

CITY OF TULSA

Engineering Services Department



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Design Standards
Manual for Water
Distribution Systems
2018

CITY OF TULSA ENGINEERING SERVICES DEPARTMENT

Design Standards Manual for Water Systems

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INTRODUCTION



A. PURPOSE OF MANUAL

The purpose of this manual is to provide guidelines and minimum design criteria for the design of water piping systems for the City of Tulsa either as part of Capital Improvement Program (CIP) or as an Infrastructure Development Project (IDP) that will construct and dedicate the systems to the City. The manual applies to existing systems being expanded, modified, upgraded, and rehabilitated as well as to the construction of new mains. The manual is not intended to be used as a construction specification. All units of measurement used in this manual are United States standard measure unless otherwise noted. The Water and Sewer Department (WSD) has other design manuals available for other facilities (booster stations, lift stations, reservoirs, and surge tanks).

B. AUTHORITY

The design standards set forth in this manual are adopted pursuant to the authority granted in the Oklahoma Administrative Code (OAC) §252:626 and Title 11-C of the Tulsa Code of Ordinances (TCO).

C. ORGANIZATION AND INTERPRETATION OF MANUAL

This manual is composed of written engineering standards, references to established standards of other organizations and agencies, and standard details of WSD. The Director of WSD, whose interpretation shall be binding and controlling in its application, shall make the interpretation of any section or of differences between sections. NOTE: Any deviations from the standards in this manual shall require a technical appeal to the Director of WSD and/or the Director's Representative. This appeal shall follow the process as described in Title 35 Chapter 8 Section 804 of the TCO (Section V).

D. REVISIONS AND PUBLIC COMMENTS

This manual may be revised periodically. Proposed revisions will be presented to the Engineering Specification Committee and recommended to the Infrastructure Development Advisory Board unless the revision is required to comply with Federal, State, County, and City laws, regulations, ordinances or codes.

At any time if you have a comment on Design Standards Manual for Water Systems, you may send an email to Engineering Services Department (ESD) through the link provided on the website. These comments will also be reviewed and responded to.

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DEVELOPMENT COORDINATION BY DEPARTMENTS



Water and Sewer Department (WSD), Engineering Services Department (ESD) and Planning and Development Department (P&DD) are the three City Departments that review and approve public water and sewer infrastructure plans. The following department descriptions provide an overview of the jurisdictional areas and services provided by each department.

A. WATER AND SEWER DEPARTMENT (WSD)

WSD is empowered by the Tulsa Code of Ordinances to ensure the proper administration and operation of the water works of the TMUA. WSD operates under a Public Works Director who reports to the Mayor's Chief of Staff. The Water and Sewer Director is the general executive officer of WSD. The Water and Sewer Director is in charge of all personnel and the entire operation, equipment and facilities of WSD. The Water and Sewer Director also has general supervision over all charges for water services, departmental policies, agreements, new connections, repairs, other operational works and for all charges not explicitly provided for in the City Code, subject to approval of the TMUA Board, City Council and Mayor.

1. Role and Functions

WSD is responsible for operational review, approval, testing and coordination of all public infrastructure projects, which include the following:

- a. Booster pump stations¹
- b. Pressure reducing facilities¹
- c. Storage facilities¹
- d. Well sites
- e. Water transmission mains (16-inch diameter and larger)
- f. Water master plans
- g. Water treatment facilities¹
- h. CIP projects for Streets Department
- i. Joint venture agency projects through Intergovernmental Agreement
- j. All plans outside city limits within the TMUA's service area including:²
 1. All water mains
 2. Fire lines
 3. Fire hydrants
 4. Water main abandonments
 5. Water main vertical realignments

B. ENGINEERING SERVICES DEPARTMENT (ESD)

ESD is empowered by the Tulsa Code of Ordinances to ensure the proper design of City Infrastructure. ESD operates under a Public Works Director who reports to the Mayor's Chief of Staff. The Director of Engineering is the general executive officer of ESD. The Director of Engineering is in charge of all personnel and the entire design and field operations of ESD. The

Director of Engineering also has general supervision over departmental policies, agreements for all charges not explicitly provided for in the City Code, subject to approval of the TMUA Board, City Council and Mayor.

1. Role and Functions

ESD is responsible for technical review, approval, inspection and coordination of all public infrastructure projects, which include the following:

- a. Booster pump stations¹
- b. Pressure reducing facilities¹
- c. Storage facilities¹
- d. Well sites
- e. Water transmission mains (16-inch diameter and larger)
- f. Water mains smaller than 16-inches in diameter
- g. Water master plans
- h. Water treatment facilities
- i. CIP projects for Streets Department
- j. Joint venture agency projects through Intergovernmental Agreement
- k. All water mains
- l. Fire lines
- m. Fire hydrants
- n. Water main abandonments
- o. Water main vertical realignments
- p. All plans outside city limits within the City's service area including:²

Contact ESD for more detailed information related to water capital improvements. The general phone number is 918-596-9566 or refer to City of Tulsa Engineering Services Department's website. For website link refer to Appendix A, pages A-1.

C. PLANNING AND DEVELOPMENT DEPARTMENT (P&DD)

P&DD is empowered by the Tulsa Code of Ordinances to ensure the proper design of City Infrastructure related to Infrastructure Development Projects (IDP). P&DD operates under a Planning and Development Director who reports to the Chief of Economic Development. The Planning and Development Director is the general executive officer of P&DD. The Planning and Development Director is in charge of all personnel and the private development design. The Planning and Development Director also has general supervision over all charges for engineering services, departmental policies, and agreements for all charges not explicitly provided for in the City Code, subject to approval of the TMUA Board, City Council and Mayor.

1. Role and Functions

P&DD is responsible for technical review, approval, inspection and coordination of all private infrastructure projects, which include the following:

- a. Water mains smaller than 16-inches in diameter^{1,3}
- b. Fire lines³

- c. Fire hydrants³
- d. Water main abandonments³
- e. Water main vertical realignments^{1,3}

Contact P&DD for more detailed information describing the development review process. The general phone number is 918-596-2514 or refer to P&DD's website. For website link refer to Appendix A, pages A-1.

¹ WSD, ESD and P&DD will jointly review these type of plans. P&DD is responsible for the civil site review and the building code review. WSD, ESD and P&DD are responsible for the review for conformance to City of Tulsa specifications and standards.

² WSD, and ESD will jointly review these type of plans.

³ If any portion of a project falls outside the Tulsa city limits, the developer must also include the approval and processes of the prevailing jurisdictional agency.

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GENERAL WATER DESIGN CRITERIA



A. GENERAL DESIGN CRITERIA/CONSIDERATIONS

1. Jurisdictional Agency Approvals

All appropriate agency levels affected within the Federal, State, County, and City involvement need to be contacted for their individual design requirements. These requirements will need to be addressed in a top down priority to avoid approval conflicts. This includes areas that are outside the city limits but served by the City of Tulsa water system.

NOTE: Any and all more stringent requirements by Federal, State, County or local codes or ordinances shall take precedence.

2. Standard Specifications and Details

The standard specifications and standard details relating to water systems that are referenced in this manual include the following:

- a. City of Tulsa Standard Specifications and Standard Details. These details and specifications are revised and updated periodically and are available electronically through the City of Tulsa website. For website link refer to Appendix A, page A-1, City of Tulsa Standard Specifications and Standard Details.
- b. Oklahoma Department of Environmental Quality (ODEQ) Public Water Supply Construction Standards. For website link refer to Appendix A, page A-1, Oklahoma Department of Environmental Quality (ODEQ) Public Water Supply Construction Standards.
- c. Oklahoma Department of Transportation Standard Specifications Book and Oklahoma Department of Transportation Design Standards & Specification Drawings. For website link refer to Appendix A, page A-1, Oklahoma Department of Transportation Standard Specifications Book and Oklahoma Department of Transportation Design Standards & Specification Drawings.

3. Environmental and Cultural Regulatory Requirements

This section is not intended to be all encompassing, but is provided as an overview of environmental and cultural requirements and typical agency involvement. A thorough consideration of the environmental and cultural impact of the project at the project location or along the project route shall be evaluated to identify environmental and cultural requirements. Private developers shall be responsible for regulatory compliance and for obtaining the required permits for their projects.

Whenever a project impacts Waters of the United States, a Clean Water Act Section 404 permit will be required by the U.S. Army Corps of Engineers (Corps).

Projects shall not adversely impact threatened or endangered species or their habitat and shall comply with the Federal Endangered Species Act. To address any biological requirements, an assessment report of the project may be required by the U.S. Fish and Wildlife Service.

No project shall adversely impact historic or prehistoric properties. Projects shall comply with the National Historic Preservation Act.

4. Community Notification and Involvement

The City has made a commitment to early citizen notification and involvement. The goal of identifying neighborhood concerns has a high priority. Communication through printed notice, a public information phone number and public presentations could be a necessary element in construction plan approval.

5. Subsurface Investigations

When requested by WSD, a geotechnical engineer shall perform a soil investigation to determine the soil bearing capacity, soil backfill suitability, presence of groundwater or bedrock, corrosion potential and other conditions, which may affect the construction of the water or sewer main. Test holes shall be located at a maximum spacing of not more than 1,000-feet and at railroad, highway and canal crossings.

B. LOCATION, ALIGNMENT, AND EASEMENT REQUIREMENTS FOR WATER MAINS

A route study or alignment report shall be completed to assure a functional hydraulic gradient/grade as well as continuity of an accessible right-of-way (ROW) and/or easement corridor.

The Water Services Department (WSD) requires safe and quick access to all City water mains at all times in order to repair main breaks, install taps, and perform preventive maintenance. For this reason, City of Tulsa water mains shall be constructed within the public ROW as discussed below. Water mains that are not installed in the ROW may only be permitted within a dedicated water easement. The water easements are discussed later in this chapter.

1. Public Water in the Public Right-of-Way

The location and alignment of all water mains in the right of way shall be per the latest edition of City of Tulsa Subdivision Regulations Standard Location of Underground Utility Lines for Residential Streets. Design engineers can obtain a copy through the Planning and Development Department (P&DD). The standard utility locations are presented with the realization that every case will not be covered and there may be instances where the standards cannot be applied. Refer to the link in Appendix A, page A-1, Planning and Development Department, or http://www.tmapc.org/Documents/Full_Sub_Regs.pdf.

When the developer is only required to dedicate ROW for half street improvements the WSD will allow water extensions to be constructed in non-standard locations within the half street without a technical appeal. However, WSD will need to approve the location of the

proposed main(s) on a case by case basis.

Contact P&DD for more detailed information describing the development review process. The general phone number is 918-596-2514 or refer to P&DD's website. For website link refer to Appendix A, pages ii and iii.

