be in conformance with the *Montana Public Works Standard Specifications* (MPWSS), 6th Edition, 2010 Standard Drawings and the 500-series of the City of Missoula Standard Drawings, found in [Appendix 2-B](#).

5.2 General Requirements

5.2.1 Design Standards

Sanitary sewer systems shall be designed, constructed, and tested in accordance with the current editions of [Circular DEQ-2 – Montana Department of Environmental Quality – Design Standards for Public Sewage Systems](#), the *Montana Public Works Standard Specifications Seventh Edition*, the 2021 *Uniform Plumbing Code* (UPC), and these standards.

5.2.2 Plan Requirements

A. Sanitary sewer system improvement plans shall comply with the specific requirements of Chapter 20 of [DEQ Circular-2](#) and [Section 3.2](#) (Improvement Plans) of this Manual and shall at a minimum include:

1. **Topography and elevations.** Existing or proposed streets and all streams or water surfaces must be clearly shown.
2. **Streams.** The direction of flow in all streams, and high and low water elevations of all water surfaces at sewer outlets and overflows shall be shown.
3. **Boundaries.** The boundary lines of the municipality or the sewer district, and the area to be sewered, shall be shown.
4. Location of existing and proposed boulevard or street trees. Existing trees should be drawn to show the approximate measured drip line.
5. Location, size, and direction of flow of relevant existing and proposed sanitary sewers draining to the treatment facility.
6. Plan views drawn to a corresponding horizontal scale. Plan views and profile shall be shown on the same sheet, with corresponding horizontal scale of not more than 20 feet to the inch, and a vertical scale of not more than 10 feet to the inch when printed on 22- x 34-inch sheets, with both scales clearly indicated. Plans and profiles must show:
 - a. Size, material, and type of pipe.
 - b. Location of streets and sewers.
 - c. Line of ground surface.
 - d. Length between manholes.
 - e. Invert and surface elevation at each manhole, and grade of sewer between each adjacent manhole (all manholes must be numbered). The engineer of record shall use existing City manhole numbers for all tie-in manholes.
 - f. The engineer of record shall state on the plans that all sewers are sufficiently deep to serve adjacent basements except where otherwise noted on the plans. Elevation and location of the basement floor may be required depending on sewer depth.
 - g. Locations of all special features such as inverted siphons, concrete encasements, elevated sewers, etc.
 - h. All known existing and proposed structures and utilities, both above and below ground, that might interfere with the proposed construction or require a setback, particularly water mains, services, and water supply structures (e.g., wells, clear wells, basins, etc.), existing sewer mains and services, gas mains and services, stormwater infrastructure, and fiber optic/telephone and power conduits;
7. Detail drawings, made to a scale to clearly show the nature of the design, shall be furnished to show the following:
 - a. All stream and ditch crossings and sewer outlets, with elevations of the stream bed and normal and extreme high and low water levels;
 - b. Details of all special sewer joints and cross sections; and

- c. Details of all sewer appurtenances such as manholes, lamp holes, inspection chambers, inverted siphons, regulators, tide gates, and elevated sewers.

5.2.3 Design Report

- A. A sanitary sewer design report shall be prepared by a Professional Engineer licensed in the State of Montana and approved by MDEQ per Chapter 10 of [DEQ Circular-2](#).
- B. The design report shall demonstrate at a minimum that all sanitary sewer extensions:
 - 1. Have adequate capacity to convey wastewater from the anticipated service area,
 - 2. Address sewer flows at full buildout of the development,
 - 3. Meet minimum flow velocities and/or flow depth requirements in Chapter 30 of [DEQ Circular-2](#), and
 - 4. Address impacts to the wastewater treatment plant.
- C. For existing or proposed lift stations, provide the following:
 - 1. A description of the existing and/or proposed wet well, pumping system, and force main;
 - 2. The capacity of the existing and/or proposed pumps and potential for upgrading/upsizing;
 - 3. A map showing the existing and/or proposed lift station service area;
 - 4. Average daily and peak hour design flows, with supporting information verifying existing and/or proposed users within the lift station service area;
 - 5. Reserve capacity;
 - 6. The pump run and cycle times for the existing and/or proposed average and peak design flows;
 - 7. The hydraulic capacity of the existing and/or proposed force main(s); and
 - 8. Recommendations for improvements to an existing lift station, if necessary, to enable the lift station to serve the proposed development.
- D. Estimating wastewater flows for non-residential developments shall be determined on a case by case basis by the engineer of record based on the projected land use occupancy and building type meeting [DEQ Circular-4](#) – table 3.1-1 and 3.1-2 whenever possible. The engineer of record shall provide all relevant references, assumptions, and calculations for alternate methods of non-residential wastewater flow estimation used within the submitted design report.

5.2.4 General Sanitary Sewer Service Requirements

Specific sewer service requirements for accessory structures on a property can be found at [Frequently Asked Questions about Water & Sewer for Accessory Structures](#).

