

## **DIVISION 3 - WATER SYSTEM DESIGN REQUIREMENTS**

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### **3.1 General**

Design requirements for water systems within the City of Webster shall base on land use.

- 3.1.1 Construction and sizing of all water mains and appurtenances shall meet or exceed the requirements of the Texas Department of Health and the Texas State Board of Insurance.
- 3.1.2 The Public Water System shall not extend beyond the water meter. All construction to the meter shall conform to the Standards. All private construction beyond the meter shall conform to the requirements of the City of Webster Plumbing Code.
- 3.1.3 Design shall conform to the City of Webster Construction Details.

### **3.2 Overall System Layout**

- 3.2.1 Layout and size of all water mains shall be consistent with the overall layout and phasing plan of the City's water system. The overall water system shall be designed to maintain adequate pressure throughout the system.
- 3.2.2 The layout of the water mains should provide maximum circulation of water to prevent future problems of odor, taste, or color due to stagnant water.
  - A. Provide a source of fresh water at each end or at multiple points in a subdivision. Provide adequate circulation and place valves and fire hydrants, so that flushing of all mains will be simplified.
  - B. Dead-ends should be avoided. All dead-ends should be isolated with a line valve, be as short as possible, and be equipped with a fire hydrant or blow off at the end of the main as required in Section 3.3. All dead end water lines must be approved by the Public Works and Engineering Department.
  - C. In unavoidable permanent dead-end situations, reduce the sizes of pipe successively. Carry a six-inch (6") pipe to the last fire hydrant, then use

four-inch (4") PVC to the end of the line. Provide a standard two-inch (2") blow off at the end of the main.

- D. Where a water main is stubbed out for future extensions, place a valve to isolate the dead-end and provide no customer services from the dead-end until it is extended. Provide a standard two-inch (2") blow off at the end of the main.

### **3.3 Water Main Sizing and Materials**

3.3.1 Water mains shall have a minimum size as follows:

- A. Four-inch (4") mains may serve a maximum of twenty (20) lots when supported on both ends by a larger main. A dead end four inch (4") main may supply a maximum of ten (10) lots, shall not exceed four hundred feet (400') long and shall be terminated with a blow off. Fire hydrants are not allowed on a four inch (4") main.
- B. Six-inch (6") mains shall be a maximum of nine hundred feet (900') long when supported on both ends by eight-inch (8") mains or larger and shall have no more than two (2) intermediate fire hydrants. Dead end six-inch (6") mains shall not be more than six hundred feet (600') in length and shall terminate at a fire hydrant. Six-inch (6") fire hydrant leads shall not exceed two hundred feet (200') in length. All four-inch (4) mains shall be specifically approved by the Public Works and Engineering Department.
- C. Eight-inch (8") mains are required for mains over one thousand five hundred feet (1,500') long, or when three (3) or more intermediate fire hydrants are required. Eight-inch (8") mains shall not be dead end, except as specifically approved by the Public Works and Engineering Department. If approved by the Public Works and Engineering Department, the maximum length of a dead-end eight-inch (8") main shall be three hundred fifty feet (600') and it shall be terminated with a fire hydrant.
- D. Twelve-inch (12") and larger mains will be required at locations established by Public Works and Engineering Department.

3.3.2 The length of a dead-end water main shall be measured from the intersection with a multiple feed (looped) main to the end of the main. The allowable length of a dead-end main with multiple sizes shall not exceed the allowable length of smallest main as required in Section 3.3.1.

3.3.3 Water mains shall be constructed using the following materials:

- A. Poly Vinyl Chloride (PVC) Pressure Pipe, four-inch (4") through twelve-inch (12"), shall conform to the requirements of ANSI/AWWA C900, current revision, Class 150 DR 18. Pipe shall be designed and constructed in conformance with the minimum requirements of the "Manual of Water Supply Practices", AWWA Manual No. M23.
- B. Ductile-Iron Pipe (D.I.P.), four-inch (4") through fifty-four-inch (54"), shall conform to the requirements of "Ductile-Iron Pipe, Centrifugally Cast in

Metal Molds for Sand-Lined Molds, for Water and Other Liquids", AWWA C151, (ANSI A21.51), current revision. Pipe thickness shall be the minimum specified in C151. Under special conditions, the Department of Public Works may require thickness design in conformance with the minimum requirements of "Thickness Design for Ductile-Iron Pipe", AWWA C150 (ANSI A21.51), current revision. Pipe shall be installed in conformance with the minimum requirements of AWWA C600, "Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances". Ductile-Iron Pipe shall be furnished with bituminous or cement mortar lining, AWWA C104 (ANSI A21.4). Polyethylene tube encasement shall be provided as required in Section 3.9.6 of these Standards.

