

**SECTION 6900 – WATER MAINS**

**CITY OF BLUE SPRINGS, MISSOURI  
DESIGN CRITERIA**

6901 GENERAL ..... 2

6902 Capacity..... 2

    A. The water distribution system and any extension shall have adequate capacity to:..... 2

    B. Criteria for Estimating Water Demand. .... 2

6903 Water Main Design ..... 3

    A. Diameter ..... 3

    B. Location..... 3

    C. Away from Right of Way: ..... 4

    D. Valves ..... 4

    E. Separation ..... 5

    F. Crossings ..... 5

    G. Dead End Water Mains ..... 6

    H. Restraint Design ..... 7

    I. Pipe Encasement..... 8

6904 Easements ..... 8

6905 Plans ..... 9

6901 GENERAL

The following City of Blue Springs water design standards are based on Federal, State and local health requirements and engineering design criteria. The latest edition of The Minimum Design Standards for Missouri Community Water Systems which rely heavily on “Ten States Standards” shall apply where applicable. All installations, whether public or privately owned, are to deliver water to the consumer which meet the bacteriological and chemical quality standards of the Missouri Department of Natural Resources.

6902 Capacity

A. The water distribution system and any extension shall have adequate capacity to:

1. Supply the peak hour demands of all water consumers' needs while maintaining pressure of not less than thirty (35) PSIG at all points of delivery, without reducing the service to any customer below these requirements.
2. Supply residential fire protection by delivering not less than one thousand (1,000) gallons per minute for fire protection on the day of maximum daily water demand with a residual pressure of not less than twenty (20) pounds per square inch.
3. Supply non-residential fire protection by delivering water in such quantity as to adequately protect life and adjoining properties, as determined by either the Central Jackson County Fire Protection District or Prairie Township Fire Protection District and the Director of Public Works and the requirements of the Code of Ordinances, City of Blue Springs, Missouri.

B. Criteria for Estimating Water Demand.

1. The latest calibrated version of the water model adopted by the City of Blue Springs or that of the water utility providing the water service shall be used for evaluating the effect and determining minimum pipe size of new development on the existing water distribution system.
2. The following criteria will be used in estimating the average day demand, maximum day demand and peak hour demand incident to the determination of future water main sizes.
  - a. Population per service connection. The numbers in Table 1 shall be used in determining the population for which to design the water works.

Table 1 – Per Unit Occupancies	
Service Connection Type	Persons/Unit
Residences	3.7

Apartments or Condominiums	
• 1 Bedroom	2.0
• 2 Bedroom	3.0
• 3 Bedroom	3.7
Mobile Homes	3.0 – 3.7
Camper trailers without sewer hookup	2.5
Camper trailers with sewer hookup	3.0
Motels	3.0

- b. Average daily water demand of residential population in gallons per day equals residential population times one hundred (100) gallons per person.
- c. Average daily domestic water demand of non-residential users in gallons per day equals number of employees users times *twenty (20)* gallons per day. Additional water demand allowance may be required for commercial and industrial establishments that have known water demands that exceed one hundred (100) gallons per day per employee.
- d. Average daily school water demand in gallons per day equals number of staff and students times twenty (20) gallons per person.
- e. Average daily water demand in gallons per day equals average daily water demand of residential population plus average daily domestic water demand of non-residential users plus average daily school water demand.
- f. Maximum daily water demand in gallons per day equals average daily water demand times 2.1.
- g. Peak hour demand in gallons per day equals maximum daily water demand times 2.0.

## 6903 Water Main Design

### A. Diameter

1. The minimum size of a water main shall be six (6) inches in diameter. Larger mains shall be required, if necessary, to deliver the required fire flow while maintaining the minimum residual pressure of 20 PSIG throughout the distribution system.

### B. Location

1. Within the Right of Way:

- a. Water mains shall be located at least 4 feet from back of curb with an embankment slope of 3:1 or flatter.
  - b. Street crossings shall be bored under existing streets.
  - c. All boring excavations shall be located no closer than 2 feet from back of curb and with a minimum depth not less than 42 inches from the finished grade to the top of the water main.
  - d. No parallel utilities may be laid in the same trench as the water main.
- C. Away from Right of Way: When placed away from and outside the right of way, water mains shall be located as follows:
- a. Water mains shall be installed in easements with an embankment slope of 3:1 or flatter.
  - b. Water mains shall not be located in the rear of the property.
  - c. Water mains shall be located in the center of the easement.
- D. Valves
1. The ability to adequately isolate parts of the distribution system is essential in an emergency. Sufficient valves shall be provided on water mains to allow a system to be adequately flushed and so that inconvenience and sanitary hazards to customers will be minimized during repairs. Valves shall be installed to limit the number of residential connection between valves to 50 customers. Additionally, the following requirements shall be met when locating system valves.
    - a. Valves on transmission and major distribution mains shall be installed as follows: three valves at every tee and four valves at every cross. If the distance between a tee or cross is greater than 1,500 feet an in-line valve shall be required at a point midway between the tee or cross.
    - b. Valves on minor distribution mains shall be installed as follows: two valves at every tee on opposite lines, three valves at every cross, and an in-line valve every 1,000 feet as a minimum.
    - c. Valves shall be placed at or near the ends of mains in such a manner that a shutdown can be made for a future main extension without causing loss of service on the existing main.