2. Public Water within all other Easements

- a. General - Easements will only be considered in the following cases:
 1. The project route falls in a future ROW alignment.
 2. A short segment of water main that is not technically feasible to design in the ROW and the proposed alignment results in a more efficient operation of the water system as determined by WSD.
 3. Or as approved by WSD through the Technical Appeal process.

For projects requiring the installation of public water infrastructure within a property owned by the City of Tulsa, a temporary right-of-entry access agreement must be executed prior to construction. Contact WSD to initiate the process during the design review.

- b. Minimum Easement Widths for Water Mains
The minimum widths for water mains with 8-feet of cover or less shall be as shown in Figure 1 as follows:

Figure 1 - Minimum Easement Widths for Water Mains

Main Diameter (inches)	Minimum Easement Width (feet)
12 and less	20
16 to 30	40
Greater than 30	60

- c. For water mains with greater than 8 feet of cover, easement width may be increased on a case by case basis to reflect the required construction and maintenance activities
- d. All appurtenances shall have a contiguous easement/clearance as shown in Figure 2, Minimum Easement/Clearance for Appurtenances. Additional easement may be required.

Figure 2 - Minimum Easement/Clearance for Appurtenances

Appurtenances	Minimum Clearance / Easement
Air Relief	3 feet on all sides
Fire Hydrant	3 feet on all sides
Meters 2 inches and smaller	3 feet on all sides
Meters 3 inches and larger	3 feet on all sides of meter vault
Miscellaneous	6 feet on all sides

3. Encroachments within an Easement

Water easements shall be free of all obstructions and shall at all times be accessible to City service equipment. No buildings, sport courts, swimming pools, fences, shade structures, appurtenances, concrete pads, nor permanent structures of any kind shall be constructed upon, over or under any water easements.

No landscaping shall be placed within an easement that will render the easement inaccessible by equipment. WSD has the right to remove any obstruction without notice to the property owner and all related costs shall be the property owner's responsibility. The maintenance of all landscaping in easements is the responsibility of the property owner or homeowners association thereof and shall be indicated as such in the Conditions, Covenants, and Restrictions (CC&R's). A copy of the CC&R's providing evidence of this maintenance responsibility by the homeowners association or other ownership group shall be submitted to the City of Tulsa, P&DD for verification.

4. Encroachments Adjacent to Existing Water Easements

No buildings or permanent structures will be allowed to encroach on a water easement.

Regardless of the easement width, buildings shall have a sufficient setback from the water pipe such that buildings, building foundations or building slabs will not be undermined or damaged by a water main break or subsequent repair.

If the water easement does not meet the minimum width requirements as shown in Figure 1, Minimum Easement Widths for Water Mains, then clearances shall be as follows:

Water Main

Buildings, building slabs or structures proposed outside of the easement but parallel to a water main within 12 feet, shall be required to submit structural analysis and a geotechnical soil survey report with each signed and sealed by an Oklahoma Registered Professional Engineer. These reports shall be submitted to the City for review and approval. The reports shall verify the integrity of the proposed structure under the condition of a water main failure, as well as verifying that the proposed structure and its foundations will not compromise the structural integrity of the water main.

NOTE: The horizontal distance is measured from the edge of the building foundation to

the outside of the water pipe.

Exceptions:

- Pre-Built/Fabricated Wood Shed-type Structures
- Pre-Built/Fabricated Aluminum Shed-type Structures
- Pre-Built/Fabricated Shade Structures
- Free Standing Barbecue Islands
- Enclosures to Existing Garage/Carport/Patio where the existing concrete slab and roof will not be altered

C. HORIZONTAL AND VERTICAL SEPARATION REQUIREMENTS

To minimize the potential for cross contamination, water mains shall maintain a minimum horizontal and vertical separation from other utilities per ODEQ requirements. Horizontal separation is summarized in Figure 3, Water/Sewer Horizontal Separation Requirement Table, and vertical separation is summarized in Figure 4, Water/Sewer Vertical Separation Requirement Table.

Figure 3 - Water Horizontal Separation Requirement Table

Water Horizontal Separation Requirement (outside to outside)		TYPE OF PARALLEL UTILITY						
		Distribution Water Main	Transmission Water Main	Water Service Connection	Sewer Main	Sewer Service Connection	Dry Utilities	Storm Drains / Culverts & Irrigation
Type of Water Utility	Distribution Water Main	3-ft Minimum	3-ft Minimum	3-ft Minimum	10-ft Minimum	5-ft Minimum	5-ft Minimum	5-ft Minimum
	Transmission Water Main	3-ft Minimum	3-ft Minimum	3-ft Minimum	10-ft Minimum	5-ft Minimum	5-ft Minimum	5-ft Minimum
	Water Service Connection	3-ft Minimum	3-ft Minimum	3-ft Minimum	10-ft Minimum	5-ft Minimum	5-ft Minimum	5-ft Minimum

Note: Clearances are measured from outside of pipe to outside of pipe. Minimum separation and extra protection shall be in accordance with the requirements set forth in ODEQ, or as approved by WSD.

Figure 4 - Water Vertical Separation Requirement Table

Water Vertical Separation Requirement		TYPE OF UTILITY CROSSING						
		Distribution Water Main	Transmission Water Main	Water Service Connection	Sewer Main	Sewer Service Connection	Dry Utilities	Storm Drains / Culverts & Irrigation
Type of Water Utility	Distribution Water Main	1-ft Minimum	2-ft Minimum	6-inch Minimum	2-ft Minimum	2-ft Minimum	2-ft Minimum	2-ft Minimum
	Transmission Water Main	2-ft Minimum	2-ft Minimum	2-ft Minimum	2-ft Minimum	2-ft Minimum	2-ft Minimum	2-ft Minimum
	Water Service Connection	1-ft Minimum	2-ft Minimum	6-inch Minimum	2-ft Minimum	2-ft Minimum	2-ft Minimum	2-ft Minimum

Note: Clearances are measured from outside of pipe to outside of pipe. Minimum separation and extra protection shall be in accordance with the requirements set forth in ODEQ, or as approved by WSD.

1. Separation Requirements from Water Supply System

While no general statement can be made to cover all conditions, it is recognized that sewers shall meet the requirements of the appropriate reviewing agency with respect to minimum distances from public water supply wells or other water supply sources and structures.

All existing and proposed petroleum storage facilities within 200 feet of the proposed water main shall be shown on the plans.

2. Tree Separation Requirements

To protect the public water infrastructure, all trees shall maintain 5 feet minimum, 10 feet preferred, horizontal separation measured from outside of pipe to the tree trunk.

D. SUBMITTALS

1. Design Reports

The objective of a water design report is to verify the design demands of the proposed development. All developments requiring public water main extensions must provide a design reports along with the design plan submittal. The design reports should include the following:

- a. Project Description
 1. Type of land use – e.g., commercial, residential, mixed use
 2. Provide the number of lots or units.
 3. Provide a site map/location of the development showing major streets and physical features such as canals, floodplains, railroads, washes, existing water and sewer infrastructure and any information needed to gain a clear understanding of the project.
 4. Phasing – identify the phase lines if applicable.
- b. Design Flows/Modeling
 1. Design the distribution system to provide a minimum of 45 psi throughout the distribution system under normal operating conditions including peak demand and fire flows where fire protection is provided.
 2. Submit a hydraulic analysis of the system that demonstrates:
 - i. a minimum of 45 psi shall be maintained throughout the distribution system during peak demand, and
 - ii. that flows are calculated at not less than one (1) gallon per minute per service connection.
 3. Size all lines after a hydraulic analysis pursuant to the International Fire Code, published by the International Code Council, Inc., 2015 Edition, Distribution System Requirements for Fire Protection, M 31, published by the AWWA, 3rd

Edition or other recommendations of similar organizations for the fire service area. The minimum main size is 6 inches in diameter.

- i. In all cases, consideration must be given to the average domestic demand simultaneous to any fire-flow event.
4. The engineer shall provide flow calculations and any necessary computer models for the items listed above in order to provide documentation for the basis of design. The engineer shall provide a clear, understandable schematic of the system showing the junction nodes, pipes, etc. for any computer modeling. The engineer shall also provide input data which shows the pipe diameter, pipe lengths, system demands, pipe flows AND output data that show pressures, velocities, head loss, and flow rates.

NOTE: These design parameters supersede the minimum requirements in Chapter IV, Pipe Sizing for Distribution Mains that states the prescribed minimum requirement of 12-inch mains in arterial streets, 8-inch mains in collector streets, and 6-inch mains in local streets in case of conflict regarding design minimums.

c. Environmental Issues

The report shall address potential compliance issues with Clean Water Act Section 404, cultural resources, or any other environmental requirements.

d. Signed/Sealed

The design report shall be signed and sealed by an Oklahoma Registered Professional Civil Engineer.

2. Checklists – Private Development and Capital Improvement Projects (CIP)

All technical and engineering plans relating to CIP and private developer projects subject to the development review process shall be submitted to P&DD or WSD for review and approval. Refer to Chapter II to determine which department is responsible for the plan review.

For preparation of private development and CIP water/sewer main extensions that will become a part of the Tulsa system, refer to the checklists and guidelines available on P&DD and WSD websites. For website links refer to Appendix A, pages A-1.

3. Construction Plans and Technical Specifications

a. Technical Specifications

Signed and sealed technical specifications shall accompany the design plans for the construction of water mains and all other appurtenances. The specifications shall include but not be limited to the following:

1. Specifications for the approved procedures of operation during construction.

2. All construction information not shown on the drawings that is necessary to inform the builder in detail of design requirements for the quality of materials, workmanship and fabrication of the project.
3. Technical specifications shall conform to the ODEQ and COT Standard Specifications.

4. Record Drawings

One Mylar set of construction plans shall be submitted to the inspector as record drawings. The record drawings shall be sealed and signed by an Oklahoma Registered Professional Civil Engineer.

The cover sheet shall show the name, address, and phone number and seal of the Design Engineer and the Engineer certifying "record drawings", stating the following:

"I hereby certify that this "Record Drawing" was made under my supervision or as noted and are correct to the best of my knowledge and belief."

Registered Professional Engineer (Civil)

Date

a. Infrastructure Development Process (IDP)

The developer or his representative must provide the following items for plans to be accepted as record drawings by the Engineering Services Department.

1. Easement and rights-of way shown on the drawings must be shown on a recorded plat or map of dedication. Easements dedicated by separate instruments and described by metes and bounds must be recorded. The Engineering Services Department must receive a full size copy that has been approved by IDP before the City accepts the main for service.
2. Prints must be blacklines on plain background, having dark, clean, crisp, clear line work, symbols, and annotation. These items must be sufficient boldness and size, and be free from background obscuring, so as to be legible and easily read. No shading or tinting is acceptable.
3. Minimum acceptable height for all record drawing lettering is 1/8 inch. Larger lettering is preferred, especially for dimensioning, stationing, size, material, slope, and elevation callouts. Standard bold block lettering is required.
4. All items changed or unchanged must have a bold (AB) lettered next to them. Required, minor as-built changes to the approved plans must be shown clearly by boldly striking through the item changed and placing the as-built information next to or as near as possible to it. All as-built annotation changes must be larger and bolder than the original and free from background obscuring.

