



# STANDARDS AND SPECIFICATIONS For Design and Construction

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# 1. General

## 1.01 PURPOSE

The purpose of these Standards and Specifications for Design and Construction (STANDARDS) is to provide a consistent policy under which certain physical aspects of water distribution design will be implemented.

STANDARDS cannot provide for all situations. They are intended to assist, but not to substitute, for competent work by design professionals and construction personnel by providing basic information.

STANDARDS are not intended to limit innovative or creative effort which may result in a better quality, a better long term solution, or a better product for our members.

Following the above purpose, STANDARDS have the objective of developing a water distribution system which will:

- a) Be consistent with the latest version of the Corporation's Water System Analysis;
- b) Provide sufficient capacity to maintain minimum pressure during periods of maximum use, and to provide sufficient volumes of water at adequate pressures to provide the expected maximum daily consumption plus emergency conditions at a minimum energy loss;
- c) Be of materials strong enough to resist all expected loads, both internal and external, and able to preserve the potability of the water supply;
- d) Be economical and safe to build and to maintain; and
- e) Conform to the latest Oklahoma DEQ regulations Title 252, Chapter 626, Public Water Supply Construction Standards.

Alternate materials and methods will be considered for approval on a case-by-case basis based upon the above objectives.

## 1.01 APPLICABILITY

STANDARDS shall serve as a guide for all design, construction, upgrading, extending or otherwise modifying the water distribution system and facilities operated, owned, or maintained by Fifty-One East Water, Inc.

## 1.02 INCLUSIONS BY REFERENCE

The following documents and/or regulations are hereby included by reference:

- a) The most recently revised By-Laws governing Fifty-One East Water, Inc.;
- b) The most recently revised Policies and Procedures of Fifty-One East Water, Inc.;
- c) The current regulations of the Oklahoma Department of Environmental Quality as published in Title 252, Chapter 626 Public Water Supply Construction Standards (OKDEQ); and
- d) Current regulations, design standards, and/or construction requirements of any governing body with jurisdiction over the design, construction, operation and/or maintenance of the planned water line, facility, structure, or other device that will be owned, operated, and/or maintained by Fifty-One East Water, Inc. within the jurisdiction of the governing body.

## 1.03 REVISIONS TO THESE STANDARDS

It is anticipated that revisions to STANDARDS will be made from time to time. The date appearing at the top of each page is the date of the latest revision. Users should apply the latest published issue to any work contemplated. Alterations and/or exceptions to these standards may be considered by the Board of Directors on a case by case basis. The latest revision is always available from our web site [www.51erwi.com](http://www.51erwi.com).

## 1.04 DEFINITION OF TERMS

Corporation - Fifty-One East Water, Inc.

Board of Directors - the Board of Directors for Fifty-One East Water, Inc.

Member - Person(s) or legal entity that has purchased a Membership in the Corporation for the right to purchase water from the Corporation. Must meet all requirements in the Corporation by-laws and Policies and Procedures.

Distribution System - the distribution pipelines, pumping stations, valves, hydrants, towers, tanks and all other appurtenances used to transmit water from the supply source(s) to the service line(s) or other end point(s).

Main - water supply pipe used in the distribution system.

Service Line - the pipe carrying potable water from the main to the meter.

Manager - Person(s) employed by the Board of Directors to manage the overall operation of the Corporation and the Distribution System.

Corporation Engineer - the Engineer retained or employed by the Corporation and licensed in the state of Oklahoma as a Civil Engineer.

Easement - a right afforded to the Corporation to make limited use of real property not owned by the Corporation. As used in STANDARDS it may also refer to 1) an area of land within which the limited use right is afforded; or 2) the legal instrument through which the limited use right is conveyed to the Corporation.

Right-of-Way - all land or interests therein which by deed, conveyance, agreement, dedication, usage or process of law is reserved for or dedicated to the use of the general public (RoW).