5.2.5 Public Infrastructure Review Stage Process

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

5.2.6 Utility Service Area

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

5.2.7 Connections to Public Sanitary Sewer

A. Requirements for Connection to the Sanitary Sewer System

1. Public sewer is considered to be available when any building or structure or any exterior drainage facility connected to a building is located 200 feet or less from any public sewer system abutting and serving the lot or premises of the building or exterior drainage facility. (Ord. 3336 §1, 2007)
2. Plumbed structures that are or will be generating wastewater and have public sanitary sewer available are required to connect to the public sanitary sewer, if available. Each lot, parcel, or townhome shall be provided with a separate connection to a public sewer. In certain circumstances, more than one building may share a connection:
 - a. A single connection is allowed for 2 mobile or manufactured homes located on a single parcel or property.
 - b. Applicants wishing to connect multiple buildings on a lot to a single service line shall provide capacity calculations, such as a drainage fixture unit count, to determine if sufficient capacity exists.
3. A graywater irrigation system that has been installed in conformance with the *Uniform Plumbing Code* and permitted by the Missoula City County Health Department may remain in use in accordance with [MMC 13.04.010\(B\)\(2\), Sewer Regulations](#). Once plumbed buildings are connected to city sewer, a graywater system in conformance with the *Uniform Plumbing Code* may be discharged from May to October to an irrigation system as permitted by the Missoula City-County Health Department. From November to April, all graywater must be discharged to the public sanitary sewer.
4. When a property with an existing septic system is connected to the sanitary sewer system, each cesspool, septic tank, and seepage pit that has been abandoned from further use shall have the sewage removed therefrom; be completely filled with earth, sand, gravel, concrete, or other approved material; and have all risers removed. An exception shall be granted when the contractor cannot easily locate the tank or pit in the field and conducts a records search at the Missoula City-County Health Department to determine if the physical location of the tank or pit can be ascertained.
5. For unplatted property, a judgment shall be made about the ability to subdivide in the future any property where two or more buildings exist. This judgment is to consider the usage of the buildings and their independent use.
6. The following exceptions apply:
 - a. A functioning septic system exists in good condition. If the septic system fails, all plumbed structures on that parcel shall be required to connect to sewer; and
 - b. Until there is a change in use. If the structure is enlarged or change in use of the structure is likely to increase the effluent flow as determined by City Engineering personnel, sewer connection will be required. Increased (effluent flow) use includes, but is not limited to, the addition to a residence of one (1) or more spaces that can be used as bedrooms.

- B. Process for Verifying if a Property is Connected to the Sanitary Sewer System.** Verification of sewer connection shall be conducted through a combination of ditch card and dye tests. A dye test is required if any of the following conditions are met:
1. No ditch card on file.
 2. Ditch card on file but no city permit issued.
 3. Service installed or recorded by someone other than a licensed and bonded contractor.
 4. Ditch card does not have adequate information or connection date.
 5. Legal description or address of the property has changed and changes are not clear or initialed on ditch card.
- C. Connection Upon Sale or Transfer of Ownership.** Connection to available public sewer must be made prior to transfer or sale of real estate, except in foreclosures, and shall follow the requirements of [MMC 13.04.020, Sewer Regulations](#).
- D. Connections to Public Sanitary Sewer Outside the City Limits.** Connections to public sanitary sewer outside the city limits shall comply with the requirements established in [City of Missoula Resolution 8181](#). All commercial connections shall have water meters installed so that the rate can be determined by water use volume per [City of Missoula Resolution 8017](#). The water meter installation shall meet all the applicable standards in [Section 4.2.4.F](#) of this Manual except that a water meter conforming to Missoula Water standards shall be provided by the owner or contractor.
- E. Connections to Public Sanitary Sewer Within City Limits**
1. **New Building Connection.** During building permit review, sewer availability is determined and Sewer Development Fees (SDFs) are calculated, SDF is paid by owner/applicant, and applicable permits are purchased by City-licensed, bonded excavator.
 2. **Existing Building.** If sewer is available to a property requesting a connection, and has metered water, SDFs are calculated using meter size, SDF is paid by owner/applicant, and applicable permits are purchased by City-licensed, bonded excavator. If water is not metered, a water fixture usage count shall be provided to determine applicable meter size, SDFs are calculated, SDF is paid by owner/applicant, and applicable permits are purchased by City-licensed, bonded excavator.
- F. Requirements for Remodels**
1. The City of Missoula requires the property owner to verify all sewer service pipes for location and type of pipe prior to construction of additions or expansion of buildings, in accordance with Section 315 of the *Uniform Plumbing Code*.
 2. The methods of verification for the location and type of pipe shall be
 - a. A sewer record card that is specific and reliable,
 - b. Video inspection,
 - c. Physical exposure and inspection of the pipe, or
 - d. Electronic underground detectors, which are allowed for location purposes only.
 3. No building can be constructed if the pipe material under or within two feet of that building is determined to be anything other than those approved for use under or within a building by the *Uniform Plumbing Code*, Table 701.1.