- C. Steel Water Pipe, four-inch (4") and larger shall conform to the requirements of "Standard for Steel Water Pipe Six Inches and Larger", AWWA C200. Steel pipe, minimum wall thickness shall conform to the thickness shown on the City of Webster Construction Details. All steel pipes shall have coal tar coating in accordance with "Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape-Hot Applied", AWWA C203.
- D. Other pipe materials may be used for construction of water mains, when specifically approved by the Public Works and Engineering Department.
- E. Bedding and backfill shall conform to the City of Webster Construction Details.
- F. Alternate materials may be used with specific approval from the Public Works and Engineering Department.

- 3.3.4 Water mains and appurtenances are not allowed in the following sizes: three-inch (3"), ten-inch (10"), and fourteen-inch (14").
- 3.3.5 All public water mains shall be installed within a water line or public utility easement or right-of-way.
- 3.3.6 Construction of water mains shall be in accordance with approved construction plans and the City of Webster Construction Details.

### **3.4 Location of Water Mains**

- 3.4.1 The recommended location for water mains within the right-of-way is five feet (5') inside right-of-way.
- 3.4.2 Water mains shall be placed along a uniform alignment with the right-of-way. When necessary, the water main may be deflected at a fire hydrant location to accommodate proper installation of the fire hydrant. At all locations where a water main changes alignment, the location of the water main shall be clearly shown on the construction plans. A minimum distance of two feet (2') shall be maintained from the right-of-way line to the outside edge of the water line.
- 3.4.3 For new construction, any water main, except at a flush valve, located less than five feet (5') from the road right-of-way line and within the right-of-way shall have a water line easement adjoining the right-of-way. Water line easements adjoining a right-of-way for mains smaller than twelve inches (12")

shall have a minimum width of five feet (5') or as required. For mains greater than twelve inches (12") in diameter, the easement adjoining the right-of-way shall have a minimum width of ten feet (10') or as required.

- 3.4.4 When necessary, water mains may be located within the esplanade section of boulevard type streets. Mains should be located as near the centerline as possible to avoid conflicts with future pavement widening.
- 3.4.5 Along streets with open ditch drainage, all twelve-inch (12") and smaller water mains may be located five feet (5') from the right-of-way line, and sixteen inch (16") and larger water mains shall be located subject to Public Works and Engineering Department approval.
- 3.4.6 Water mains may be located at the center of a ten foot (10') wide or as required waterline easement, provided the easement adjoins a public right-of-way.
- 3.4.7 Location of a water main in an easement not adjoining a public right-of-way shall be prohibited, except as specifically approved by the Public Works and Engineering Department. When approved, these water mains shall be centered in a sixteen-foot (16') wide exclusive easement restricted to water only or as specifically approved by the Public Works and Engineering Department.

### **3.5 Clearance of Water Lines from Other Utilities**

Water mains shall be designed and located to conform with the regulations of the Texas Department of Health.

- 3.5.1 When a water main is placed parallel to another utility line at or near the same grade, it shall have a minimum of four feet (4') of horizontal separation. When the other utility is a sanitary sewer, a minimum of nine feet (9') of separation must be provided. In the event that a minimum of nine feet (9') cannot be maintained, the sanitary sewer must be constructed of pressure type pipe with water-tight joints as used in water main construction and the clearances must be as defined in the following sections or as specifically approved by the Public Works and Engineering Department. When a water main crosses a utility other than sanitary sewer, a minimum of six inches (6") of clearance must be maintained, and the water main shall have one joint of pipe, a minimum of eighteen feet (18') long, centered on the other utility.
  - A. Where a sanitary sewer parallels the water main, the sanitary sewer shall be constructed of ductile iron, or PVC pipe meeting AWWA specifications, having a minimum working pressure rating of one hundred fifty pounds per square inch (150 psi) or greater, and equipped with pressure type joints. The water main and sanitary sewer shall be separated by a minimum vertical distance of two feet (2'), and a minimum horizontal distance of four feet (4'), measured between the nearest outside diameters of the pipes, and the water main shall be located above the sewer.
  - B. Where a sanitary sewer crosses the water main, and that portion of the sewer within nine feet (9') of the water is constructed as described in