Roadway - that entire portion of the RoW used, or to be used, for vehicle movement, which exists between the curbs and/or edge of the surface used for vehicle movement.

Plans - construction plans, including system site plans, water system plans, profiles, cross sections, detailed drawings...., or reproductions thereof, approved or to be approved by the Corporation Engineer and/or Manager and/or OK DEQ, which show the location, character, dimensions, and details for the work to be done.

As-Built Plans - plans prepared by the Corporation Engineer, Management, and/or the Contractor indicating that the approved plans have been revised, if necessary, to accurately show all as-built construction details.

Hydrant - a fire hydrant, flushing hydrant, blow-off hydrant, or other device with a valve and spout connected to a Main for the purpose of drawing, discharging, or flushing water from the Main.

Hydrant Lead - the line connecting a hydrant to a main.

Hydrant Control Valve - a valve, usually a gate valve, in the hydrant lead between the Main and the hydrant used to regulate the flow of water from the hydrant.

**1.05 ENGINEERING POLICY**

The engineering policy for the Corporation allows for the research, preparation, design, review, and oversight of all proposed extensions, replacements, upgrades, or other modifications to the distribution system of the Corporation. Plans that cause any extension, replacement, upgrade or other modification to the distribution system shall be communicated to the Corporation and subsequently to the Corporation Engineer for review.

**1.06 SPECIAL FACILITIES**

The design and construction of the following are considered special facilities and are not covered in detail in STANDARDS.

- a) Pump Stations
- b) Storage Tanks or Towers
- c) Treatment Plants
- d) Pressure Regulating Devices
- e) Flow Measurement Devices
- f) Fire Lines

## 2. Design

### 2.01 GENERAL DESIGN CONSIDERATION

The Distribution System shall have sufficient capacity to maintain 30 psi at all meters during peak hour use, and to provide sufficient volumes of water at adequate pressure to satisfy the expected maximum day demand plus emergency conditions. Normal working pressures may vary in the Distribution System due to changes in elevation in topography, but will generally be between 45 psi and 120 psi.

As a condition of water service, all developments will be required to provide public mains of sufficient size for projected peak hour demands and maximum day demand. This may include the extension of mains in easements across the property to adjoining properties and across the street frontage of the property to adjoining properties. Off-site improvements from a suitable main as determined by the Corporation Engineer and/or the Corporation Manager will be the financial responsibility of the developer.

### 2.02 DISTRIBUTION SYSTEM CAPACITY

Design capacities and pipe sizing shall be determined by the following as listed in order of priority:

- a) As detailed or identified in the latest edition of the Corporation's Water System Analysis;
- b) Minimum pipe size as identified in section 2.06;
- c) For service of commercial, agricultural or industrial properties, and where there is an absence of detailed design information per subsection a) of this section, design capacities and main sizing shall be determined by considering the following factors and assumptions for the area(s) to be served, both immediate and adjacent:
  - i. The highest of current or projected population within the area to be served;
  - ii. The highest maximum daily water demand based upon current or projected land use; and
  - iii. The special needs of commercial, agricultural, industrial, or institutional users to be served at specific locations.
- d) Detailed design factors, consumption data, and other information to be used for design purposes:
  - i. Maximum daily demand based upon factors by land use;
  - ii. Peak hour demand based upon peaking factors by land use;
  - iii. Demand for unique, commercial installations, agricultural uses, industrial users, multiple family dwellings, and institutional concerns will be calculated on an individual basis.



