

## **PART 7 - WATER DISTRIBUTION SYSTEM**

### **7.01 APPROVALS, PERMITS, AS-BUILTS AND MAINTENANCE BONDS**

- A. Plans and specifications for public water distribution facilities must be certified by a professional engineer registered in the State of Iowa and utilize the NGVD of 1929.
- B. Plans and specifications for public water distribution facilities must be reviewed and approved by the City Engineer prior to construction.
- C. Plans and specifications for public water distribution facilities must be reviewed and approved by the Iowa Department of Natural Resources prior to construction. Other local, state and federal permits may be required, depending on the circumstances. It shall be the responsibility of the Engineer of Record to acquire all applicable permits. A copy of all permits shall be provided to the City Engineer before construction.
- D. The Engineer of Record is responsible to submit "Record of Construction" drawings to the City Engineer on reproducible vellum or Mylar and a digital base map in an AutoCAD file or other approved electronic format.
- E. A 4-year maintenance bond covering defective materials and workmanship is required for all water main improvements.

### **7.02 DESIGN RESOURCES**

The design for water distribution facilities shall be in conformance with the following:

- A. Requirements and Standards of the Iowa Department of Natural Resources.
- B. City's Construction Specifications.
- C. City's Plumbing Code.
- D. Conflict - In case of a conflict between the above design standards, the most restrictive requirement shall apply.

### **7.03 DEFINITIONS**

- A. A **Distribution Main** means a water pipe owned, operated and maintained by the City, which is used for the purpose of distribution of water and from which service connections are made.
- B. A **Private Service Pipe** means a water pipe installed, owned, operated and maintained by the private consumer. Service pipes are often 1 inch in size for residential and may be 2 to 6 inches in size for commercial or 8 to 12 inches for large industrial applications.
- C. A **Private Fire Hydrant** is one which is located on privately-owned property or on streets not dedicated to public use unless the water main is within a public

easement. Private fire hydrants must be served by a minimum of a 6-inch pipe. A private fire hydrant is the responsibility of the property owner and is to be used for fire protection only. Where it is the owner's intention that these hydrants be used by the City Fire Department, these hydrants shall conform to the Department of Public Works specifications for fire hydrants. The City has the right to utilize the hydrants for flushing purposes.

#### **7.04 CONSTRUCTION SPECIFICATIONS**

Construction must comply with the City's standard construction specifications for water distribution facilities.

#### **7.05 SYSTEM DESIGN**

- A. **Size:** All mains shall be a minimum of 8 inches in diameter. A larger size may be required by the City Engineer, depending upon water demand and fire flows.
- B. **Depth:** Water main shall be installed with a minimum depth of cover of 5½ feet. Generally, the maximum depth shall not exceed 7 feet.
- C. **Alignment:**
  - 1. All mains shall be looped, except for short runs to serve cul-de-sacs where the distance is less than 500 feet.
  - 2. Water mains shall be constructed such that the distance service lines are extended beneath the paving of the circular turnaround on cul-de-sacs, are kept to a minimum.
  - 3. Water distribution mains will be extended to, through or across the frontage of all subdivisions and land development projects. Provisions will be made to connect water mains to serve future adjacent undeveloped land.
  - 4. Water mains will be located so the front of each property has access for a service connection.
- D. **Changes in Alignment:**
  - 1. Thrust restraints are required at all changes in alignment exceeding 10°, at all dead ends and on fire hydrants. Thrust restraints shall be constructed as shown in Figure 7.1. Wrap pipes and fittings in plastic before pouring thrust blocks.
  - 2. The maximum deflection at joints shall not exceed the pipe manufacturer's recommendations.
  - 3. Where there is considerable deflection of the water main materials required for either horizontal or vertical changes in alignment, ductile iron materials shall be used.

**E. Separation from Sewers:**

1. There shall be no physical connection between a public or private potable water supply system and a sewer appurtenance which would permit the passage of any sewage or polluted water in the potable supply.
2. Under normal conditions, water mains parallel to sewers shall be placed at least 10 feet horizontally from any sanitary sewer, storm sewer or manhole. Where local conditions prevent this separation, the water main may be laid closer provided the bottom of the water main is at least 18 inches above the top of the sewer and the water main is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the sewer.
3. Water mains crossing sewer services, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. Where local conditions prevent this vertical separation, the water main shall not be placed closer than 6 inches above a sewer or 18 inches below a sewer under any circumstances. Additionally, 1 full length of water pipe crossing the sewer shall be centered at the point of crossing so that the water pipe joints will be equal distance as far as possible from the sewer. The water and sewer pipes must be adequately supported and have pressure tight joints. A low permeability soil shall be used for backfill material within 10 feet of the point of crossing.
4. No water pipe shall pass through or come in contact with any part of a sewer manhole. A minimum horizontal separation of 3 feet shall be maintained.
5. Water mains shall be separated from sewer force mains by a horizontal distance of at least 10 feet unless:
  - a. The force main is constructed of water main materials meeting a minimum pressure rating of 150 psi and the requirements of Sections 8.02 and 8.04 of these standards, and;
  - b. The water main is laid at least 4 linear feet from the sewer force main.