Section 3.4.3 A, the water line may be placed no closer than six inches (6") from the sewer. The separation distance must be measured between the nearest outside pipe diameters. The water line shall be located at a higher elevation than the sewer, wherever possible, and one (1) joint, a minimum of eighteen feet (18') long, of the new pipe must be centered on the existing line.

- 3.5.2 For water mains crossing an existing or proposed sanitary sewer or force main, the following clearances shall be provided for protection from contamination. The minimum clearances will be approved only when justified and field conditions so dictate. The latest edition of "Rules and Regulations for Public Water Systems", Texas Department of Health, Water Hygiene Division, shall be followed for minimum criteria and instructions for water line crossings.
- 3.5.3 Where water lines are installed in areas which have existing sanitary sewers, every effort should be made to maintain nine feet (9') of separation between the outside pipe diameters of the two lines. Where this separation cannot be achieved because of local conditions, which must be fully documented in any planning material submitted, the following spaces shall be observed
- A. Where a new water line is to cross or be installed in parallel with an existing sanitary sewer, and the sewer is constructed as described in Section 3.5.1, the separation distances specified in those rules shall apply as though the sewer were new.
  - B. Where a new water line is to be installed in parallel with an existing clay, truss, or concrete gravity sewer showing no evidence of leakage and the water line is installed above the sewer a minimum of two feet (2') vertically and four feet (4') horizontally, the sanitary sewer need not be disturbed. Should excavation for the water line produce evidence that the sewer is leaking, then the sewer must be repaired.
  - C. Where a new water main is to cross an existing clay, truss, or concrete gravity sewer showing no evidence of leakage, the sewer need not be disturbed if the water line is to be installed at least twenty-four inches (24") above the existing sewer. A full joint of the water line, at least eighteen feet (18') long, should be centered over the sewer crossing, in this case, so as to provide maximum protection against contamination.
  - D. Existing clay, truss, or concrete sewer pipe which shows no evidence of leakage and because of physical limitations must remain at a higher elevation than a proposed intersecting water line or closer than two feet (2') may remain undisturbed if the water line is inserted in a joint of pressure type encasement pipe at least eighteen feet (18') long and two (2) nominal sizes larger than the water line. The encasement pipe should be centered on the sewer crossing and both ends sealed with cement grout. In lieu of this procedure, that portion of the sewer within nine feet (9') of the water line may be replaced with cast iron or ductile iron pipe with watertight joints as described in Section 3.5.1.

- E. Unless sanitary sewer manholes and the connecting sewer can be made completely watertight and tested for no leakage, they must be installed so as to provide a minimum of nine feet (9') of horizontal clearance from an existing or proposed water line. Encasement of the water line in a carrier pipe as described in Section 3.5.3 D may be approved in special cases if the plans have approval of the Texas Department of Health.

### **3.6 Depth of Cover**

Minimum depth of cover for water mains shall be as follows:

- 3.6.1 Twelve-inch (12") and smaller mains shall have a minimum cover of four feet (4') from the top of curb. For open ditch roadway sections, twelve-inch (12") and smaller mains shall be installed at least three feet (3') below the ultimate flow line of ditch or six feet (6') below natural ground at the right-of-way line, whichever is deeper.
- 3.6.2 Sixteen-inch (16") and larger mains shall have a minimum cover of five feet (5') from the top of curb. For open ditch roadway sections, sixteen-inch (16") and larger mains shall be installed at least three feet (3') below the flow line of ditch or seven feet (7') below natural ground at the right-of-way line, whichever is deeper.
- 3.6.3 Changes in grade to clear other utilities or underground features may be made by deflecting pipe joints. The maximum designed deflection shall be one-half (1/2) of manufacturers allowable deflection. If a depth greater than eight feet (8') to the top of pipe is required, a welded steel section will be used. The standard depth of cover maintained on the water main and the grade change shall be made using the welded steel section. The installation of fittings for vertical deflections or changes in grade shall not be allowed except with specific approval of the Public Works and Engineering Department.