## 2.03 MAIN CLASSIFICATION

Mains are classified as one of the following. Sizes are illustrative only. Mains are classified by their intended use and purpose, not only by size:

- a) Transmission Main (Typically 8-inch or larger)  
Mains which are used for transporting water from the source of supply (master meters), to elevated storage tanks and/or throughout the service area of the Distribution System. Transmission Mains are typically along major or section line roads. The primary purpose of Transmission Mains is to efficiently transmit water to storage tanks and to various parts of the Distribution System, but customers may be connected to Transmission Mains;
- b) Feeder Main (Typically 6-inch or 8-inch)  
Mains that transport water from the Transmission Mains into developed areas. Feeder mains may be along major or section line roads, or along access roads into a development. The primary purpose of Feeder Mains is to supply water from Transmission Mains to developed areas with a pipe size appropriate for the developed area and projected growth within that area. Customers may be connected to Feeder Mains;
- c) Distribution Main (Typically 2-inch, 4-inch or 6-inch)  
Mains which directly supply water to individual Members' service lines. The primary purpose of Distribution Mains is to deliver water from Feeder Mains or Transmission Mains to localized areas with low demand requirements. Distribution Mains may be along roads or utility easements.

## 2.04 CONSTRUCTION PLANS

Complete plans and specifications for improvements to Corporation water mains shall be approved by the Corporation Manager, Corporation Engineer, and the Board of Directors prior to beginning construction.

These plans and specifications shall meet the following requirements:

- a) Dimensions - Plans shall be clearly and legibly drawn drawings and shall be submitted on 24 x 36 inch sheets;
- b) Form - Title Sheet, Plan and Profiles and Water Main Appurtenances;
- c) Scale - Horizontal scale shall be 1":10', 20', or 40'. Vertical scale shall be 1":2', 4', or 5'. Scales shall be chosen to generally fill the usable area of the sheet and to show all relevant detail.

## 2.05 BORES

Mains installed by directional boring will be fused HDPE unless otherwise specified by the conditions of any permit(s) received for the construction.

## 2.06 PIPE MATERIALS

All water main pipe, excluding bores, shall be PVC slip joint bell pipe.

- a) PVC Transmission Mains (as classified by the Corporation) shall conform to AWWA C900 DR 18 235 psi (or higher pressure rating);
- b) Other PVC mains 4-inch to 8-inch shall conform to AWWA C900 DR 21 200 psi (or higher pressure rating);
- c) Other PVC mains 12-inch and larger shall conform to AWWA C900 DR 18 235 psi (or higher pressure rating);
- d) All HDPE shall conform to AWWA C909 235 psi (or higher pressure rating); and
- e) The Corporation Engineer may specify other pipe classifications on a case-by-case basis for special circumstances or facilities.

## 2.07 MAIN SIZE

All lines used in the Distribution System shall be IPS standard sized pipe.

- a) 2-inch - shall only be used for dead-end lines or small hydrant leads and must be approved by the Corporation Manager and Engineer;
- b) 3-inch - shall only be used for service lines to 3-inch meters;
- c) 4-inch - shall only be used on Feeder Mains serving 10 or fewer residential meters, and shall be connected to a minimum 6-inch main which is looped. Also used as hydrant leads;
- d) 6-inch - shall be used on Feeder Mains in developed areas, and on small Transmission Mains near the edges of the Distribution System. Shall be connected to a main of equal or larger size;
- e) 8-inch - shall be used on Transmission Mains along major/section-line roads. May be used on Feeder Mains in developed areas. Shall be connected to a Transmission Main of equal or larger size or directly to the water supply source (master meter);
- f) 10-inch - shall not be used except at connections to, or for repairs on, existing mains;
- g) 12-inch - shall be used as Transmission Mains in the Distribution System, and shall be constructed along major/section-line roads;
- h) HDPE - shall be at least one pipe-size larger than the main to which it is connected. Allowable sizes are: 6", 8", 12", 16" IPS.

The Corporation shall require mains be sized appropriately to provide the capacity for current and projected development in the area and adjoining properties. All dead-end mains shall terminate with an approved hydrant and/or flushing station appropriate for the main size.

**2.08 MINIMUM DEPTH**

The standard minimum cover over buried mains shall be 36-inches from the finish grade. The Corporation may require additional cover at its discretion.