G. Ownership and Maintenance Responsibilities

1. Property owners own their respective sewer service line. As such, they are responsible for the cost of construction and maintenance of the sewer service lines and appurtenances from the public sewer main to the premises of the property owner, including any and all costs for construction, repairs, maintenance, replacement, removal, utility locations, pretreatment facilities, clean-outs, manholes, saddles, and any other items necessary for the construction, operation, or maintenance of the service lateral with the following exceptions:
 - a. The City of Missoula will maintain City-owned STEP (Septic Tank Effluent Pump) tanks, sewer service pipeline(s) from STEP main to tank, and appurtenances that are accepted by the City of Missoula with public easements granted to and accepted by the City of Missoula.
 - b. The City of Missoula will own and maintain wyes or tees that are an integral part of the sewer main when the main is installed.

5.2.8 Construction Documentation

- A. **As-Built Drawings.** The engineer of record is required by the MDEQ approval to certify that main extension and main replacement projects are completed in substantial accordance with approved plans. The engineer of record is also required to submit a complete set of as-built drawings to the MDEQ. In order to complete these tasks, the engineer of record 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 manhole connections. 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(s) pictured.
- C. **Ditch Cards.** The contractor or engineer shall complete a ditch card for each new, repaired, or replaced sewer service connection using the template included in [Appendix 5-D](#).
- D. **Construction Test Results.** At a minimum, test results from the sewer main exfiltration tests, light tests, mandrel tests, tv video results, manhole leakage tests, and compaction tests shall be supplied.
- E. Detailed requirements for additional construction documentation submittals can be found in Stage 6 of the [Public Infrastructure Review Stage Process](#).

5.2.9 Sewage Quality Control

- A. No development may introduce any sewage into the City of Missoula sewerage facility inconsistent with normal domestic sewage.
- B. No stormwater may discharge to any sanitary sewer system.
- C. High-strength waste dischargers (breweries, wineries, distilleries, processing plants, etc.) must test and pre-treat their discharge to ensure it complies with sewage quality requirements provided in the 2021 *Uniform Plumbing Code*.
- D. Sewage pre-treatment may be required and shall be designed according to [Section 5.3.7](#) of this chapter.

5.2.10 Latecomer's Agreement and Payment for General Benefit Facilities

Latecomer's fees are described in [Chapter 2](#) of this Manual.

5.2.11 Upsizing and Deepening

The City may require larger and/or deeper sewer mains than the minimum main size and depth requirements for a particular development in order to serve other developments in the area. The rules for upsizing and deepening are described in [Section 2.2.4](#) (Construction Within Right-of-Way) of this Manual.

5.2.12 Main Extensions

- A. The City will require sewer mains be extended in accordance with the City's best wet utility practices outlined in [Section 4.2.5](#) (Water System) of this Manual.
- B. No main stub-outs will be allowed to accommodate for future main extensions. All sewer mains must terminate in City owned manholes.

5.2.13 Tie-Ins to Existing System

- A. Predco saddle taps shall be used for service lateral connection to existing sewer mains. Inserta-Tee taps may be required for large diameter (36-inch or greater) profile type PVC sewer mains.
- B. All manhole penetrations to existing sewers shall be core drilled for main or service tie-ins.
- C. All service taps or in-line tees shall be spaced at least 2 feet from adjacent services (measured center to center) and 3 feet from the outside of adjacent manholes.

5.2.14 Protection of Sewer Services during Construction

When a sewer is intended to be reused, it must be properly capped during construction with the use of a fitted pipe cap. Temporary caps (i.e., wood blocking or material shoved into the end of the pipe) will not be allowed.

5.3 Design Standards

5.3.1 Sewer Gravity Mains

A. Location

Sewer main shall be located relative to other ROW infrastructure in accordance with the City's best practices for wet utility construction, as listed in [Section 4.2.5](#) (Water System) of this Manual.

B. Diameter

1. Public sanitary sewer mains or laterals shall be a minimum of 8 inches in diameter and of sufficient size to accommodate the property they are intended to serve.
2. New sewer mains shall be equal in size or smaller than any existing mains that they connect to downstream.
3. Sizing of new sewer mains shall utilize upstream flows from sewer models available from City of Missoula Public Works Department.

C. Depth

1. Sewer mains shall be buried a minimum of 4 feet from top of pipe to final grade.
2. Bury depths less than 5 feet or horizontal distance of less than five feet from unheated structures such as stormwater manholes, telecommunication vaults, tunnels, and irrigation culverts shall require insulation conforming to [City of Missoula Standard Modification to MPWSS Section 02724](#) and [City of Missoula Standard Drawing 500](#). Insulation thickness shall be designed by the engineer of record based on the final pipe depth to properly protect the pipe from freezing.
3. Manholes less than 5 feet deep, as measured from invert of pipe to the rim elevation, shall be constructed with a flat top.

D. Grade

1. Sewer main minimum slopes shall be in conformance with [DEQ Circular-2](#), Chapter 30, unless otherwise approved by the City Utility Engineer and MDEQ.
2. Upsizing of mains will not be approved for utilization of minimum slopes to meet elevation restraints.

E. Clearance. The minimum clearance distances from other utilities shall be in accordance with MDEQ regulations as well as the best utility practices outlined in [Section 4.2.5](#) (Water System) of this Manual.