Note: This includes abandoned pipe. Must note if abandoned pipe is physically removed from ground or remained in place.

5. The record drawing must indicate the locations of the beginning(s) and end(s) of the construction, and all valves, fire hydrants, pipe fittings, and service connections. Their locations must be shown by stationing and dimensioning from appropriate monument lines or in their absence appropriate lot lines, property lines or easement line references. No dimensioning from points of curvature or tangency is acceptable for record drawing purposes. The drawings must clearly indicate the specific points of reference.

Note: In all cases where the pipe line is constructed within or parallel, in close proximity, with the right-of-way, all stationing and dimensioning must be from the nearest appropriate monument line and monument line intersection tied to City of Tulsa datum is acceptable.

6. The water service stationing shown must be the locations of the taps at the main. Their locations must be measured perpendicular or radial relative to the appropriate right-of-way monument line, easement centerline, or property line intersection. Service tap locations must be indicated by using the following method throughout the plan set.

Stationing in the same general direction along a straight or curvilinear pipe run starting with the nearest appropriate monument line or monument line intersection, or in their absence, appropriate easement line references as noted in Item 5, being designated as Station 0+00. The relative stationing of all monument line intersections occurs along the pipe runs must also be shown. When a monument line intersection occurs along the pipe run, the service tap stationing should again begin with Station 0+00 at the intersection and this process repeated to the end of the pipe run. Do not locate 0+00 at the closed end of a cul-de-sac or similar type street.

Note: When water services are not installed perpendicular to the water main, both the location of the tap at the main and the distance of the meter set from the nearest side property line of the lot must be shown.

7. On phased projects, the phase lines must be clearly shown on the key map and on the plan and profile sheets, and their locations clearly identifiable. Actual pipe end locations relative to phasing lines must be shown by dimensioning or stationing.
8. A complete list of all materials installed and abandoned must be shown on the cover/quantity sheet. The specific size and material type of each pipeline installed must be shown at every construction reference to that pipe. Any changes to the record drawing must be reflected on the materials list.

9. Benchmark(s) location(s) and elevation(s) must be shown on the cover sheet. Only City of Tulsa datum is acceptable.

10. The record drawing must be an approved plan with the approving body's signature.

b. Capital Improvement Project (CIP)

The contractor or his representative must provide the following items for plans to be accepted as redline drawings by the Engineering Services Department.

1. Prints must be redlines on white background, having dark, clean, crisp, clear line work, symbols, and annotation. These items must be sufficient boldness and size, and be free from background obscuring, so as to be legible and easily read. No shading, tinting, or aerial pictures are acceptable.

2. All items changed or unchanged must have a bold (AB) lettered next to them. Required, minor as-built changes to the approved plans must be shown clearly by striking through the item changed and placing the as-built information next to or as near as possible to it. All as-built annotation changes must be red-ink free from background obscuring. Note: This includes abandoned pipe. Must note if abandoned pipe is physically removed from ground or remained in place.

3. The redline drawing must indicate the locations of the beginning(s) and end(s) of the construction, and all valves, fire hydrants, pipe fittings, and service connections. Their locations must be shown by stationing and dimensioning from appropriate monument lines or in their absence appropriate lot lines, property lines or easement line references. No dimensioning from points of curvature or tangency is acceptable for record drawing purposes. The drawings must clearly indicate the specific points of reference.

Note: In all cases where the pipe line is constructed within or parallel, in close proximity, with the right-of-way, all stationing and dimensioning must be from the nearest appropriate monument line and monument line intersection.

4. The water service stationing shown must be the locations of the taps at the main. Their locations must be measured perpendicular or radial relative to the appropriate right-of-way monument line, easement centerline, or property line intersection. Service tap locations must be indicated by using the following method throughout the plan set.

Stationing in the same general direction along a straight or curvilinear pipe run starting with the nearest appropriate monument line or monument line intersection, or in their absence, appropriate easement line references as noted in Item 5, being designated as Station 0+00. The relative stationing of all monument line intersections occurs along the pipe runs must also be shown.

When a monument line intersection occurs along the pipe run, the service tap stationing should again begin with Station 0+00 at the intersection and this process repeated to the end of the pipe run. Do not locate 0+00 at the closed end of a cul-de-sac or similar type street.

Note: When water services are not installed perpendicular to the water main, both the location of the tap at the main and the distance of the meter set from the nearest side property line of the lot must be shown.

5. On phased projects, the phase lines must be clearly shown on the key map and on the plan and profile sheets, and their locations clearly identifiable. Actual pipe end locations relative to phasing lines must be shown by dimensioning or stationing.
6. A complete list of all materials installed and abandoned must be shown on the cover/quantity sheet. The specific size and material type of each pipeline installed must be shown at every construction reference to that pipe. Any changes to the record drawing must be reflected on the materials list.
7. Benchmark(s) location(s) and elevation(s) must be shown on the cover sheet. Only City of Tulsa datum is acceptable.
8. The record drawing must be an approved plan with the approving body's signature.

The engineer or his representative must provide the following items for plans to be accepted as record drawings by the Engineering Services Department.

9. Easement and rights-of way shown on the drawings must be shown on a recorded plat or map of dedication. Easements dedicated by separate instruments and described by metes and bounds must be recorded. The Engineering Services Department must receive a copy that has been approved by IDP before the City accepts the main for service.
10. Prints must be blacklines on plain background, having dark, clean, crisp, clear line work, symbols, and annotation. These items must be sufficient boldness and size, and be free from background obscuring, so as to be legible and easily read. No shading or tinting is acceptable.
11. Minimum acceptable height for all record drawing lettering is 1/8 inch. Larger lettering is preferred, especially for dimensioning, stationing, size, material, slope, and elevation callouts. Standard bold block lettering is required.
12. All items changed or unchanged must have a bold (AB) lettered next to them. Required, minor as-built changes to the approved plans must be shown clearly by boldly striking through the item changed and placing the as-built information

next to or as near as possible to it. All as-built annotation changes must be larger and bolder than the original and free from background obscuring. **Note:** This includes abandoned pipe. Must note if abandoned pipe is physically removed from ground or remained in place.

13. The record drawing must indicate the locations of the beginning(s) and end(s) of the construction, and all valves, fire hydrants, pipe fittings, and service connections. Their locations must be shown by stationing and dimensioning from appropriate monument lines or in their absence appropriate lot lines, property lines or easement line references. No dimensioning from points of curvature or tangency is acceptable for record drawing purposes. The drawings must clearly indicate the specific points of reference.

Note: In all cases where the pipe line is constructed within or parallel, in close proximity, with the right-of-way, all stationing and dimensioning must be from the nearest appropriate monument line and monument line intersection.

14. The water service stationing shown must be the locations of the taps at the main. Their locations must be measured perpendicular or radial relative to the appropriate right-of-way monument line, easement centerline, or property line intersection. Service tap locations must be indicated by using the following method throughout the plan set.

Stationing in the same general direction along a straight or curvilinear pipe run starting with the nearest appropriate monument line or monument line intersection, or in their absence, appropriate easement line references as noted in Item 5, being designated as Station 0+00. The relative stationing of all monument line intersections occurs along the pipe runs must also be shown. When a monument line intersection occurs along the pipe run, the service tap stationing should again begin with Station 0+00 at the intersection and this process repeated to the end of the pipe run. Do not locate 0+00 at the closed end of a cul-de-sac or similar type street.

Note: When water services are not installed perpendicular to the water main, both the location of the tap at the main and the distance of the meter set from the nearest side property line of the lot must be shown.

15. On phased projects, the phase lines must be clearly shown on the key map and on the plan and profile sheets, and their locations clearly identifiable. Actual pipe end locations relative to phasing lines must be shown by dimensioning or stationing.
16. A complete list of all materials installed and abandoned must be shown on the cover/quantity sheet. The specific size and material type of each pipeline installed must be shown at every construction reference to that pipe. Any changes to the record drawing must be reflected on the materials list.

17. Benchmark(s) location(s) and elevation(s) must be shown on the cover sheet. Only City of Tulsa datum is acceptable.
18. The record drawing must be an approved plan with the approving body's signature.

E. WATER DEMAND DESIGN FLOWS

Included in this section are basic water demands flow criteria established by WSD. The minimum water main pipe sizes established in Figure 8, Minimum Water Main Sizing COT Grid System (Chapter IV, Section C), may not always be adequate to meet water demands. For some projects, a detailed analysis of domestic and fire flow demands may be required to properly define requirements for system design.

1. Water Design Demand

The following Figure 5, Water Design Demand, shall be used to calculate water design demand flows utilized in the preparation of engineering design reports, plans, and specifications.

Figure 5 – Water Design Demand

Land Use	Unit	Water Average Daily Demand/Unit (gal)
Single Family Residential	Dwelling	250
Multi-Family	Dwelling	250
Commercial (retail/mall)	1000-sqft	125
Commercial (office)	1000-sqft	115
Warehousing/Big Box Retail	1000-sqft	30
Industrial	1000-sqft	65
Schools	Student	20
Hotel	Room	100
Hospital (all flows)	Bed	300
Landscape Water Requirements		
General Landscaping	Acre	3000
Public Right of Way or Streetscape	Acre	1000

NOTES: The following Italicized notes are for Figure 5, Water Design Demand

Complete design flows are not provided for industrial and hospital facilities because case-by-case evaluation is necessary due to varying water demands observed for these use types. Some industrial uses such as data warehouses, food processing and bottling plants can use more than ten times as much water as compared to warehousing or dry assembly manufacturing with no cooling tower use. Water use in hospitals varies greatly depending upon cooling tower and boiler use, the extent to which the hospital is used as a research and teaching facility, the amount of out-patient versus in-patient services provided, and the types of equipment used. Estimates of anticipated water use must be produced for each new development or major expansion using projections of demands taking into account the following types of categories:

- Water for cooling towers: Cooling towers use can make up more than fifty percent of water demand at industrial facilities having large refrigeration units or cooling of servers. In most cases, cooling towers use twenty to forty percent of the water requirements for industrial operations and hospitals.
- Water used as an input for production: In some manufacturing operations, water is used as an input in the manufacturing process and must be included in demand projections because of the large volumes used. Examples include ice-making, soft-drink or water bottling operations, and food manufacturing such as industrial bakeries.
- Water used in production/activities: In many manufacturing operations water is used for cooling, cleaning, or other operational activities and must be included in demand projections. Examples include metal forming and finishing, semi-conductor wafer production, and aerospace parts manufacturing. Processes employing newer technologies tend to use less water than older technologies, but estimates must be made on a location and process-specific basis. Some medical facilities are now using the newer medical imaging techniques and sterilization processes that use little or no water, while some medical equipment still requires significant amounts of water.
- Bed to space ratios and mix of services: Bed to space ratios and services provided in hospitals can vary greatly. These variations depend upon the proportion of space necessary to provide 24/7 nursing care, full linen service, and full food service to patients staying overnight. Furthermore, some hospitals are highly specialized and focus on particular types of treatment and/or research while others provide general and emergency services only. Water use on a per-square-foot or per-bed-basis can even vary significantly between different parts of hospitals, so large expansions will require an individual analysis.