**2.09 LOCATION**

- a) All mains shall be installed on private easements. Such easements shall be a minimum 20-foot in width;
- b) Construction in public RoW shall only be allowed for crossing roadways;
- c) Roadway crossings generally shall be at 90 degrees to the roadway;
- d) The mains shall terminate at the furthest property line along major/section-line roads bordering the development;
- e) Water mains shall be separated from sewer and waste lines in accordance with OKDEQ;
- f) Water mains shall be separated from other utilities in accordance with OKDEQ;
- g) Water mains shall maintain as much separation from other utilities as possible;
- h) At no time shall a main be constructed under a building or structure. At no time shall a building or structure (including overhanging structures) be constructed above a main;
- i) Roadway Crossings
  - i. Shall meet all requirements of the permit(s) obtained for the crossing;
  - ii. Shall be designed to cross as near as perpendicular to the roadway as possible;
  - iii. Shall be the greater of 6-feet or the depth specified by the permit(s) below the lowest point of the RoW;
  - iv. Shall be fused HDPE from RoW to RoW; and
- j) Surface Water Crossings
  - i. Mains crossing a body of water, stream, creek or drainage channel shall be designed to cross as near perpendicular to the channel as possible;
  - ii. The minimum cover from the bottom of the body of water or channel to the top of the pipe shall be the greater of 60 inches or the current OKDEQ requirement; and
  - iii. Mains crossing a body of water or channel shall be fused HDPE and extend a minimum of 15 feet on either side of the body of water or channel.

**2.10****CASING**

Casing shall be used

- a) On all roadway crossings of Transmission Mains as classified by the Corporation;
- b) On all surface water crossings if required by the jurisdiction of the Army Corps of Engineers or other governing agency; and
- c) On all other bores as specified by the Corporation Engineer and/or Manager.

Where casing is used,

- a) The casing shall be constructed of steel, or of the material specified by any permit(s) obtained for the construction;
- b) The casing shall be sealed, or plugged with a watertight seal;
- c) The casing shall have appropriately size vent pipes near each end;
- d) The main inside the casing shall be fused HDPE;
- e) The HDPE shall extended a minimum of 10 feet beyond the casing; and
- f) The HDPE shall have properly installed spacers to prevent contact with the casing.

**2.11****HDPE**

HDPE shall be used for all bores, water crossings, road crossings, and within all casings. HDPE shall be constructed with the following requirements:

- a) Shall be at least one standard pipe size larger than the PVC main connected to the HDPE section.
- b) Shall have fused HDPE wall-anchors approximately 10 feet before each end of the HDPE section;
- c) Shall have fused HDPE mechanical joint transition ends at each end of the HDPE pipe section;
- d) Shall be pressure tested on-site according to Corporation Engineer and/or Manager requirements before installing in a bore or trench; and
- e) Shall be designed and constructed to meet all other HDPE requirements in other sections of STANDARDS.

**2.12****HDPE WALL ANCHORS**

The design engineer shall ensure the concrete wall anchor shall not conflict with other utilities. Typical HDPE wall anchor requirements are as follows:

- a) Anchors will be constructed of reinforced concrete. The reinforcing steel shall begin 3 inches from the outer edges of the concrete and be evenly spaced no more than 6 inches apart throughout;
- b) The concrete wall shall be constructed so that the fused wall-anchor is centered both vertically and horizontally within the reinforced concrete wall;
- c) For 6" or 8" HDPE - The concrete wall shall be:
  - i. at least 18" deep along the longitudinal axis of the HDPE section;
  - ii. at least 36" total height; and
  - iii. at least 90" total width perpendicular to the HDPE, extending at least 30" beyond the excavated trench wall;

- d) For 12" HDPE - The concrete wall shall be:
  - i. at least 24" deep along the longitudinal axis of the HDPE section;
  - ii. at least 48" total height; and
  - iii. at least 120" total width perpendicular to the HDPE, extending at least 45" beyond the excavated trench wall; and
- e) For 16" HDPE - The concrete wall shall be:
  - i. at least 30" deep along the longitudinal axis of the HDPE section;
  - ii. at least 60" total height; and
  - iii. at least 174" total width perpendicular to the HDPE, extending at least 65" beyond the excavated trench wall.