F. Materials and Installation

1. Pipe and fittings materials and installation shall be in conformance with the [City of Missoula Modification to MPWSS Section 02730](#).
2. Trenching, bedding, and backfill shall be in conformance with [City of Missoula Modification to MPWSS Section 02221](#) and [City of Missoula Modification to MPWSS Section 01400](#).

G. Casing. Gravity sewer mains shall be installed through a casing as required by City Engineering or the jurisdictional authority (i.e., railroad, Montana Department of Transportation (interstate), etc.). Casing requirements shall conform with [City of Missoula Modification to MPWSS Section 02740](#) or jurisdictional standards.

H. Testing. Testing of all new or repaired sanitary sewer mains shall be conducted in accordance with [City of Missoula Modification to MPWSS Section 02730](#).

5.3.2 Lift Station Force Mains

A. Lift station force mains shall be designed per [DEQ Circular-2](#) and the following:

1. Shall be either DR11 HDPE or DR18 C900 PVC.
2. Service taps shall not be allowed on lift station force mains.
3. Force mains shall only be connected to the gravity system at manholes.
4. Trace Wire. Contractor shall bury trace wire with all pressurized sewer mains. Trace wire shall be at minimum #14 solid copper direct bury wire and shall be **GREEN** color. Trace wire shall be taped to the top center of the pipeline prior to backfilling. Trace wire connections will be made by twisting the wires, installing a silicone-filled water resistant wire nut, and wrapping the connection with electrical tape.

- a. Tracer wire shall be brought to the surface every 500 feet along the centerline of the force main. Provide SnakePit Roadway terminal box or approved equal installed flush to surface. Mark locating box with carsonite post for all boxes not located within paved roadway surfaces.
 - b. Force mains burst through existing mains or installed without continuous trench access shall be installed with ¼-inch steel toner cable.
- 5. Sewer warning tape is required in both the trench as well as spiral wrapped around the force main at 2-foot intervals.
- 6. City Engineering may require force mains to be deeper than the typical 6.5 feet in select places to avoid creating unnecessary high points. Air/vacuum release valves shall be avoided to the extent possible.
- 7. Force mains shall require thrust blocks and mechanical thrust restraint at all bends.
- 8. All forcemains shall be designed with a flushing velocity between 2.0 to 3.0 feet per second to allow for future increases in pumping capacity. For stations with VFD controls flushing velocity shall be maintained at low operation set point.

B. Testing

Testing of all new or repaired lift station force mains shall be conducted in accordance with [City of Missoula Standard Modification to MPWSS Section 02730](#).

5.3.3 Sewer Service Lines

This section applies to all sanitary sewer service lines from 5 feet outside the face of a building or structure to the sewer main in accordance with [City of Missoula Standard Drawing 520](#).

A. Location

- 1. Service stubs shall stop 5 feet inside the property line or easement and shall be no closer than 10 feet from a building.
- 2. Sewer service lines shall be installed where shown on the drawings.
- 3. Services shall be a minimum of 4.0 feet away from an adjacent property line. If services are installed less than 4.0 feet away from an adjacent property line, a utility easement shall be required. When the only way to connect a property is through an adjoining lot, there must be a properly recorded private utility easement, as per [Section 2.10.2](#) (Construction Within Right-of-Way) of this Manual. This utility easement shall be required prior to the City issuing the excavation permit.
- 4. Sewage from one building shall not flow into or under another building if the second building is located on a separate lot.
- 5. Internal drop structure sewer services shall be designed per [City of Missoula Standard Drawing 513](#).
- 6. Sewer services shall be installed perpendicular to main, and within projected boundary of lot served. In all cases, the first 5 feet of sewer service shall be perpendicular to main. Applicants wishing to install services parallel to the right of way must submit a Services-in-Right-of-Way Request, requirements for which are detailed in [Appendix 2-C](#) of this Manual.

7. Sewer service lines should be installed at least 10 feet laterally from any existing tree.
8. Minimum vertical separation of 0.5-ft shall be maintained where service lines cross wet utilities.

B. Pipe Diameter

1. Sanitary sewer service lines, stub-outs, and drain, waste, and vent pipes shall be of sufficient size to accommodate the property they are intended to serve using a fixture unit count:
 - a. Single family and duplex residential sewer services shall be a minimum of 4 inches in diameter.
 - b. Multi-family residential, commercial, or industrial sewer services shall be a minimum of 6 inches in diameter.

C. Depth

1. Gravity sewer services buried shallower than 4 feet, and pressure sewer services buried shallower than 5 feet, shall require insulation conforming [City of Missoula Modification to MPWSS Section 02724](#) and per [City of Missoula Standard Drawing 500](#).
2. Minimum cover below ground elevation at the end of the stub-out shall be 8 feet-6 inches where mains are intended to serve basements. The maximum depth shall be 13 feet
3. In order to keep service lines deep enough to serve each home, it may be necessary to use a 22-degree fitting at the sewer main tap as per [City of Missoula Standard Drawing 520](#).