2. Water Peak Flow

Peak Flow shall equal 200 percent of the average day demand.

NOTE: For clarification, the following example characterizes the calculations performed to determine the design flows and quantities involved in a hypothetical facility.

EXAMPLE: Hypothetical water demand/flow evaluation (not including fire flows).

ASSUME: A 100 dwelling unit multi-family development.

CRITERIA: From Figure 5, Water Design Flows.

Average daily flow = 250 gallons per unit per day (gpupd)

Average total daily flow = 100 x 250 = 25,000 gallons per day (GPD)

Peak daily flow = 25,000 GPD x 2 (peaking factor)

Peak daily flow = 50,000 GPD.

F. WATER ABANDONMENT

1. Abandonment Methods for Existing Water Pipe

There are three approved methods of abandoning water and sewer mains in public ROW and easements:

- a. Total removal of pipe.
- b. Crush pipe in place by mechanical means. This cannot be applied to asbestos cement pipe.
- c. Leave pipe in place and fill with low strength grout or cellulose concrete.
- d. No other methods are acceptable.

G. TAPS AHEAD OF PAVING

1. Water Taps Ahead of Paving

City of Tulsa does not allow new taps ahead of paving unless the property owner can provide a conceptual design report and a site plan demonstrating the appropriate sizing and location of the mains. This applies to connections such as water mains and service taps for fire lines and/or domestic use. The request for taps ahead of paving shall be submitted by the developer through a Water Technical Appeal.

If the City approves the request for taps ahead of paving, and the size or location changes after the installation due to design changes, or for any other reason, it shall be the property owner's responsibility to abandon any unused infrastructure at the property owner's expense.

H. CROSS CONNECTIONS AND BACKFLOW PREVENTION

1. Cross Connection

No physical connection shall be allowed between a potable and a non-potable water supply system. Any such connection is considered a cross connection.

2. Backflow Prevention

To protect the public water system, a backflow preventer shall be installed and located on private property outside of the right-of-way or public utility easement. All maintenance of the backflow preventer is the responsibility of the property owner. Also refer to the City of Tulsa adopted IPC and IFC.

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WATER DISTRIBUTION AND TRANSMISSION SYSTEMS



A. WATER SYSTEM OVERVIEW

1. Pressure Zones

Approximately 9 operating pressure zones serve the municipal water distribution system for the City of Tulsa (COT). These zones operate nominally within a static pressure range between 45 to 135 PSI and provides a minimum of 25 PSI at the customer's meter, which is in accordance with the ODEQ. This 25 PSI minimum applies only if the property elevation at the point of service is within the pressure zone elevation range, otherwise the developer/owner is required to install a private booster facility. With regards to typically high seasonal water demand variations among pressure zones with elevated storage, operating pressure fluctuations are normal. Information on pressure zones serving the various areas of the City can be obtained from the Engineering Services Department (ESD). Figures 6a, 6b, 6c & 6d, Typical Primary Pressure Zone Configuration, schematically shows a major pressure zone representing elevated storage. Not all pressure zones include elevated storage. Therefore, individual development design requirements may vary.