### 2.13 VALVES

Valves shall be the same size as the main in which they are installed. Valves shall conform to AWWA C509. Valves shall be resilient wedge gate valves. Valves shall be left open. A properly sized valve shall be installed on all sides of intersecting mains.

### 2.14 ANGLES, TEES, AND OTHER FITTINGS

All angles, tees, crosses or other fittings shall be sized to match the largest main to which they are connected. All fittings will be mechanical joint fittings. If connecting to a smaller sized main, reducers will be used after the valve to connect to the smaller main. The exception being Tees installed for a hydrant lead. In these cases, the Tee may reduce to the line size of the hydrant lead.

### 2.15 THRUST RESTRAINT

Joint restraint shall be used at all bends and fittings or where joint restraint devices are specified by the approved construction plans. Thrust blocks are not allowed in place of restrained joint systems.

### 2.16 BACKFLOW PREVENTION

When deemed necessary by the Corporation Engineer and/or Manager, approved metering systems shall be required to install an approved backflow prevention device.

### 2.17 HYDRANTS

- a) Fire Hydrants
  - i. Shall be spaced every 500 feet in residential developments;
  - ii. Shall not be installed on a main of less than 6-inches diameter without the approval of the Corporation Manager or Board of Directors;
  - iii. Shall be distributed in rural areas at the direction of the Corporation Manager and/or Engineer based on protecting existing structures of existing Members as new mains are constructed or existing mains are replaced;
  - iv. Shall be located as nearly as possible to the corner of roadway intersections and at intervals as near as possible to the coverage described in section 2.17 a) i;

- v. Shall be placed at the termination of 6-inch or larger mains on dead end roads and/or cul-de-sacs;
- vi. Shall have a hydrant control valve anchored to the main line tee to permit maintenance on the hydrant without shutting down the main supplying the hydrant;
- vii. Shall have a 6-inch mechanical joint shoe, 5-1/4" dry barrel, 1 pumper nozzle, and 2 hose nozzles;
- viii. Shall be bedded with gravel to allow proper drain hole function; and
- ix. Shall have extensions added to the barrel to ensure the proper bury depth is at the finished grade level

b) Other Hydrants

- i. Shall be placed at the termination of all dead-end mains that do not have a fire hydrant at the termination;
  - ii. Shall have an appropriately-sized control valve;
  - iii. Shall be Kupferle #77 Post Hydrant or #2 Post Hydrant;
  - iv. Shall have a 2-inch or a 4-inch mechanical joint horizontal inlet with Kupferle "Sidekick" option;
  - v. Shall have 2-1/2" outlet;
  - vi. Shall be bedded with gravel to allow proper drain hole function;
  - vii. Shall be installed with a an Eclipse #9400 Automatic Flushing Station with Diffusion Plate if determined necessary by the Corporation Engineer and/or Manager in order to maintain proper water quality;
- c) All hydrants, excepting those terminating dead-end mains, installed in-line with a main shall have a properly sized valve placed on both sides of the Tee on the main; and
- d) All hydrants installed at intersecting mains shall have valves positioned on the mains in such manner that each main can be isolated individually to the hydrant.

## 2.18 SERVICE LINES

Service Lines are the water line extending from the water main to the member's meter. The term "service line" can often times be used to describe the member's line extending from the meter to the member's point(s)-of-use. The Corporation is only responsible for the service line from the main to the meter. The service line will be equal to or greater than the size of the meter. At no time will the service line be greater in size than the main. The service line shall run as close to perpendicular to the main as possible and shall run directly to the meter.