D. Materials and Installation

1. Pipe and fittings materials shall be PVC Schedule 40 conforming to [City of Missoula Modification to MPWSS Section 02730](#).
2. Trenching, bedding, and backfill shall be in conformance with the with [City of Missoula Modification to MPWSS Section 02221](#) and [City of Missoula Modification to MPWSS Section 01400](#).
3. When the sewer main and sewer service are installed under one contract, in-line tees shall be provided for the service lines.
4. Tees shall be rolled to a 45° angle, or 22.5° if approved.

E. Grade

1. Four-inch service lines shall be sloped at a minimum of 2%.
2. Six-inch service lines shall be sloped at a minimum of 1%.
3. Upsizing of services will not be approved for utilization of minimum slopes to meet elevation restraints.

F. Clean-outs

1. Clean-outs shall be the same material and size as the pipe conforming to [City of Missoula Modification to MPWSS Section 02730](#) and [City of Missoula Standard Drawing 521](#).
2. Clean-outs shall be placed within 2 feet of the structure, every 100 feet of distance, and at changes of horizontal direction of 135° or more.
3. Clean-outs shall have the wye fitting facing downstream of the direction of flow and be extended flush to grade.
4. A protective road box consisting of a metal ring and cover with the word “sewer” cast in the lid set to grade shall be installed if the clean-out is under asphalt or concrete in traffic areas.

5. Plug assemblies shall be a raised MIP plug GPK 228 or equivalent.
 6. If no upstream or terminal cleanout exists, another cleanout shall be installed facing upstream of the direction of flow.
- G. Abandonment.** When abandoning a sewer service, the line shall be abandoned within 5 feet of either side of the property line and capped or plugged.

5.3.4 Manholes

Manholes shall be designed and conform to [City of Missoula Modification to MPWSS Section 02730](#) and [City of Missoula Standard Drawings 512 \(Sheet 1 of 3\)](#), [\(Sheet 2 of 3\)](#), and [\(Sheet 3 of 3\)](#).

A. Location

1. All sanitary sewer manholes shall be located in streets or alleys unless a dedicated permanent public easement with sewer maintenance equipment access is provided.
 - a. Access streets must be graded, surfaced, and sloped for convenient access of sewer maintenance vehicles, must be permanently free of fences or other obstructing landscaping, and shall be maintained to provide sewer maintenance access at all times.
 - b. It will be permissible to have one manhole, without a driveway, located between two manholes with access driveways.
 - c. Manhole lid shall be located a minimum 2-ft from the gutter and centered in driving lane away from wheel paths
2. All manholes in unpaved, non-traveled areas shall be adjusted to a height of 18 inches above finished grade. Exceptions will be allowed in the following areas and shall be marked with a green carsonite marker immediately adjacent to the manhole with a sewer placard affixed to the marker:
 - a. That will cause a public hazard,
 - b. That contain landscaping or gardening, or
 - c. Where the landowner specifically requests a variance.
3. Manholes shall be spaced a maximum distance of 400 feet from each other.

B. Grade

1. Manholes with 45° or less change in flow direction shall have a minimum of 0.1 foot drop across the manhole.
2. Manholes with greater than 45° change in flow direction shall have a minimum of 0.2 foot drop across the manhole.
3. Crown of lateral main shall match crown of trunk sewer.

C. Diameter

1. Pipes entering manholes shall provide a minimum distance of 6 inches between legs, including 3 inches of blockout width for each pipe.
2. Manholes shall be sized based on the pipe size in Table 5-1.

Table 5-1 – Manhole Sizing Table

Manhole Diameter	Wall Thickness	Pipe Diameter >	Pipe Diameter ≤
4 feet	5 inches	—	18 inches
5 feet	6 inches	18 inches	24 inches
6 feet	7 inches	24 inches	—

D. Manhole Materials and Installation

1. All manhole penetrations shall be made by core drilling.
2. PVC to PVC deflection joint connections outside of the manhole shall be a GPK 906 style or equivalent gasket repair coupling or pipe bell and spigot assembly.
3. Poured-in-place or precast bases may be used in accordance with [City of Missoula Standard Drawings 512 \(Sheet 1 of 3\)](#), [\(Sheet 2 of 3\)](#), and [\(Sheet 3 of 3\)](#).
4. All joints between manhole sections, adjusting rings, manhole ring and top section, and around sewer pipe into manhole shall be watertight. Jointing material shall be "ConSeal" or equal for all joints except between the sewer pipe and manhole wall.
5. Base shall be supported by 4 cement blocks (CMU) equally spaced around perimeter.
6. Any manhole less than 5 feet in depth shall have a flat top lid.

E. Manhole Liner. City Engineering may require manholes to be lined per City of Missoula Modifications to MPWSS Section 09950 in areas of high groundwater or high concentrations of H₂S gas. Contractor shall follow all manufacturer recommendations for installation.

F. Drop Structures

1. Drop structures shall be avoided to the extent practical. Where the lateral is 2 feet higher than the existing manhole invert, a drop structure is required.
2. A drop structure shall only be approved when the slope of the lateral would exceed 10%.
3. Concrete for drop structures shall be formed.
4. Base and fill concrete may be poured monolithically.
5. Drop structures shall be external, with the exception of manholes within the Reserve Street right of way.