Figure 6a - Primary Pressure Zone Configuration

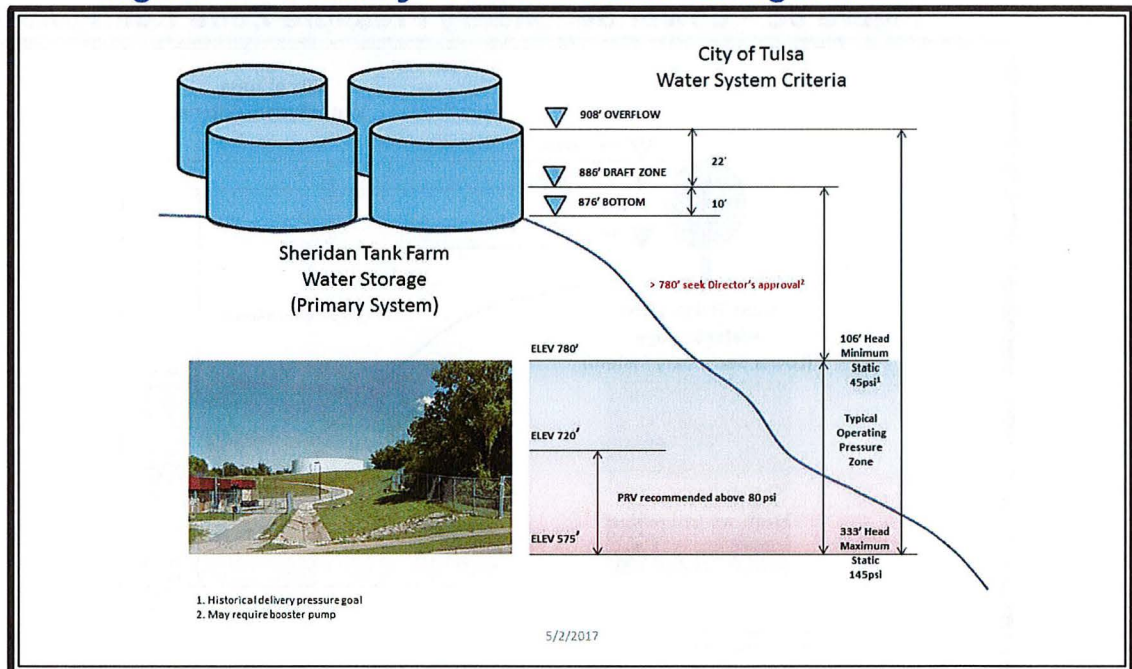


Figure 6b – Upper Secondary Pressure Zone Configuration

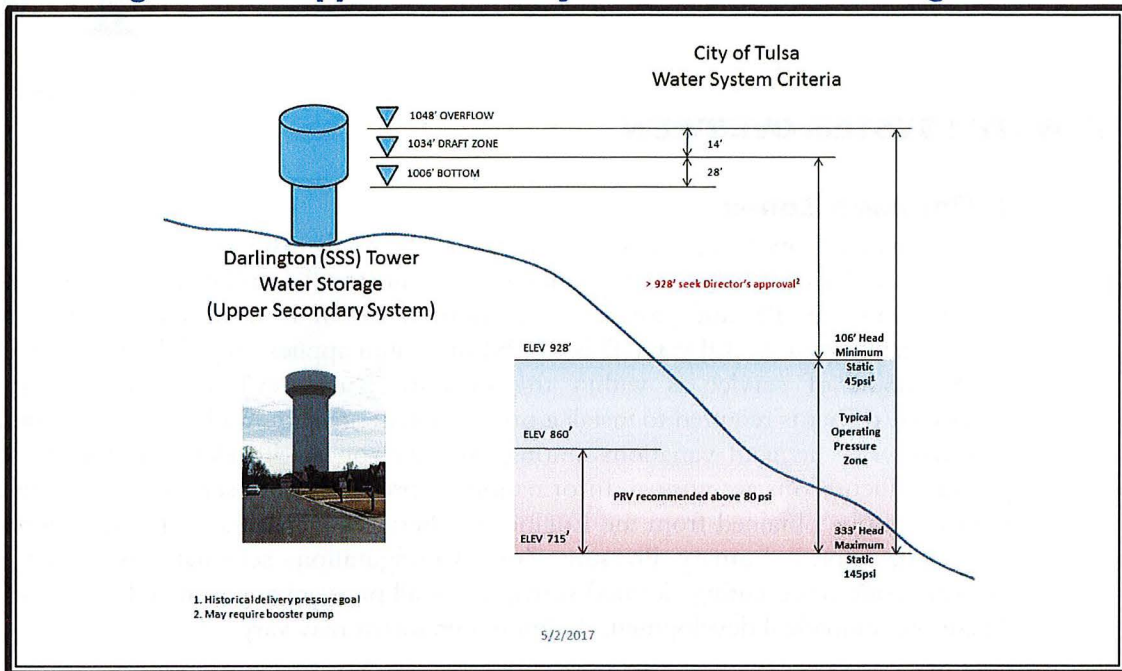


Figure 6c – Lower Secondary Pressure Zone Configuration

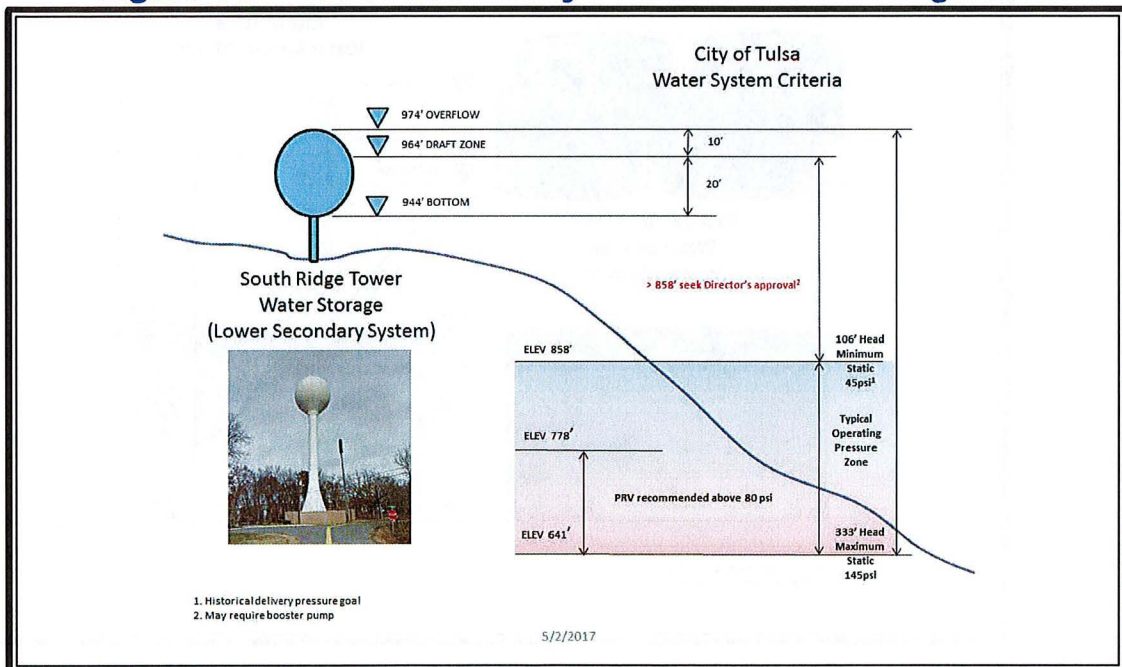


Figure 6d – NW Secondary Pressure Zone Configuration

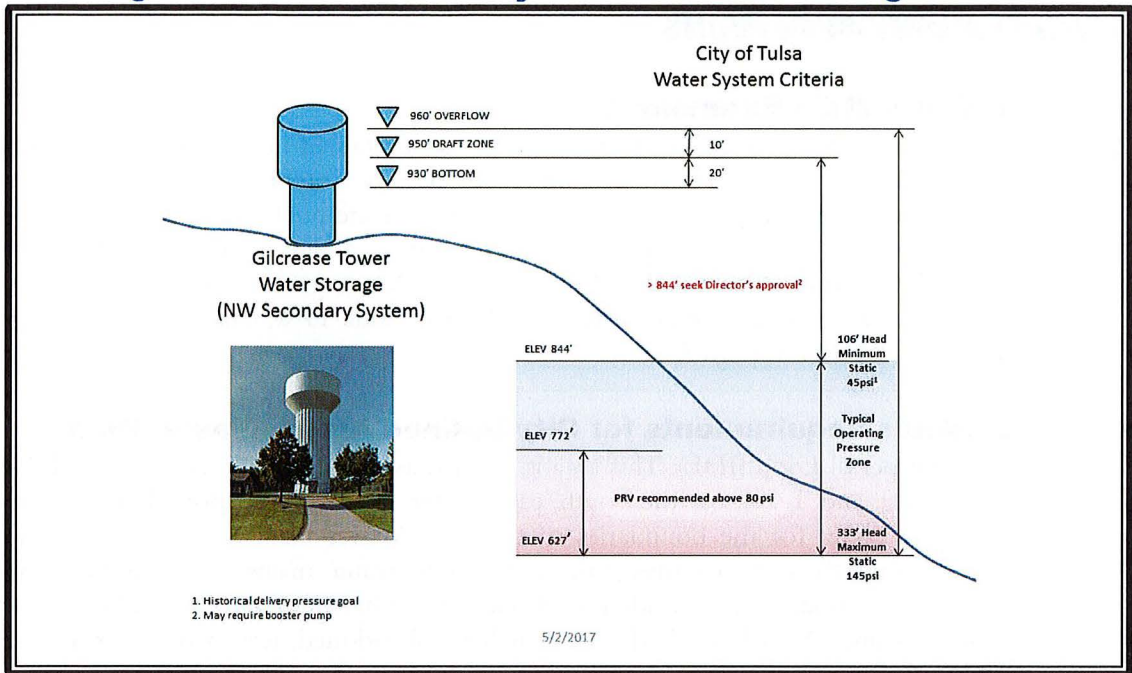
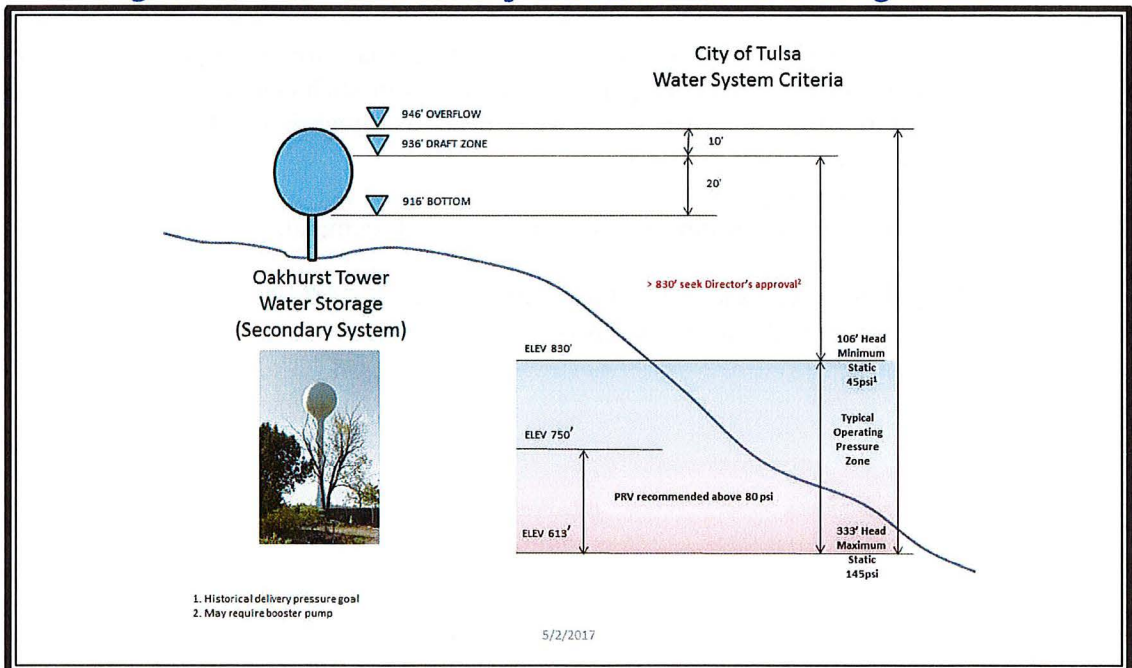


Figure 6f – SW Secondary Pressure Zone Configuration



B. WATER MAIN DESIGN CRITERIA APPLICABLE TO BOTH DISTRIBUTION AND TRANSMISSION MAINS

1. Water Main Extensions

The water main extension policy of the COT is contained in Section 4 of the Subdivision Regulations for the Tulsa Metropolitan Area Planning Commission (TMAPC). As set forth in the Code, if the property is not served by an adequate public water supply, each applicant for a permit for a structure requiring a water supply shall develop the site in accordance with adopted City ordinances (Title 51, Chapter 4). Water extensions shall comply with the requirements established in accordance with TOC Title 11-C, Chapter 10. For website link refer to Appendix A, page A-2.

2. Water Requirements for City Defined Areas (Master Plan)

Inner Dispersal Loop (IDL): This area is defined as Downtown Tulsa between I-244 on the north/west and I-444 on the south/east. Refer to Figure 7, Boundary Map for Inner Dispersal Loop, for the boundaries of the IDL Master Plan. All new developments that occur within these boundaries require 12- inch water mains. Existing mains 6-inch in diameter and smaller are considered substandard within the IDL and shall be replaced with 12-inch mains. All substandard mains shall be abandoned, left in place or as directed by WSD.

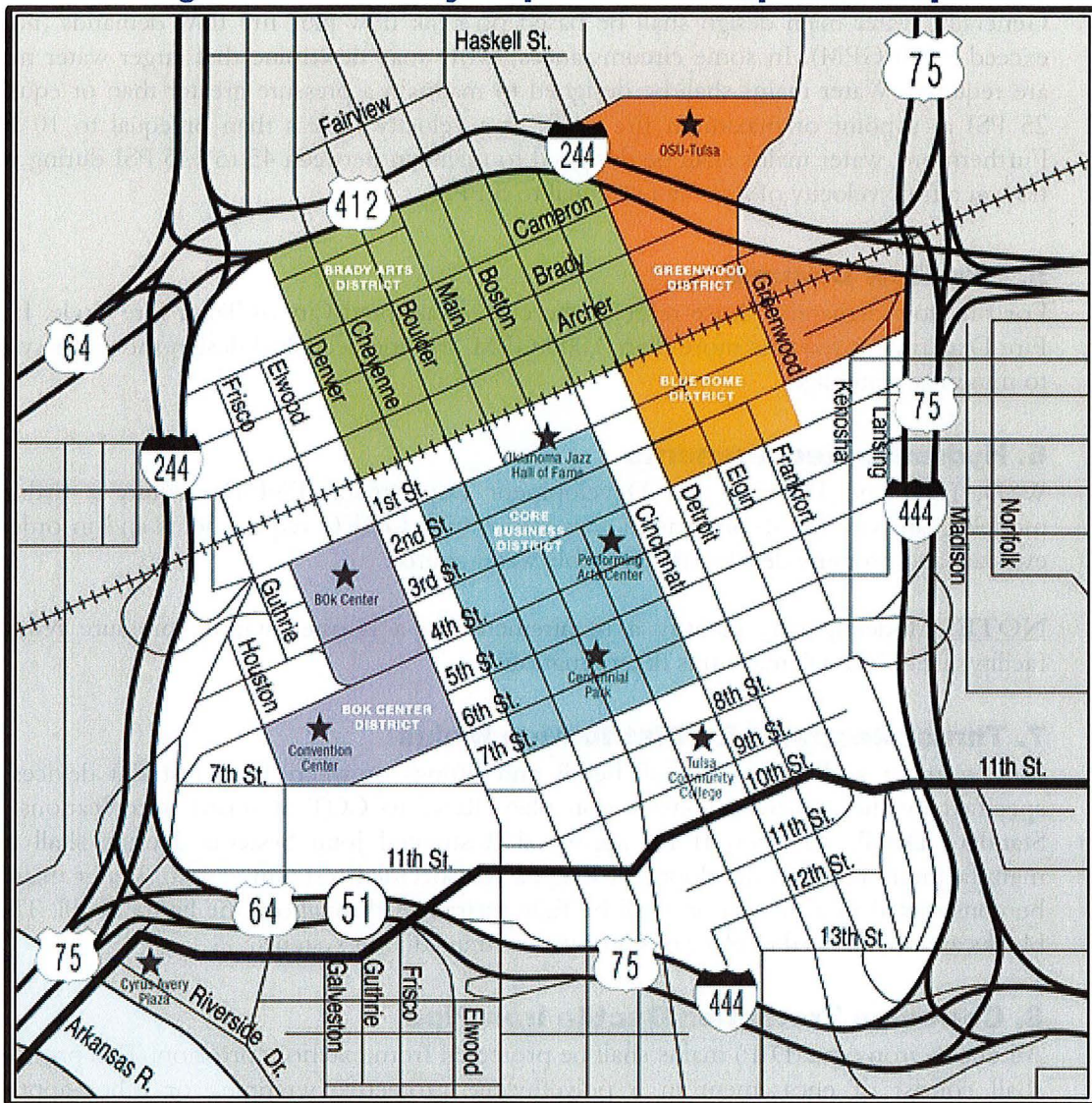
EXCEPTION: Adaptive Reuse Developments

Adaptive reuse projects that are within the IDL may not be required to upsize 6- inch substandard mains. The developer or design engineer shall demonstrate the existing main is capable of meeting the project's total water needs as categorized below:

- a. Domestic water demand.
- b. Fire flow requirements.
- c. Fire sprinkler suppression system (if needed) demand.