### **3.7 Valves**

- 3.7.1 All water system valves shall conform with AWWA standards and shall be designed as follows:
  - A. Two-inch (2") through twelve-inch (12") valves shall be resilient seated gate valves, AWWA C509, counter-clockwise opening with push-on joints. Valves shall have a complete coating on all iron parts in the valve interior to eliminate corrosion.
  - B. Sixteen-inch (16") and larger valves may be butterfly valves, AWWA C504, with complete interior coating to avoid corrosion of all iron parts, as approved by the Public Works and Engineering Department. All butterfly valves shall be installed in a vault of adequate size and construction, as approved by the Public Works and Engineering Department.
  - C. Cast iron valve boxes are required on all gate valves less than or equal to sixteen-inch (16") as noted below. Valve vaults are required on all valves larger than sixteen-inch (16").

- D. All valves shall be sized equal to the size of the main on which it is located.
  - E. Valves shall be approved by Public Works Engineering Department.
- 3.7.2 Spacing - valves shall be set at maximum distances along the main as follows:
- A. Four-inch (4") through and including twelve-inch (12") mains - one thousand five hundred feet (1,500').
  - B. Sixteen-inch (16") and larger mains - two thousand two hundred feet (2,200').
  - C. All main intersections shall have a minimum of one (1) less valve than the number of mains at the intersection.
- 3.7.3 Location - valves shall be located as follows:
- A. All mains shall be valved within the street right-of-way. Valves shall not be placed under or within two feet (2') of ultimate pavement, except as specifically approved by Public Works and Engineering Department.
  - B. Valves are normally located on the projection of intersecting street right-of-way lines or at the curb return adjoining a paved street across the main. Tapping sleeves and valves are excluded from this requirement.
  - C. All fire hydrants shall be isolated from the service main with a valve located in the fire hydrant lead.
  - D. Intermediate valves not located on the projection of intersecting street right-of-way lines may be located at lot line projections or five feet (5') from fire hydrants.
  - E. Valves shall be placed at the end of all mains that are to be extended in the future, and extend main a minimum of twenty feet (20') past valve.

### **3.8 Fire Hydrants**

- 3.8.1 Fire hydrants shall have three-way nozzle arrangement, five and one-quarter-inch (5-1/4") compression type main valve, mechanical joint boot, and conform to the requirements of AWWA C502. The pumper nozzle shall be the Houston Standard or four and one-eighth inch (4-1/8") threads and the hose nozzles shall be two and one-half-inch (2-1/2") threads. Fire hydrants shall be "Mueller" or equivalent as approved by the Public Works and Engineering Department. Fire hydrants shall have a "**Hydra-Storz**" adapter.

- 3.8.2 Spacing - fire hydrants shall be spaced along all mains six-inches (6") and larger as follows:
- A. Three Hundred Foot (300') Spacing.
  - B. Fire hydrants should be set at street intersections or as specifically approved by the Public Works and Engineering Department.
- 3.8.3 Location - fire hydrants shall be located as follows:
- A. Fire hydrants shall be located three feet (3') behind the back of curb or projected future curb and be set at the point of curvature (PC) of the intersection curb radius. A parallel tee may be used for a fire hydrant lead at the water main when specifically approved by Community Development Department.
  - B. On all State Highways and open-ditch roadways, set the fire hydrants or flushing valves within three feet (3') of the right-of-way.
  - C. Fire hydrants located between right-of-way intersections should be set at a lot line, however, this location may be adjusted five feet (5') either way to miss driveways or other obstructions, in which case the fire hydrants should not be closer than three feet (3') from curbed driveways or five feet (5') from non-curbed driveways.
  - D. Fire hydrants may be located in the esplanade section of City streets only when it is not feasible to locate them between the right-of-way line and the back of the curb. In such case, it is preferable to locate the fire hydrants seven feet (7') behind the esplanade back of curb to provide access for parkway mowers; but in no instance shall they be located closer than three feet (3') from the esplanade back of curb or five feet (5') from the esplanade edge of pavement.
  - E. All fire hydrants shall be located in protected, but easily accessible, areas behind the pavement.
- 3.8.4 Depth of Bury - the depth of bury for all fire hydrants shall be established such that the bury line on the fire hydrant is installed at the ground line at each location or at the finished ground after pavement construction is completed. The depth of bury for fire hydrants shall be shown on the construction plans. Minimum cover for fire hydrant leads shall be four feet (4').
- 3.8.5 Fire hydrants shall not be installed within nine feet (9') of a sanitary sewer system unless approved by the Public Works and Engineering Department.
- 3.8.6 Fire hydrants shall be color coded on the fire hydrant caps. The color coded paint shall be as follows:

<u>Color</u>	<u>Water Main Diameter (In.)</u>
Green	10" and Greater
Orange	8"
Red	6"

The body of the fire hydrant will be red. All paints shall conform to the City of Webster Fire Hydrant Color Code.

### **3.9 Fittings and Appurtenances**

- 3.9.1 Fittings shall be Ductile-Iron Compact Fittings Three-Inch (3") - Twelve-Inch (12"), AWWA C153/A21.53.84, conforming to the minimum requirements of "Gray-Iron and Ductile-Iron Fittings, Twelve-Inch (12") through Forty-Eight-Inch (48)", for Water and Other Liquids", AWWA C110 (ANSI 21.10), current revision. Fittings shall be furnished with bituminous or cement mortar lined, AWWA C104 (ANSI A21.4).
- 3.9.2 All fittings shall be identified and described on the construction plans.
- 3.9.3 Fittings are not permitted in fire hydrant leads, except as specifically approved by Public Works and Engineering Department.
- 3.9.4 Normally, all water main fittings have push-on joints. Mechanical joints may be used at special locations if specifically approved by Public Works and Engineering Department.
- 3.9.5 All plugs shall be provided with retention clamps.
- 3.9.6 Polyethylene tube encasement shall conform with the minimum requirements of "Polyethylene Encasement for Gray and Ductile Cast-Iron Piping for Water and Other Liquids", ANSI/AWWA C105, current revision. Soils within the project shall be tested in accordance with Appendix A of ANSI/AWWA C105 to adequately determine the requirements for encasement.
- 3.9.7 Concrete thrust blocking shall be required on all bends, tees, plugs and combinations thereof. Refer to City of Webster Construction Details for specifications.

### **3.10 Steel Water Pipe**

- 3.10.1 Welded steel pipe is required for all water mains with cover of less than four feet (4') or greater than eight feet (8') and for offset assemblies. Refer to the City of Webster Construction Details for offset assembly specifications.
- 3.10.2 All transitions from steel pipe to approved water main materials shall be constructed using electrically isolated flange joints.
- 3.10.3 Welded steel pipe shall be constructed in conformance with the City of Webster Construction Details.

### 3.11 Water Services

#### 3.11.1 Water Service in Residential / Single Family Development

- A. Water service from the main to the curb stop shall be installed using materials approved by Public Works and Engineering Department.
- B. Minimum size water service line and fittings shall be one inch (1") for single meter connections for homes having more than three thousand (3,000) square feet of living area. For homes with less than three thousand (3,000) square feet of living area, a three-quarter-inch (3/4") diameter water service line will be permitted.
- C. Minimum size water service line shall be one inch (1") for a far side double residential meter connection for homes less than three thousand (3,000) square feet. Minimum size water service line shall be one and one-half inches (1-1/2") for a far side double residential meter connection for homes greater than three thousand (3,000) square feet.
- D. Water service lines shall be placed at a minimum depth of thirty-six inches (36") below final paving elevation.
- E. Water meters shall be supplied and installed by the City of Webster. Payment for meters must be made prior to installation.
- F. Meter boxes shall be located just within the public right-of-way along the projection of a lot line. Location of meters on open ditch streets shall be specifically approved by Public Works and Engineering Department.
- G. All water service fittings and appurtenances for all projects shall be approved by Public Works and Engineering Department.
- H. City maintenance shall end at the water meter. The water meter box or vault shall be constructed to meet the City's requirements and will be maintained by the City.