G. Ring and Lid. Rings and covers shall comply with [City of Missoula Standard Drawing 510](#).

1. Covers shall be 24 inches in diameter.
2. Covers shall be bolt-down and watertight D&L A1171-10, EICO 3777Z1/AGS, or approved equal.
3. Rings shall be minimum 180 pounds and 7 inches thick. A 4-inch ring may be used only with prior City Engineer approval.

H. Collars. All manholes located in areas used for vehicular traffic will require concrete collars as shown in Standard Detail 514 if the surface infrastructure (pavement) is to be installed after the sewer infrastructure is installed.

- I. **Testing.** All new manholes shall be tested for water tightness per MDEQ requirements and in conformance with the [City of Missoula Modification to MPWSS Section 02730](#).
- J. **High Level Alarms.** When indicated on drawings or as directed by engineer or owner, high level alarms shall be installed as shown on [City of Missoula Standard Drawing 542](#).

5.3.5 STEP Systems

- A. No new, publicly-owned STEP mains will be allowed.
- B. Community STEP systems (more than 2 connections) must be professionally engineered and have prior approval by the City Engineer. All community STEP systems will be privately owned and maintained.
- C. Connections to existing STEP mains may be allowed if there is no gravity sewer available.
- D. City of Missoula shall approve all STEP system connections to the public sewer system.
- E. Design and construction of new residential connections to existing STEP mains shall be in accordance with the 2021 City STEP Manual contained in [Appendix 5-A](#) and [City of Missoula Standard Drawing 540](#).
- F. **Shared STEP Tanks**
 - 1. In accordance with Admin Rule No. 644, a maximum of two residential units, such as a duplex or two adjacent townhouses, are permitted to share a single 1500 gallon residential STEP tank. The following requirements pertain to shared STEP tanks.
 - 2. The electrical power must have a placard at the meter base stating: "Power cannot be terminated due to STEP sewer system."
 - 3. Where the residential units have differing sewer elevations of six (6) inches or greater, the lower unit shall have a backflow prevention device installed in its gravity sewer service line inside the building
 - 4. Each residential unit shall have a separate cleanout for the purpose of cleaning each unit's service line (see Figure 5-1).

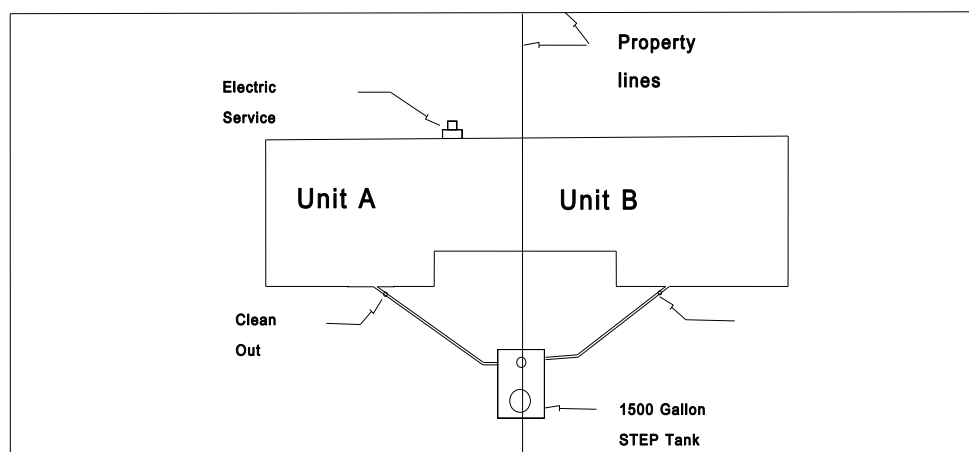


Figure 5-1 – Example – Separate STEP tank cleanouts

5. Each residential unit shall have its own separate gravity service line from the building to the STEP tank
 6. Construction and installation of the sewer shall conform to latest City of Missoula STEP sewer standards.
- G. Commercial STEP Systems.** All STEP systems serving commercial buildings must be professionally engineered and may require backup generator and telemetry.
- H. Step Sewer Easements.** Owners of property connecting to the STEP sewer system must contact City Engineering to make arrangements for executing a STEP Sewer Easement for the property. No sewer permits for STEP sewer systems will be issued until all owners of the property have signed a STEP Sewer Easement and returned it to City Engineering.