***NOTE:** Water mains smaller than 4-inch shall be replaced regardless of the type of project being submitted with the exception of one new single family residence.*

Figure 7 - Boundary Map for Inner Dispersal Loop



3. Water Main Classifications

For the purposes of this manual, all water mains in the COT system that are 16-inches and larger in diameter, are classified as transmission mains. All water mains 12-inches and smaller in diameter are classified as distribution mains. Exception: occasionally water mains 16 inches in diameter can be either depending on the design application. In some cases, development water demands including fire flow may exceed the minimum pipe sized described in Section IV.C.2 below. In the cases where the existing grid is not capable of providing adequate source water, a larger main may be stipulated and then configured as a distribution main. Water and Sewer Department (WSD) and ESD will make this determination.

4. Water Main Design

Generally, water main design shall be based on peak flow plus fire flow demands (not to exceed 3,000 GPM). In some circumstances, WSD may determine that larger water mains are required. Water mains shall be designed to maintain a pressure greater than or equal to 25 PSI at a point of maximum fire draft, at a velocity of less than or equal to 10 FPS. Furthermore, water mains shall be designed to maintain between 45 to 135 PSI during peak flow at a flow velocity of less than or equal to 5 FPS.

5. Fire Flow Demand

For fire flow demands, please refer to the current adopted City of Tulsa Fire Code. If the Fire Department requires more than 3,000 GPM, the engineer shall design the water system to minimize water age.

6. Hydraulic Requirements

WSD, ESD and Planning and Development Department (P&DD) require a hydraulic modeling analysis for all projects in accordance with ODEQ requirements and in order to evaluate and properly develop the available water source.

NOTE: Modeling may identify a requirement for a booster station, pressure reducing facility, etc. WSD will make this determination.

7. Thrust Restraint for Distribution Mains

Joint restraint shall be used at all bends and fittings or where joint restraint devices are specified by the approved construction plan. Refer to COT Standard Specifications and Standard Details, Division II for approved Restrained Joint Systems. Design shall meet manufacturers required development lengths for specified restraint system. Water mains to be constructed in a fill section shall be fully restrained throughout the limits of fill. Thrust blocks are not allowed in place of approved restrained joint systems.

8. Corrosion Protection/Ductile Iron Pipe

All ductile iron pipe (DIP) mains shall be protected from exterior corrosion. This protection shall consist of encasement in a polyethylene protective wrapping or other approved methods.

For more information on corrosivity charts refer to the American Water Works Association.

9. Shop Drawings

For pipe and appurtenances larger than 12-inch, shop drawings and technical data are required for approval. After engineer's review and recommendation, shop drawings shall be submitted to WSD for review and approval. A minimum of six copies of each shop drawing and product data shall be provided.

C. ADDITIONAL DESIGN CRITERIA ONLY APPLICABLE TO DISTRIBUTION MAINS

Distribution mains are 6, 8 or 12-inches in diameter. As described in Chapter IV, Section B, 16-inch mains are occasionally considered distribution mains. No other pipe sizes are allowed to be constructed within the Tulsa water distribution grid. Project designs shall make every effort to loop water mains throughout the development to limit dead ends.

1. Acceptable Pipe Materials

Distribution mains 6-inch through 12-inch in diameter may be ductile iron pipe (DIP), polyvinyl chloride (PVC) or high density polyethylene (HDPE) in accordance with COT Standard Specifications and Standard Details. All pipe located within the right of way limits of arterial roadway as defined in the Tulsa Metropolitan Area Major Street and Highway Plan shall be ductile iron pipe (DIP). For website link refer to Appendix A, page A-2.

2. Pipe Sizing for Distribution Mains

The design engineer shall size all distribution system pipes and appurtenances in accordance with the provisions of this manual. Additionally, the City of Tulsa has established a minimum water distribution master grid system for residential type development as indicated by Figure 8, Minimum Water Main Sizing within COT Grid System. For all other types of development, water mains are sized to meet fire flow requirements or approved master plans, whichever is greater.

Figure 8 - Minimum Water Main Sizing within COT Grid System

Location	Pipe Size (inches)
Section line streets or arterials	12
Mid-section line streets or collectors	8
Local streets (see exceptions below)	6
Inner Dispersal Loop **	12

The following four bullet points refer to Figure 8, Minimum Water Main Sizing within COT Grid System

- ** Refer to Figure 7 for the Boundary Map for Inner Dispersal Loop (IDL).
- Distribution mains that are single-feed (dead-end) systems and include fire hydrants shall be at least 8-inches in diameter.
- A 6-inch diameter distribution main configured as a system with 2 feeds (a looped system) can serve up to 6 fire hydrants. Additional hydrants can be served if the design provides for more feed points. A design analysis may be

required by WSD for acceptance of such a system.

- This is a generalized pipe size guideline, which is subject to refinement in design analysis.

3. Distribution Main Cover

All distribution mains in major streets shall have a minimum cover of 4 feet over the top of the pipe from finished grade. Distribution mains in other locations shall have a minimum cover over the top of the pipe as follows:

- Three (3) feet for distribution mains smaller than 12-inches in diameter, unless located in an easement or major street, where 4 feet will be the minimum required.
- Four (4) feet for distribution mains 12 to 16-inches in diameter.
- If finished grade cannot be identified, increased depth may be required.

4. Line Valves

Figure 9, Valve Spacing, shows the maximum spacing for line valves on distribution mains.

Figure 9 – Distribution Line Valve Spacing

Land Use	Maximum Valve Spacing (feet)
Residential	1,320
Commercial and Industrial	500

In residential developments, valves shall be located so that a maximum of 30 single family dwelling units or a maximum of 5 valves are involved in a waterline shutdown. Additional valves may be required at tapping sleeves and valves and/or tee intersections.

- A valve shall be located on each side of a creek/river crossing, railroad crossing and/or highway/interstate/turnpike crossing.
- Valves shall not be located in curbs, sidewalks, driveways, and valley gutters.
- All valves shall conform to City of Tulsa Standard Specifications and Standard Details Division II.
- Valves shall be located at the point of curvature (PC) or point of tangency (PT) of the curb return at street intersections and aligned with a property or lot line in mid-block.
- Valve boxes and covers shall be provided for all valves.

- f. An additional line valve shall be installed on dead-end lines, exclusive of mains that dead- end in a cul-de-sac, within 20 feet of the end of pipe to remove the necessity of shutting down residences and businesses should the main be extended in the future.

5. Service Connections (taps) and Meters on Distribution Water Mains

- a. New Mains

Where new mains are being installed by a developer, service connections and meter boxes/vaults will be installed by the developer's contractor.

- b. Existing Mains

All new service connections on an existing City water main shall be permitted through P&DD after all fees have been paid. Contact P&DD at 918-596-9456 for more information.

1. When multiple distribution mains in the same pressure zone are adjacent to a development, all service connections shall be taken from the largest diameter main or as approved by WSD through the Technical Appeal process.
2. The service connections shall be limited in size to 50% of the service main diameter. On looped mains there shall be a limited number of service connections comparable to the equivalent existing main capacity. On a dead end main the service connection shall be limited to half that of the looped main. A new water main extension may be required when it has been determined that the existing main capacity has been exceeded.
3. Substandard Mains - (mains smaller than 6-inches in diameter) new service connections will only be allowed for a single family residence on a single lot where adequate fire protection has been verified. Contact a Fire Protection Engineer with the Planning and Development Department to determine fire protection requirements.

- c. Service Connection Requirements

1. **Meter Boxes/Vaults** – All meters shall be installed in a meter box/vault. The meter box/vault shall be located within the public ROW, water easement or PUE. In addition, each meter must be located out of a driveway, paved area or sidewalk. If a meter box must be located in a paved area, a traffic rated meter box and separation pavers or expansion joints around a meter box shall be required. Meters 3-inches and larger require a meter vault. See vault details 525, 526, 527, 528, 529, 530, 531, 532, 533, and 534 in the City of Tulsa Standard Specifications and Standard Details. For

the website link refer to Appendix A, page A-1.

2. **Pipe Material** - Materials and installation for service lines from the main to the meter shall conform to City of Tulsa Standard Specifications and Standard Details, Division II. All service lines for meters 3-inches and larger shall be DIP. Service lines for meters less than 3-inches shall be Type K Copper Tubing. Uponor PEX is permitted in non-arterial right of way for 3/4-inch and 1-inch meters (PEX must be upsized to 1-inch and 1-1/4-inch respectively).
3. **Size** – All new domestic taps on existing or new mains for buildings including all single family residential lots shall be a minimum of 1-inch in size. New 3/4-inch taps may be installed for landscape irrigation or other approved special uses only.

Service connections can only be reduced down one size, e.g., a 2-inch tap can only be reduced to 1-1/2-inch, or 1-1/2-inch reduced to 1-inch or 1-inch to 3/4-inch.

4. **Spacing** – A minimum 1 foot separation (2 foot on same side of pipe) is required between water service connections. Taps are typically placed alternating at 10 o'clock and 2 o'clock.
5. **Static Water Pressure** – Where water pressure within a building exceeds 80 PSI or as per the International Plumbing Code (IPC), an approved water-pressure reducing valve conforming to ASSE 1003 or CSA B356 with strainer shall be installed to reduce the pressure in the building water distribution piping to not greater than 80 PSI static. The pressure reducing valve shall be required on the customer side of the service meter.
6. **Separate Service for Each Demand** - A combination of fire, domestic and landscape meters is prohibited. Each demand requires a separate service connection.
7. **Backflow Preventer** - A backflow prevention assembly may be required.

d. Type of Uses

1. Master Meters - A single service line and a master meter can be used as described below:
 - Two or more buildings located on the same lot (e.g., multi-family, trailer courts or similar projects covering one lot).
 - Developments using master meters must have a separate fire line connection and no more than two meters can be manifolded. If the

property owner wants to use sub-meters beyond the city meter, it will remain as private and shall be the responsibility of the developer/property owner and in accordance with ODEQ.

2. Mixed Use Developments - (residential and commercial) require a separate meter and separate onsite plumbing for each type of use.
3. Landscape - A separate landscape irrigation tap and meter is required for irrigated areas over 10,000 square feet, or 1,000 gallons or more per day.

6. Water Service Sizing Guidelines

IPC Section Appendix E: Water services shall be sized in accordance with the table in Figure 10, Water Service Sizing Guidelines. The columns list the maximum allowable gallons per minute (GPM) and associated water supply fixture units allowed for any given meter size and type. Project designs which exceed the listed GPM unit values shall be upsized to the next larger meter.