**F. Location of Valves:**

1. Four-way connections will have 3 valves. On looped systems valves will generally be on the main line. Four valves may be required in specific instances.
2. Three-way connections will have 2 valves. On looped systems valves will generally be on the main line. Three valves may be required in specific instances.
3. Maximum valve spacing will be 800 feet in residential areas or 400 feet in commercial areas. Maximum spacing of 400 feet will apply to mains bordering both residential and commercial areas.
4. A valve shall be placed 2 pipe lengths from all dead-ends to allow the extension of the pipe without shutting off the existing system. Do not tap services in the final 2 sections.
5. Auxiliary valves shall be provided for all fire hydrants.
6. Valves shall be located as close as possible to tees and crosses.
7. Valves should not be located within paving whenever possible.

**G. Location of Fire Hydrants:**

1. Fire hydrant spacing will be on an average distance of 400 feet. This average spacing will generally mean 1 hydrant for every block in residential, commercial and industrial areas. A fire hydrant will be required at the end of every cul-de-sac regardless of the proximity of a hydrant on the intersecting through street. A fire hydrant will be required at the end of all dead-end lines.
2. The location of fire hydrants may be modified at the request of the local jurisdiction's fire department.
3. See Figure 7.2 for typical fire hydrant installation.

**H. Service Pipes:**

1. Every building, including each unit of zero-lot-line residences, shall have a direct service connection to a public water main.
2. No water consumer shall construct water service pipes across lots or buildings to adjoining premises, but all service pipe shall be laid on streets, alleys or public ground to the premises to be served, and enter at the front or rear of the building nearest the main.
3. Such service pipe shall be laid in a straight line at right angles to the water

main, and connection made within 2 lines drawn parallel to the sides of the building to be served or not more than 3 feet outside of these sides.

4. Multiple stop boxes shall be permanently marked to identify the correct individual metered services.
5. See Figure 7.3 for typical water service installation.

## **7.06 MATERIALS**

### **A. Ductile-Iron Pipe:**

1. Thickness design shall conform to AWWA C150/A21.50-02.
2. Manufacture shall conform to AWWA C151/A21.51-02.
3. Thickness class, unless otherwise indicated or specified, shall be Class 52.
4. Cement mortar-lining shall conform to AWWA C104/A21.4-95.
5. All ductile iron pipe 8 inches in diameter and larger shall be wrapped with an 8 mil polyethylene encasement in accordance with ANSI/AWWA C105/A21.5-99 installation methods. Polyethylene encasement will not be required if tests determine the soil to be none corrosive.
6. Use single rubber-gasket push-on joints or mechanical joints conforming to ANSI/AWWA C111/A21.11-00. Furnish with all necessary hardware and gaskets.
7. Bell-and-spigot pipe joints conforming to ANSI A21.6 or ANSI A21.8.
8. For bolted/restrained mechanical joint, use Griffin Bolt-Lok restrained joint or approved equal.
9. For unbolted/restrained mechanical joint, use Griffin Snap-Lok restrained joint or approved equal.
10. Do not use drilled & tapped retainer glands.
11. Plain end of push-on pipe factory machined to a true circle and chamfered to facilitate fitting gasket.
12. All water mains shall have a 12-gauge insulated trace wire taped to the top of the pipe every 6 feet. Trace wire shall be brought to the surface at each hydrant and valve as directed.

### **B. Fittings:**

1. All fittings shall have a pressure rating of Class 250 and conform to ANSI/AWWA C110/A21.10-98 for standard ductile-iron and gray-iron

fittings or ANSI/AWWA C153/A21.53-00 for compact ductile-iron fittings.

2. Mechanical-joint fittings shall be ductile-iron compact C153/A21.53-00 or ductile standard C110/A21.10-98. Swivel tees shall be ductile-iron standard C110/A21.10-98. Where ductile-iron is not available (i.e. offsets), cast iron standard C110.A21.10-98 shall be provided.
3. All fittings shall be Class 250, shall be bituminous coated inside and outside, and shall be furnished complete with necessary accessories including plain rubber gaskets, ductile-iron glands, bolts and nuts. Verify the gasket seats are not made irregular by improper application of the lining materials.

**C. Valves & Valve Boxes:**

1. Gate valves shall conform to AWWA C509-01. Use full-line size gate valves with epoxy or polymer lining. Use Clow, Mueller or Waterous valves, or an approved equal with 200 psi working pressure and gaskets rated at 250 psi. The waterway must be a full-sized waterway. Valves shall be capable of being repacked or replacing O-rings under pressure.
2. Butterfly valves shall conform to AWWA C504-00. Use Pratt, M&H or Mueller valves, or an approved equal.
3. Valves shall open left and be furnished with a 2-inch square operating nut. Use Cor-Ten steel.
4. Valve Boxes shall be a Waterous trench adapter, or approved equal range 63 inches to 83 inches. Use lids marked "water".
5. Tapping valves shall be 200 psi minimum working pressure, mechanical joint manufactured by Mueller or Clow.