5.3.6 Sewer Lift Stations

- A.** In addition to [DEQ-2, Chapter 40](#) and [City of Missoula Standard Drawing 550 \(Sheet 1 of 3\)](#), [\(Sheet 2 of 3\)](#), and [\(Sheet 3 of 3\)](#), the following is required for design of city-owned sewer lift stations:
1. **Accessibility and Security.** Each lift station site shall be enclosed with a chain link fence. A man gate shall be provided as well as a vehicle access gate; all gates shall be locking. Warning signs shall be posted on the fence. Fencing shall be positioned to allow maintenance vehicle access to the lift station to perform routine maintenance and removal of pumps.
 2. **Safety.** Within the hatches of the lift station, fall protection grating shall be provided. Grating shall be painted orange and coated to withstand the corrosive conditions of the lift station environment. Warning signs for “Confined Space Entry” should be posted on the lids of wet-wells and underground valve vaults.
 3. **Design.** All stations shall be engineered and sized for each specific situation. Special design considerations should be given to the following:
 - a. **Groundwater.** Special groundwater protection is required for any wet well that is anticipated to be in groundwater and shall consist of the following:
 - 1) Wet well joints shall have O-ring gasket joints meeting [City of Missoula Modification to MPWSS Section 02730](#) and [City of Missoula Standard Drawings 550 Sheet \(1 of 3\)](#), [\(Sheet 2 of 3\)](#), and [\(Sheet 3 of 3\)](#).
 - 2) The exterior of the wet well shall have waterproofing exterior coating per City of Missoula Modification to MPWSS Section 02730.
 - 3) The wet well shall be tested in accordance with ASTM C1244 and [City of Missoula Standard Modifications to Section 02730](#), test method for wet wells.
 - b. **Construction Materials.** The following are material requirements for new lift stations.
 - 1) Wet-wells shall be precast concrete, entire interior of the wet well shall be coated per [City of Missoula Modification to MPWSS Section 02730](#).
 - 2) All metallic items (nuts, bolts, brackets, supports, chains, etc) within the wet well shall be made of stainless steel.

- 3) All exposed valves, fittings and appurtenances shall be coated per [City of Missoula Modification to MPWSS Section 02730](#).
 - 4) Pipe shall be Class 350 ductile iron. Discharge piping shall not be less than 4-inches in diameter. No unrestrained joints are permitted inside the lift station.
 - 5) Valves and fittings shall have flanged connections
 - 6) Provide insulated and heated enclosure for above grade valves, fittings, and appurtenances. Enclosure shall be made of aluminum or fiberglass.
 - 7) Access hatch shall meet the requirements of [City of Missoula Standard Drawings 550 Sheet \(1 of 3\)](#), [\(Sheet 2 of 3\)](#), and [\(Sheet 3 of 3\)](#) and [City of Missoula Modifications to MPWSS Section 02730](#).
- 4. Pumps.** All sewage pumping stations shall be packaged factory-built Flygt NP submersible non-clog centrifugal pumps with aboveground valve package or approved equal. Submersible pumps shall be self-cleaning semi open channel impeller. All pumps in lift stations shall be powered by 460 volt, 3 phase motors unless approved by the City of Missoula for a different voltage. Pumps shall be designed for continuous duty and shall be suitable for installation in a Class I, Div 1 location. Pumps shall be furnished with a submersible discharge connection system to permit removal and installation of the pump without the necessity of an operator entering the wet well.
- a. Pump Openings. Minimum solids passing diameter of 2.0 inches. Flygt pumps will require a deviation from [DEQ Circular 2, 42.33](#) by the Engineer.
 - b. Guiderails. Provide 2-inch 316 stainless steel (schedule 40) guide rail system for each pump.
 - c. Lifting Cable. Provide 316 stainless braided steel lifting cable designed for 50% greater than the weight of the pump. The cable shall extend from the lifting handle to a cable stay located at the top of the wet-well along with additional length for connection to a City provided truck mounted hoist.
 - d. Lifting Hoist. No external lifting hoist is required.
- 5. Electrical Equipment.** The units shall have the following options included:
- a. Submersible pumps shall be operated by variable frequency drives (VFDs).
 - b. Provide one (1) 15A duplex waterproof “in-use” ground fault indicating (GFI) utility receptacle providing 120 VAC, 60 Hertz, single phase current, mounted on control panel door. Receptacle shall be on its own circuit and shall be protected by a 15 amp thermal-magnetic circuit breaker accessible on the control panel door.
 - c. Grounding is required within the control panel with field connections to the main ground lug and each pump motor in accordance to NEC.
 - d. Station heater
 - e. Station insulation package

- 6. Controls.** Furnish a pump control system designed to automatically operate the pumps.
- a. The control system shall consist of a primary control system that utilizes a submersible pressure transducer and programmable logic control (PLC) controller to operate the pumps based on level in the wet well.
 - b. The pump controls shall include a redundant float control system that consists of five (5) float switches, intrinsically safe relays and PLC that will operate the pumps when the primary control system is not working.
 - c. Pre-configured station optimization features shall include:
 - 1) Maximum pump off time
 - 2) Maximum pumps to run
 - 3) Maximum starts per hour
 - 4) Inter-pump start and stop time delays
 - 5) Maximum pump run time
 - 6) Blocked pump detection
 - 7) Wet well washer control capability
 - 8) Pipe scour mode capability
 - 9) Wet well clean out control capability
 - d. Provide a data logger for City-defined faults and events shall include:
 - 1) Recording up to 50,000 events to internal flash memory.
 - 2) Download capability up to 100,000 events by writing directly to an SD card or USB.
 - 3) FTP data transfer and download data capability of event and fault logs in the form of a CSV file to Microsoft Excel.
 - e. The City shall be able to access the PLC directly via Ethernet link so alarm conditions and lift station information can be passed onto the City's SCADA system.
 - f. Pump control panel shall provide 24V DC power to instrumentation as required by the City.
 - g. Radio telemetry equipment shall be 5 Gigahertz and shall be compatible with the City's current system.
 - h. The control panel shall be equipped with transient voltage surge suppressor to minimize damage to the pump motors and control from transient voltage surges. The suppressor shall have a current rating of 100,000 Amps.