#### 3.11.2 Water Service in All Other Developments

- A. Detector check valves shall be required on fire lines.
- B. Service meters that are two inches (2") and smaller shall be set in a separate exclusive water meter easement with minimum dimensions of five feet by five feet (5' X 5') or as specifically approved and shall be located in easily accessible areas adjoining a public right-of-way or water line easement, but protected from traffic behind curbed sections. Meters may be located in the water main easement provided the water main easement is located such that the accessibility and protection of the meter is as specified immediately above.
- C. Service meters that are three inches (3") and larger and detector check valves shall be set in separate exclusive water meter easements with minimum dimensions of ten feet by twenty feet (10' X 20') or as specifically approved and shall be located in easily accessible areas,

adjoining a public right-of-way or water line easement, but protected from traffic behind curbed sections. Refer to the City of Webster Construction Details for details.

- D. The location of the service line tee, valve, valve box and temporary plug shall be designated on the construction plans in the appropriate location to serve the "future meter".
- E. All apartments or town homes proposed in a private street development shall have one or two master meters sized adequately to serve the entire development. Exceptions to this policy may be specifically approved by the Public Works and Engineering Department based on an unusual situation. Meters shall be installed in compliance with the City of Webster Construction Details.
- F. All large meters within the City of Webster will be installed and maintained by the City of Webster, except as specifically approved by the Public Works and Engineering Department.
- G. City maintenance shall end and include the meter and check valve vaults. The vaults shall be constructed to meet the City's requirements and will be maintained by the City.

### **3.12 Additional Standards**

- 3.12.1 Construction Features - In conjunction with the design, the engineer shall determine the extent of, and fully exemplify on the plans, all special construction features required to complete the project in a manner of safety, convenience, and economics.
- 3.12.2 Bore and Jack – Bore and jack sections shall be clearly shown on plans by location and footage. The following criteria is generally used as a basis for jack sections:
  - A. Public Streets - All public streets are to be bored and jacked regardless of surface. Bore and jack length shall be computed as roadway width at proposed bore plus five feet (5') to either side.
  - B. Driveways - Whenever it is cost effective, concrete driveways in good condition shall be bored and jacked. Bore and jack length shall be computed as driveway width at bore plus one foot (1') to either side. Where driveways cross culvert pipe sections along open ditch streets and the proposed water main is in close proximity and parallel to the culvert pipe, the length of bore shall be the same as the length of culvert pipe.
  - C. Sidewalks - When the water line crosses under a sidewalk four feet (4') or more in width and in good condition, the sidewalk shall either be bored and jacked or the sidewalk shall be removed and replaced to the City of Webster criteria, whichever is cost effective. Bore and jack length shall be at least the width of the sidewalk. The proposed type of construction shall be noted on the plans.

- D. Trees - When saving trees and shrubs in a previously developed area is a consideration, all trees six inches (6") and larger in diameter within ten feet (10') of the centerline of the water main must be noted on the plans. The water main should be bored and jacked within the drip line of any tree larger than six inches (6") in diameter.
  - E. Bore Pits - Bore pits shall be at least three feet (3') from back of curb and five feet (5') from back of curb on a major thoroughfare. Bore pits in highway, county road, or railroad right-of-way shall conform to these requirements and to the requirements of the crossing permit and/or use agreement. All bore pits shall be shored in accordance with OSHA requirements. Bore pits and/or receiving pits to be located in street or driveway paving, shall be shown on plans.
- 3.12.3 Open Cuts - Where open cuts are required in street paving, plans should call for steel plate covers to be installed and maintained over the cut during periods when contractor is not actively engaged in work at the site. Streets that are open cut shall be "saw cut".
- 3.12.4 All existing developed areas shall be restored to original condition after construction.
- 3.12.5 Proper barricading and signage, conforming to the latest revision of the Texas Manual of Uniform Traffic Control Devices, must be required on all projects. Adequate signage for vehicular and pedestrian traffic will be installed.