## 2.19 METERS

All residential water meters served by the Corporation shall be furnished by the Corporation, and shall be installed by the Corporation field crew or by a contractor retained by the Corporation. The Corporation may require other types of meters (commercial, industrial, etc.) be provided by and installed by the

water user's contractor. The Corporation shall dictate the meter type, model, and manufacturer for all meters connected to the Distribution System. No meter will be set, installed, or connected until all applicable forms and fees have been received, and the Board of Directors has approved the membership and meter.

Meters will be installed on private property, outside of RoW, and generally within 10 feet of the drive or other entrance.

## **2.20 CLEARANCES**

Meters, Hydrants and Air Reliefs shall maintain a minimum clearance of 3 feet on all sides.

## **2.21 WATER PRESSURE**

The Corporation shall supply a minimum of pressure to the meter as per OKDEQ. It is the developer's and/or member's responsibility to determine the need for, to install, and to maintain an appropriate pressure reducing device on the member's water line(s).

## **2.22 SEPARATION OF WATER SOURCES**

On premises where water is supplied by more than one source, the systems and sources shall be kept entirely separate as per OKDEQ. An appropriate and approved backflow prevention assembly may be installed with approval from the Corporation Manager and/or Engineer. The member shall be required to properly maintain and test any backflow prevention assembly as specified by the Corporation Manager. Documentation of maintenance and testing may be requested by the Corporation.

## **2.23 PIPE BEDDING**

Water mains shall typically be bedded in natural earth material (dirt). When rock is present, pipe shall be bedded in 6-inches of sand or granular rock material. At times, granular rock material be used to encompass the entire pipe to provide protection from rigid edges present in excavated rock formations.

## **2.24 BACK FILLING OF TRENCHES**

Back filling of trenches used to construct a main shall be completed in layers, and shall be compacted to minimize settling. Trenches shall be graded level with the finished grade. Where appropriate, backfilled trenches shall be sodded and/or seeded.

**2.25****TRACER WIRE**

Tracer wire shall be installed on all mains and service lines as follows:

- a) Tracer wire shall be electrically continuous;
- b) Tracer wire shall be twelve (#12) AWG HS-CCS minimum, high strength copper clad steel conductor insulated with 30 mil high density, high molecular weight polyethylene insulation rated for direct burial use at 30 volts;
- c) Insulation color shall be blue and shall meet APWA color code standards for identification of buried utilities;
- d) Tracer wire shall be installed with access points spaced no greater than 1000 feet or as directed by the Corporation Engineer and/or Manager;
- e) Tracer wire shall be securely bonded at all wire joints with an approved, watertight connector, and the wire shall be tied in a loose knot below the connection;
- f) Tracer wire shall be accessible via an above ground pedestal at each hydrant;
- g) Tracer wire shall be accessible in the meter can for each meter;
- h) Tracer wire shall be accessible in at least one valve box within the cluster at intersecting mains;
- i) Tracer wire shall be accessible at valves along a main which are more than 500 feet from an access point on the main in either direction along the main;
- j) Tracer wire at valve boxes shall be brought up the outside of the valve box to a point 12 inches below the final grade and looped inside through a hole drilled in the valve box;
- k) Tracer wire shall NOT be looped around the top of a valve or valve nut;
- l) Tracer wire shall be installed in such manner as to be able to properly trace and locate all mains and service lines without loss or deterioration of signal, and without the transmitted signal migrating off the tracer wire;
- m) Tracer wire shall be installed with the pipe in the same trench, and within bored holes, and within casing during pipe installation;
- n) Tracer wire shall be securely affixed to the pipe at intervals no greater than 10 feet;
- o) Tracer wire shall be continuous between access points with no splices permitted;

**2.26****CUT/WARNING TAPE**

Cut Tape or Warning Tape shall be installed in the trenches of all installed mains during backfill. The cut tape shall be approximately 12 inches to 18 inches above the top of the pipe, and as close as directly above the pipe as possible.