7. Wet Wells

- a. Concrete precast wet wells shall be tested per [the City of Missoula Standard Modifications to Section 02730](#).
- b. Wet well inlets shall include a compression-type flexible connection, cast into the wet well wall, providing 10° deflection per [City of Missoula Standard Modifications to Section 02730](#).
- c. All wet well joints shall include an exterior joint seal, of a minimum 12-inch width per [City of Missoula Standard Modifications to Section 02730](#).

8. Emergency Operation

- a. All lift stations shall be provided with backup generator power. Backup power shall be Caterpillar or approved equal meeting the following minimum requirements:
 - 1) Wired for 460 volt, three phase
 - 2) Weatherproof enclosure
 - 3) Noise emissions not to exceed 65 dba at 20 feet from enclosure.
 - 4) Automatic transfer switch
 - 5) Standard muffler
 - 6) Liquid cooled, diesel powered engine
 - 7) Generator sized to step start all pumps and provide additional power for any other lift station components.
 - 8) All backup power generation equipment shall have local availability in Missoula County on a 24-hour availability for parts and service.
- b. Lift stations shall be equipped with an OPW adapter bypass valve for emergency operations.
- c. A spare pump and motor with cable shall be provided prior to turning over the lift station to the City for operation.

9. Appurtenances

- a. Provide an electromagnetic flowmeter suitable for raw sewage conditions. Connect flowmeter readout to control panel and SCADA system for recording of flow.
- b. Install pressure transmitter on force main piping that indicates gage pressure in psi and reports a signal back to the control panel and SCADA system for recording and monitoring.

5.3.7 Wastewater Pre-Treatment

A. Hydrocarbon, Oil, Grease, and Sand (HOGS) Interceptor

1. A sand and oil interceptor, also known as HOGS, shall be installed per [City of Missoula Standard Drawing 530](#) when connecting newly constructed or remodeled carwashes, repair shops, parking structures and other structures that contribute to or discharge oil, grease, or grit to the municipal sewer system. If HOGS are used for stormwater management, then the stormwater shall discharge to properly sized and maintained bioswales or retention ponds on site. HOGS that are used for stormwater management shall not discharge to state waters. See [City of Missoula Standard Drawing 630](#) for a typical layout for a fuel island.
2. Sizing of the sand and oil interceptor must be in accordance with *Uniform Plumbing Code*.

B. Grease Interceptor

1. A gravity grease interceptor (GGI) shall be installed for all newly constructed or remodeled food preparation facilities connected to the municipal sewer system, in accordance with the City of Missoula's FOG (Fats, Oils, and Grease) Sector Control Program, which is included as [Appendix 5-B](#) of this Manual as well as the latest version of the *Uniform Plumbing Code*, Chapter 10.

2. The sizing of the grease interceptor must be in accordance the Grease Interceptor Sizing Worksheet from Chapter 10 of the *Uniform Plumbing Code*. A copy of this worksheet is included in [Appendix 5-C](#) of this Manual.
 3. Variances for gravity grease interceptors may be granted for Food Service Establishments that do not generate grease products. An applicant shall complete a Grease Interceptor Variance Request Form, included in [Appendix 5-C](#), to initiate the process. The applicant has the burden of proof of demonstrating, by means of submitting data and other pertinent information with the variance application ([Appendix 5-C](#)) why a variance should be granted. The effluent limit specified in Missoula Municipal Code may not be violated even if a variance is granted. The granting of any variance shall be at the sole discretion of the City as represented by the Grease Interceptor Variance Committee. Each variance application includes an application fee, as shown in the Public Works and Mobility Fee Schedule. For FSEs submitting a variance application, building plans will not be approved until the application is submitted and the committee makes a decision. Preliminary engineering questions regarding grease variances should be directed towards the City's Plumbing Inspector.
 4. All grease interceptor lids shall be bolt-down, water tight lids in accordance with [City of Missoula Standard Drawing 510](#).
- C. Neutralization Tank.** A neutralization tank for breweries may be required to reduce pH levels of by-products.
- D. Solids Settlement Tank.** A solids settlement tank may be required for facilities generating a large volume of solids, such as hops from breweries.

5.3.8 Grinder Pump Systems

- A. In locations where the City does not desire a larger lift station, grinder pump systems utilizing small diameter sewer force mains may be considered but will only be granted with specific written approval from the City Utility Engineer.
- B. Force mains from grinder pump systems shall comply with [Section 5.3.2](#) of this chapter.
- C. All grinder pump systems connected to the City sewer system shall comply with the requirements of [DEQ Circular-2](#), Appendix C.7.

5.3.9 Ejector Pump Systems

- A. Ejector pumps may be used for pressurized services from individual houses, per [City of Missoula Standard Drawing 541](#). These pressurized services must connect to the gravity main, not a manhole.