E. Separation

1. The water main shall be located at least ten feet horizontally from any existing or proposed line carrying non-potable fluids such as, but not limited to drains, storm sewers, sanitary sewers, sewer service connections, and process waste or product lines. The distance shall be measured edge to edge. No waterline shall be located closer than ten feet to any part of a sanitary manhole.
2. At crossings, the full length of water pipe shall be located so both joints will be as far from the non-potable pipeline as possible but in no case less than ten feet or centered on a 20-foot pipe. In areas where the recommended separations cannot be obtained, the non-potable pipeline shall be encased in concrete six (6) inches around the pipe.

F. Crossings

1. An elevation shall be maintained such that the bottom of the water main is at least 18 inches above the top of the non-potable line while meeting minimum cover requirements.
2. For DIP water mains crossing other cathodically protected pipe lines, calculations to determine the need for a cathodic protection system for the water main shall be submitted. Cathodic protection system will be designed as required.
3. No water main shall be located closer than 25 feet to any wastewater disposal facility, agricultural waste disposal facility, or landfill. Water mains shall be separated by a minimum of 25 feet from septic tanks and wastewater disposal areas such as cesspools, subsurface disposal fields, pit privies, land application fields, and seepage beds.
  - a. Drainage Courses and Streams
    - i. The location of water mains relative to drainage courses and streams shall be designed to comply with KC APWA Section 5600, latest edition.
    - ii. Pipelines crossing drainage courses and streams shall be designed to cross as nearly perpendicular as possible.
  - b. Underwater Crossings
    - i. Flowing and intermittent streams five hundred feet or less in length shall have a minimum cover of six feet over the pipe. When crossing water courses greater than 15 feet in width it shall be designed by a professional engineer licensed in the State of Missouri. The following shall be provided:

1. The pipe shall be of special construction, having flexible watertight joints. Steel or ductile iron ball-joint river pipe shall be used for open cut crossings. Mechanical or restrained joint or fusion welded pipe may be used for open cut crossings, provided it is encased in a welded steel casing. Mechanical or restrained joint or fusion weld pipe shall be used for bored crossings.
2. Adequate support and anchorage shall be provided on both sides of the stream.
3. Straddle blocks and valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible and should not be subject to flooding.
4. The valve closest to the supply source shall be in an accessible location and installed in a vault, manhole, or meter pit sized to allow the installation of leak detection equipment.
5. Permanent taps shall be provided on each side of the valve within the manhole, vault, or meter pit to allow insertion of a small meter to determine leakage and for sampling purposes.
6. Bank erosion is a major cause of stream crossing failures, and erosion protection measures such as rip rap have limited success. Stream movement and the history of bank erosion must be considered when choosing the length that the crossing pipe or casing shall extend beyond the upper edge of the stream channel. The stream crossing pipe or casing shall extend at least 15 feet beyond the upper edge of the stream channel on each side of the stream.
7. Concrete ditch check may be required downstream of the pipe crossing.

#### G. Dead End Water Mains

1. Dead ends shall be minimized by looping of all mains.
2. Dead end water main length is controlled by pressure, pipe size, and required fire flow.
3. All dead end water mains that are to be extended in the future shall be installed to the limits of the platted subdivision such that extensions to the mains to serve adjacent subdivision plats may be connected at the plat boundary and shall be installed with an inline valve and a temporary fire hydrant that is mechanically restrained. The valve shall be the same size as the main.

4. When a subdivision or platted lot abuts or contains a planned water main and the subdivision or platted lot will benefit from the main, the Contractor/Developer is responsible for the cost of the water main extension to the plat boundary as described above. Such cost shall be limited to that of a 6-inch main unless a larger main is necessary to serve the development.
5. All dead end water mains serving a cul-de-sac shall be extended around the cul-de-sac so that no service lines need to be bored more than.

#### H. Restraint Design

1. Where required thrust restraint methods may be a combination of any of the following
  - i. Restraint push-on joints for ductile iron pipe, C900, or C909
    1. Internal restrained gasket
    2. External mechanical restraintC909 shall be restrained with external mechanical restraints.  
All mechanical joint fittings shall be restrained with Megalug or equivalent restraints.
  - ii. Thrust blocks
  - iii. Straddle blocks
2. The dimensions and design details for horizontal and vertical concrete thrust blocks for pipe sizes 24-inch and smaller diameter are provided on Standard Detail Drawing WAT-14. As long as the conditions which are specified in the notes on the blocking standard details are met for the particular application, then the standard detail applies and can be simply referenced on the contract drawings. If any of the conditions on the standard detail cannot be met, then special design blocking is required.
  - a. For water mains 12 inches and larger, straddle blocks shall be used in lieu of thrust blocks. Engineering calculations shall be submitted for approval.
  - b. Restrained joint pipe calculations shall comply with the design requirements of the Ductile Iron Pipe Research Association (DIPRA) for ductile iron pipe (DIP) or of the Uni-Bell PVC Pipe Association for polyvinyl chloride (PVC) pipe.
  - c. Restrained joint pipe that is designed and manufactured by the same manufacturer as the DIP and PVC pipe shall be used in cul-de-sacs. In the event that the manufacturer of the PVC pipe does not manufacture restrained joint pipe, a joint restraint system acceptable to and approved by the PVC pipe manufacturer shall be used.
3. Temporary Restraint Methods:

- a. Retainer glands (e.g., Megalug, Uni-Flange, etc.), Duc-Lugs and all-thread, set screw collars, and field-welded collars are considered short-term restraint. When it is necessary to put the pipeline into service immediately and concrete blocking is utilized, a retainer gland may be installed to provide short-term restraint while the concrete cures.
- b. Gripper gaskets (e.g., Field-Lok, Fast-Grip, etc.) should only be utilized on one side of fittings where field adjustment becomes necessary or it is not possible to lay pipe from both directions.

4. Straddle Blocks

- i. Straddle blocks shall be provided as required to restrain piping.
- ii. Straddle blocks shall also be provided in accordance with the following table:

Percent of Grade	Center to Center Max. Spacing (ft)
$20 \leq \text{Slope} < 35$	36
$35 \leq \text{Slope} < 50$	24
$50 \leq \text{Slope}$	16

- iii. The design criteria for straddle blocks shall be as indicated on Standard Detail Drawing WAT-15.
- iv. Straddle blocks at shorter intervals may be required under extreme conditions as determined by the Public Works Department.

I. Pipe Encasement: Pipe encasement, when required and/or permitted, is intended to provide maximum support for pipe in locations where standard embedment may be insufficient.

## 6904 Easements

A. For City of Blue Springs owned and operated waterlines, where public waterlines do not reside in public right of way easements are required. Other water service providers (Jackson Co. PWSD #16, Jackson Co. PWSD #17, and Jackson Co. PWSD #13) standards shall be followed when working in water districts. The following guidelines shall be followed:

- 1. Easements shall be a minimum of 10 feet wide when adjacent to the R/W.



2. Easements shall be a minimum of 15 feet wide when detached from the R/W (i.e. between buildings or across undeveloped areas), where the additional 5 feet are needed and additional access necessary to drive equipment in to perform a repair.
  3. For deep installations (i.e. greater than 7 feet deep), easements shall be a minimum of 2 feet wide for every foot of trench depth.
- B. Temporary construction easements shall be acquired as necessary to complete the installation of the project.
- C. Legal Descriptions: Legal descriptions shall include drawings indicating the point of commencement, the point of beginning, line bearings, line distances, the ending point, and the area described. The drawings shall be on letter size paper. Legal descriptions and drawings shall be sealed by a Land Surveyor registered in the State of Missouri and meet the filing requirements of Jackson Cass County. All documentation shall be formatted to meet the requirements of the County Recorder. Aerial photographs shall not be used in the background of the drawing.
- D. Water Mains Extending beyond Platted Areas: In the event that a water main needs to extend beyond the platted area of a development, proposed easements shall be provided for the main(s) prior to receiving approval of the Engineering Plans.

## 6905 Plans

- A. Plans for water systems shall be legible and no larger than standard size 24 inches by 36 inches.
1. Plans shall include the following:
    - a. Suitable title identifying the project, and index.
    - b. The name of the Continuing Operating Authority responsible for the water supply.
    - c. The name of the public water system, or proposed public supply system.
    - d. The public water system's ID number.
    - e. Scale, in feet.
    - f. North point.
    - g. Latest U.S.G.S. datum and topographical elevations for new and existing tanks determined from surveys beginning at USGS or department elevation monuments.

- h. Legible prints suitable for reproduction.
  - i. Date, name, and address of the designing engineer.
  - j. Imprint of professional engineer's seal in conformance with State of Missouri's engineering registration requirements.
  - k. Boundaries of municipality, water district, or area to be served.
  - l. Location and size of existing water mains.
  - m. Location and nature of existing water system structures and appurtenances affecting the proposed improvements, noted on one sheet.
  - n. Location and description of existing and proposed sewerage system.
  - o. Location of proposed water mains and water system structures, with size, length and identity.
  - p. Contour lines at suitable intervals.
  - q. Names of streets and roads.
2. Detailed plans include:
- a. Stream crossings, providing profiles with elevations of the streambed, general geology under the stream bed and the normal and extreme high and low water levels.
  - b. Profiles, where necessary, having a horizontal scale of not more than 100 feet to the inch and a vertical scale of not more than ten feet to the inch, with both scales clearly indicated. (Note: This does not apply to entire distribution systems.).
  - c. Location and size of the property to be used for the water works development with respect to known references such as roads, streams, section lines, or streets.
  - d. Topography and arrangement of present or planned wells or structures, with contour intervals not greater than two feet.
  - e. One hundred-year flood plain or elevations of the highest known flood level, floor of the structure, upper terminal of protective casings and outside surrounding grade, using U. S. Coast and Geodetic Survey, U. S. Geological Survey or equivalent elevations where applicable as reference.
  - f. Adequate description of any features not otherwise covered by the specifications.