Figure 10 - Water Service Sizing Guidelines

Column 1	Column 2	Column 3	Column 4
Meter Size & Description	DE & P&DD Maximum Allowable GPM	Maximum Flush Tank Fixture Tank Units IPC/IRC	Maximum Flush Valve Fixture Units IPC/IRC
5/8" x 3/4"	20	21	7
3/4" x 3/4"	30	53	14
1"	50	129	50
1-1/2"	100	375	245
2"	160	696	625
3" Compound	320	1,955	1,955
4" Compound	500	3,728	3,728
6" Compound	1,000	(1)	(1)
8" Compound	1,600	(1)	(1)

(1) The design of the IPC is limited to 593 GPM maximum

Column 1 identifies meter sizes and types available from the City of Tulsa. Use of water meter 6-inches and larger requires special advance consultation with WSD to determine availability, meter cost, and delivery schedule.

Column 2 is the design water meter flow rate as determined by Development Engineer and P&DD.

Column 3 is the maximum number of fixture units permitted on a water meter when the plumbing fixtures are predominantly flush valve type water closets and urinals. Values based on 2015 International Plumbing Code (IPC), or 2009 International Residential Code (IRC), whichever is applicable.

Column 4 is the maximum number of fixture units permitted on a water meter when the plumbing fixtures are predominantly flush type water closets and urinals, based on 2015 IPC, or 2009 IRC, whichever is applicable.

Turbine (Turbo) water meters are designed to accommodate large demands within a narrow range of fluctuating flow as those associated with industrial type development. These meters are not shown in the table above, but are still available on a case by case basis and their use will be determined by WSD Division in conjunction with P&DD Water Section staff.

D. TRANSMISSION MAINS

1. Acceptable Pipe Materials

Transmission mains 16-inches in diameter shall be ductile iron pipe (DIP). Transmission mains 16- inches through 42-inches in diameter, regardless of location, shall be DIP, concrete cylinder pipe (CCP), or steel cylinder pipe. Mains 48-inches in diameter and larger shall be DIP or CCP. The pipe shall conform to the City of Tulsa Standard Specifications and Standard Details.

NOTE: Service connections will not be allowed on transmission mains.

2. Pipe Sizing

Transmission mains shall be sized to carry the designed peak flow required including fire flow without exceeding the velocities or headlosses shown on Figure 11, Allowable Velocity/Headloss, which shows specific requirements for transmission mains.

Figure 11 - Allowable Velocity/Headloss

Pipe Sizes (inches)	Maximum Allowable Velocity (fps)	Maximum Allowable Headloss (ft/1000 ft)
16	5	6.06
20	5	4.66
24 and larger	5	Varies*

* To be determined by WSD

NOTE: The above table is based on a Hazen-Williams pipe roughness coefficient of C = 120.

3. Cover

Minimum cover from finished grade to the top of the exterior surface of the pipe shall be 4-feet for 16-inch water mains and larger. If finished grade cannot be identified, increased depth may be required.

4. Line Valves

Figure 12, Line Valve Spacing, shows the maximum spacing for line valves on transmission mains.

Figure 12 - Transmission Line Valve Spacing

Pipe Size (inches)	Maximum Spacing (feet)
16 to 30	2,640
Greater than 30	5,280

All valves shall conform to City of Tulsa Standard Specifications and Standard Details.

An isolation valve shall be placed at the main between the water main and each fire hydrant

and a second maintenance valve at the fire hydrant when installed on a transmission main.

Line valves on transmission mains up to 48-inch may be gate valves (vertical or lay-down) or ball valves. Transmission main valves will be reviewed on a case by case basis and approved by ESD and WSD. A typical valve installation is shown in City of Tulsa Standard Specifications and Standard Details.

If WSD requires the installation of electronic monitoring and remote operation equipment, the line valve shall be a butterfly valve with a rectangular vault, housing the valve operator and telemetry equipment. Each installation will require individual details. The design engineer shall check with WSD and ESD on acceptable equipment and the specific design requirements.

5. Restraint Systems

All bends, fittings, line valves, and bulkheads shall be restrained by using a joint restraint system compatible with the type of pipe. ESD will review all restraint systems prior to approval. The length of the restraint system shall be shown on the construction plans and complete supporting data on the restraint system design shall be submitted to ESD for review and approval. Concrete thrust blocks will not be accepted in lieu of restrained joints, but may be used in conjunction with restrained joint systems as approved or required by ESD.

6. Corrosion Protection

Where indicated by soil testing or as directed by ESD, mains shall be protected from exterior corrosion. This protection may consist of encasement in a polyethylene protective wrapping or other approved methods. Refer to the American Water Works Association Corrosivity charts for more information.

7. Side Outlets

Flanged side outlets are provided to integrate parallel or crossing distribution lines. A minimum 12- inch flanged side outlet with a flanged side valve shall be provided at 1,320 foot intervals along the alignment. When connecting a transmission main to a distribution main, a maintenance valve at the connection to the distribution main shall be installed in addition to the flanged side valve from the transmission main. Prior to approval, WSD must review the location of outlets and tie-in connections to any existing or proposed facility including the bulkheads at the end of transmission mains.

8. Bypass Assemblies

Bypass assemblies shall be provided at valves on transmission mains 16-inches and larger in diameter. A typical assembly is shown schematically in COT Standard Specifications and Standard Details.

Bypass assemblies shall be installed a minimum of 150 feet away from any intersection to keep maintenance crews out of traffic.

Transmission mains between valves shall be treated as an independent unit with provisions for dewatering, filling, removing air, and adding air as appropriate for the transmission main construction and maintenance. A bottom tangent flanged outlet shall be provided at all profile low points and a top tangent flanged outlet shall be provided at all profile high points in all transmission mains.

9. Air/Vacuum Valve Assemblies

All air/vacuum valve assemblies for transmission mains require individual approval by WSD and ESD. Air/vacuum relief valve assemblies shall be installed at high points in the transmission main at locations approved by WSD and ESD.

10. Access Outlets for 42-inch Mains and Larger

Access outlet with manhole as shown in COT Standard Specifications and Standard Details shall be installed on 36-inch diameter and larger transmission mains on each side of a line valve and shall not exceed 2,600 feet unless otherwise approved by WSD through the Technical Appeal process.

11. Use of Fire Hydrants and Placement

In water mains 16-inches and larger a fire hydrant shall be placed at the high point and/or low point of the profile to permit air release, de-watering and maintenance purposes when applicable. The bonnets on these hydrants are to be painted black.

12. Testing

Water main testing will be per COT Standard Specifications and Standard Details.

E. FIRE LINE SYSTEMS

A fire line is a private pipe system connected directly to the City water system. All maintenance of the private fire line is the responsibility of the property owner and begins at the detector check/control valve located within the public right-of-way or water easement. A fire line, by the nature of its function and use, is susceptible to backflow. Consequently, it is subject to the requirements for backflow prevention.

A fire line shall be utilized for fire protection only and shall serve only a single property. Typically, a fire line is a connection for on-site private hydrants or an interior fire sprinkler system for a building. WSD's review and approval interest is limited only to that portion to be constructed in the ROW or water easement.

1. Acceptable Pipe Materials

All fire line installations shall conform to the applicable COT Standard Specifications and Standard Details. A fire line sized 4-inch and larger shall be constructed of ductile iron pipe (DIP) from the detector check/control valve at the water main to the property line, backflow prevention device or detector check valve.

2. Design Requirements

All fire line installations shall be approved and permitted collectively by the Fire Department, P&DD, WSD and ESD. Fire lines shall conform to the City Fire Code and the following WSD requirements:

- a. The standard size for fire line connections shall be 4-inches or larger. Fire lines smaller than 4-inches will require a meter. The meter will be installed by city forces after application and will be locked in the open position.
- b. Every fire line shall connect perpendicular to the public water main with a detector check/control valve. Fire lines should not be installed at the end of a dead-end main.
- c. If the Fire Department determines that a fire pump system is needed requiring a redundant water source (i.e. two fire line connections), the water supply shall be provided from multiple water mains serving the same pressure zone. If two water mains are not available and the fire lines shall connect from a single source, WSD and ESD must review the proposed connections prior to P&DD approval.
- d. Backflow prevention devices are required per the City of Tulsa adopted IPC and IFC. The backflow preventer shall be installed on private property and outside of the right-of-way or outside of the public utility easement. For additional requirements on backflow prevention refer to Chapter III.
- e. Properties may require a detector check assembly with a bypass meter assembly when one or more of the following conditions exists or may exist:
 - There are hose connections on the on-site water system other than hose cabinets or racks.
 - There are fire hydrants or yard hydrants on the on-site water system, which are not equipped with a locking device approved by WSD. The keys to such locks shall be delivered to the Fire Department.
 - The on-site water system includes outlets for future connections.
 - The on-site water system allows fire demand flow rates to occur without activating an alarm.
 - There will be an obvious means by which water from the on-site fire system might be used for purposes other than firefighting.

NOTE: The design engineer shall check with P&DD as to the need for a detector check device in these cases.

- f. The public water system typically operates between 45 PSI to 135 PSI and may fluctuate 20 PSI higher or lower than the average system pressure. The fire line shall be designed

to accommodate the increase or decrease of pressure fluctuations.

F. FIRE HYDRANT REQUIREMENTS

Public fire hydrants shall be located where they can be quickly found and easily used by fire engines arriving at an incident. Standardized location criteria is based on predictability, visibility, unobstructed accessibility, the type of development, Fire Department tactical needs, and the expected route fire engines will travel to the site.

Determining proper fire hydrant location requires the application of engineering judgment and common sense to the specific conditions found in each project. Minor variances in the locations or spacing of individual hydrants may be approved provided the functional intent of these design standards is achieved.

1. Location and Design Requirements

- a. Shall be installed in the public right-of-way or a dedicated water easement.
- b. Located on the right hand (passenger) side of streets, intersections, driveways, entrances to a development and fire lanes within 6 feet of the curb. This location matches the hose connections on fire pumpers and allows the hydrant to be connected in the quickest, most efficient manner.
- c. When designing a fire hydrant layout, the first hydrant is to be located at street intersections and at the main entrance into a subdivision, apartment complex or commercial development. Additional hydrants shall then be spaced approximately evenly between these points at a distance not to exceed the maximum spacing between hydrants as shown in Figure 13, Fire Hydrant Spacing. Spacing is measured along the route of travel of a fire engine.
- d. Located not less than 1 foot and not more than 6 feet from the back of curb along streets.
- e. Place hydrant within 30 feet of a dead end water main greater than 100 feet in length to facilitate flushing and maintenance of the water main. However, a fire hydrant and valve may be placed directly at the end of a dead end main only if the hydrant is public and it's apparent that the water main cannot be extended any further, for example in cul-de-sacs or at the end of a water pressure zone.
- f. No hydrant will be required on a cul-de-sac if all houses are within 350 feet of a hydrant and the dead end water main is less than 100 feet. The water main shall end with a tapped cap and a corporation stop, with a valve box and lock as approved by WSD.
- g. Do not obscure or obstruct hydrants behind fences, gates, walls or landscaping.