**D. Hydrants:**

Specification standard.....AWWA Standard C502-94

Acceptable manufacturers  
and model.....Waterous Pacer or Mueller SuperCentur-  
ion 200 or Clow F2500

Type of shutoff.....Compression

Type of construction.....Break flange or break bolt

Main valve opening.....5¼ inch minimum

Nozzle arrangement and size:

3 nozzle.....Two 2½-inch hose nozzles and one 4½-

inch pumper nozzle. The 4½-inch pumper nozzle is to face the street, or at an intersection, face the higher classification street.

Nozzle thread.....National Standard Hose Threads

Type of inlet connection.....Mechanical Joint

Size of inlet connection.....6 inches

Depth of bury.....Distance from ground line to top of connecting pipe shall be 5½ feet

Direction of opening.....Open to left (counterclockwise)

Packing.....Conventional or O-Ring

Size and shape of operating nut.....1½ inch, standard pentagon

Working pressure.....150 psi

Color.....Yellow

**E. Special Fittings:**

1. Special pipe fittings must be approved by the City Engineer.
2. Special fittings must be the same diameter, thickness and pressure class as standard fittings.
3. Special fittings shall be manufactured to meet requirements of same specifications as standard fittings except for laying length and types of end connection.
4. Swivel fitting shall be Tyler 5-198 or approved equal. Retaining spools may be used.
5. Cast-iron tapping sleeves shall be Mueller or Clow.

6. Stainless-steel tapping sleeves shall be epoxy coated with ductile-iron flange and shall be compatible with Mueller or Clow tapping valves. Sleeves shall be Ford FAST, Smith-Blair 662 and 663 or Romac SST.
7. Tapping sleeves for 12 inches or 16 inches shall be Ford Fast stainless steel. The outlet of the tap shall not be greater than  $\frac{1}{2}$  of the diameter of the pipe tapped.

**F. Sleeve Type Couplings:**

Standard solid black sleeves shall be Tyler 5-144L or approved equal. Bolted straight coupling shall be Smith-Blair 441 or Romac Style 501, 6 bolt, 6 inches long, or approved equal.

**G. Gaskets, Bolts, and Nuts:**

1. Mechanical joints made with:
  - a. Bolts:  $\frac{3}{4}$ -inch Cor-ten steel.
  - b. Bolt studs with nut on each end.
2. All threaded rods used to restrain fittings shall be  $\frac{3}{4}$  inch diameter.

**7.07 BEDDING AND BACKFILL**

- A. All mains 16 inches and larger shall be bedded in crushed stone to a depth of  $\frac{1}{2}$  the pipe diameter. See jurisdictional construction specifications for type of crushed stone.
- B. All other pipe shall be bedded in accordance with manufacturer's recommendations.
- C. Within public right-of-way, backfill shall consist of Class A crushed stone or suitable job excavated material placed in 1-foot lifts compacted to 90% Modified Proctor Density. If crushed stone is used, the top 12 inches of backfill shall consist of suitable job excavated materials. See City's construction specifications for type of crushed stone. Flowable mortar may be used upon approval of mix design by the City Engineer. Sand backfill is not permitted.
- D. In all other areas backfill shall consist of suitable job excavated material placed in 1-foot lifts and compacted to 85% Modified Proctor Density.



#### **7.08 PERFORMANCE AND TESTING**

- A. Bacterial test for coliform organisms shall be performed by the contractor in accordance with AWWA C651-99. A minimum free residual chlorine concentration of 10mg/l shall be maintained for the 24-hour disinfection period. The contractor shall provide documentation of bacterial tests from a certified laboratory.
- B. Pressure and leakage test in accordance with AWWA C600-99.
- C. Valves shall be located and tested to verify operation.
- D. Fire hydrants shall be tested to verify operation.
- E. Flow tests shall be conducted to verify that all components of the water system are fully open and operational and to determine fire flow capacity.

#### **7.09 LOCATION OF EASEMENTS**

- A. All public water mains should be located within the public right-of-way. In rare exceptions, dedicated easements may be used for location of water main outside of public right-of-way.
- B. To limit damage to structures in the event of a main break, water mains shall be placed a minimum distance of 1.5 times the depth from building setback lines. Greater separations are desirable.
- C. All water mains outside public right-of-way shall be placed in an easement for operation and maintenance. Easement width from the center of the pipe shall generally be 1.0 times the pipe depth rounded up to the nearest 5 feet.
- D. The minimum easement width is 20 feet.