2. Coverage Requirements

- a. Existing fire hydrants on major streets, collector streets or any other streets not divided by raised median islands can be included in the coverage analysis. If those street classes are divided by raised median islands, then the existing hydrant can only be included in the coverage analysis if it is located on the same side as the new development.
- b. Existing fire hydrants determined to be on a transmission main are intended for air relief, dewatering, and maintenance purposes and can be scheduled out of service periodically. Therefore, these fire hydrants shall not be included in the total count to meet a developer's fire hydrant coverage requirement. The bonnets on these hydrants are painted black.
- c. Fire hydrants separated from a subdivision, building or other development by a continuous fence, wall or other obstruction cannot be counted as providing protection to that subdivision or development. For example, where a residential subdivision is separated from its perimeter street by a continuous fence, fire hydrants shall be installed along the perimeter street and internally along the streets within the subdivision, with hydrant spacing measured along the route of travel of the fire engine, not over the fence.

3. Clearance Requirements

All fire hydrants shall maintain a 3 foot horizontal clearance from any utility and above ground structures.

4. Specification Requirements

All fire hydrants shall be dry barrel type conforming to COT Standard Specifications and Standard Details.

5. Maximum Fire Hydrant Spacing

Figure 13, Fire Hydrant Spacing, shows the maximum spacing for fire hydrants. Spacing distance shall be measured along the centerline of the street or route, which the fire truck will most likely travel.

Fire hydrant spacing requirements apply to all new developments, including those that do not need to install new public water mains. New developments adjacent to existing water infrastructure shall install the necessary hydrants to meet the spacing requirements.

Figure 13 – Fire Hydrant Spacing

Development Type	Maximum Spacing (feet)
Single Family Residential	500
Townhouses and Apartments	300
Commercial and Industrial (including shopping Centers) ¹	300

1. A fire hydrant is required within 400 feet of the most remote building corner or the most remote hazard on site, measured as the hose lays along designated fire lanes or other clear access routes (within 600 feet of the most remote corner of fire sprinkled buildings).

6. Fire Hydrant Relocations

In the design phase of projects, every attempt should be made to locate driveways outside of existing fire hydrant locations. In the event that a hydrant must be relocated, the relocation shall require the existing line and valve be cut and removed from the existing water main and a new section of pipe installed with a coupling. A new fire hydrant service line shall be installed perpendicular to the new hydrant location.

In circumstances where the relocation of the existing hydrant would be 5 feet or less in either side- to-side direction, WSD will allow a 90 degree bend to be placed on the existing hydrant service line and the hydrant to be relocated. Hydrant relocations with a 90 degree bend will only be allowed up to a maximum distance of 5 feet.

7. Private Fire Hydrants

Private hydrants are those hydrants located on private property and/or connected to any water line not owned and maintained by WSD. Private fire hydrants shall have their bonnets painted reflective white to identify them as privately owned and maintained. The property owner is responsible for maintaining all private fire lines and private fire hydrants.

APPEAL PROCESS FOR WATER REQUIREMENTS



A. WSD DIRECTOR'S REPRESENTATIVE INTERPRETATION OF CITY CODE PROCESS

As stated above, City Code cannot be waived and only the Director's Representative has the authority to interpret the Code. It is the responsibility of the applicant to propose to the representative what can be done differently to still meet the intent of the Code. The representative will then discuss the Code requirements with the applicant and determine if what is being proposed still complies with the intent of the Code. At the end of the meeting, the representative will either render a decision, or inform the applicant that it may take up to two weeks to render a decision. If the appeal is denied, the applicant may pursue legal recourse with the Tulsa County Superior Court.

B. PURPOSE OF APPEALS

The purpose of a technical appeal is to provide customers with a description of the City of Tulsa's Planning and Development Department (P&DD), Engineering Services Department (ESD) and Water Services Department (WSD) appeal processes relating to all water requirements.

P&DD, in coordination with ESD & WSD, stipulate water infrastructure requirements for all developments within the City of Tulsa

- If the customer does not agree or cannot meet the stipulations or design standards, they may file a Technical Appeal as described in City of Tulsa Code of Ordinances Title 35 Chapter 8.

C. APPEALS PROCESS (City of Tulsa Code of Ordinances Title 35 Chapter 8)

- A. Initiation of an appeal.** Any person aggrieved by a decision of a code official related to infrastructure development may appeal the decision to the Director. The initiation of such an appeal shall be in writing and shall be filed with the Director or their designee no later than twenty (20) days after the code official's decision was served. The notice of appeal shall:
1. Set forth in detail the precise decision or requirement being appealed;
 2. State precisely why the decision or requirement is in error;
 3. Designate the section(s) of the code, ordinances, statute(s), design standards and manuals or policy which support(s) the appellant's position; and
 4. Be accompanied by a fee as provided in Title 49, Tulsa Revised Ordinances.
- B. Informal review.** Upon receipt of the notice of appeal, the Director shall conduct an informal review to determine if a formal appeal is necessary. Upon finding that an appeal is necessary, the Director shall notify the Chairman of the Board, who shall then proceed in accordance with the Board's rules to schedule the hearing and notify the appellant accordingly.
- C. Board investigation and hearing.** Upon receipt of notice of an appeal from the Director or their designee, the Board shall make such investigation into the complaint which it may deem necessary and hold a hearing upon the appeal.
- D. Notice of hearing.** The Board shall meet upon notice from the chairman within twenty (20) days of being notified by the

Director that an appeal is necessary or at a stated periodic meeting. The Board shall serve written notice of the hearing upon the appellant and upon the person against whom the appeal was filed. The notice shall be served either personally or by certified mail, return receipt requested, at least ten (10) days prior to any scheduled hearing, and shall include:

1. A statement of the date, time, place and nature of the hearing;
2. A statement of the legal authority and jurisdiction under which the hearing is to be held;
3. A reference to the particular section(s) of the code and rules involved;
4. A short, plain statement of the complaint or appeal and a statement of the issues before the Board;
5. A statement that the nature of the proceeding before the Board will be an informal inquiry into the complaint, at which time an opportunity will be afforded for the individual to respond to the allegations in the notice of appeal by the presentation of testimony or documentary evidence; and
6. A statement that the individual has a right to be represented by legal counsel.

E. Board recommendation. At the conclusion of a hearing on an appeal, the Board shall recommend, in writing, to the Director to affirm, modify or reverse the decision of the code official by a concurring vote of a majority of the members attending.

F. Decision of the Director. Within twenty (20) days from receipt of the Board's recommendation, the Director shall decide the matter on appeal. The decision shall be in writing which shall be mailed to the appellant and other interested parties.

G. Enforcement of Director's decision stayed. If any ruling, requirement, decision, or interpretation by the Director is appealed to the City Council, the enforcement of the Director's decision shall automatically be stayed until the Council has rendered a final decision.

H. Appeals to the City Council.

1. Any persons aggrieved by a decision of the Director may perfect an appeal to the City Council by filing a written notice of appeal with the City Clerk and the Director within ten (10) days from the date of the Director's decision. Such notice shall specify the grounds for the appeal. A hearing on the appeal shall be conducted by the Council no later than thirty (30) days from the date the notice of appeal was filed with the City Clerk unless otherwise agreed by appellant.
2. The City Council shall have jurisdiction to affirm, modify or reverse the decision of the Director. Where practical difficulties or an unnecessary hardship will result from the strict application of this code, the Council shall have the power, in a specific case, to grant a variance from any provision, in accordance with the general purpose and intent of the code, so that the public health, safety, convenience, prosperity and general welfare may be secure and substantial justice done. Any such variance shall not be construed as an amendment or general waiver of any provision of this code.
3. Appeal from City Council. Any rulings, requirements, decisions or interpretations of the City Council shall be final and binding upon all parties, provided that any right of appeal to the courts shall not be abrogated.

APPENDIX A



WEB LINKS

The following is a list of useful website links that are references in the design manual and other related items to water.

WATER SERVICES DEPARTMENT'S MAIN WEBSITE

<https://www.cityoftulsa.org/government/departments/water-and-sewer/>

PLANNING AND DEVELOPMENT DEPARTMENT'S MAIN WEBSITE

<https://www.cityoftulsa.org/government/departments/planning-and-development/>

ENGINEERING SERVICES DEPARTMENT'S MAIN WEBSITE

<https://www.cityoftulsa.org/government/departments/engineering-services/>

Standard Specifications

<https://www.cityoftulsa.org/media/1036/standspecs-cover-index.pdf>

<https://www.cityoftulsa.org/media/1037/standspecs-division1.pdf>

<https://www.cityoftulsa.org/media/3129/division2-2-17-17.pdf>

<https://www.cityoftulsa.org/media/1039/standspecs-division3-3-23-15.pdf>

<https://www.cityoftulsa.org/media/1041/standspecs-division5.pdf>

Checklist Requirements for Water Plans

<https://www.cityoftulsa.org/media/1035/checklist-water-5-18-16.pdf>

Engineering Standard Details

<https://www.cityoftulsa.org/government/departments/engineering-services/standard-details-8-x-11/>

<https://www.cityoftulsa.org/government/departments/engineering-services/standard-details-22-x-34/>

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY (ODEQ-Water)

<http://www.deq.state.ok.us/rules/626.pdf>

OKLAHOMA ADMINISTRATIVE CODE (OAC)

Oklahoma Administrative Code (OAC) §252:626

<http://www.oar.state.ok.us/oar/codedoc02.nsf/All/2C77FE07C3279A6D8625803C00533200?OpenDocument>

OKLAHOMA DEPARTMENT OF TRANSPORTATION (ODOT)

https://ok.gov/odot/Doing_Business/Construction/Construction_Engineering_-_Standards,_Specifications,_Materials_and_Testing/index.html

TULSA METROPOLITAN AREA MAJOR STREET AND HIGHWAY PLAN

http://www.incog.org/Mapping_GIS_Resources/Documents/Major%20Street%20&%20Highway%20Plan%20Map.pdf

CITY OF TULSA WATER CHAPTER CODES

Title 51C Building Code
https://www.municode.com/library/ok/tulsa/codes/code_of_ordinances?nodeId=TUCOOR_TIT51BUCO

Chapter 4 ICC International Existing Building Code, 2015 Edition, Adopted
https://www.municode.com/library/ok/tulsa/codes/code_of_ordinances?nodeId=TUCOOR_TIT51BUCO_CH4ICINEXBU CO2015EDAD

Title 11C Waterworks and Sewerage
https://www.municode.com/library/ok/tulsa/codes/code_of_ordinances?nodeId=CD_ORD_TIT11-CWASE

Chapter 3 Water Rates
https://www.municode.com/library/ok/tulsa/codes/code_of_ordinances?nodeId=CD_ORD_TIT11-CWASE_CH3WARA

Chapter 10 Approval of Water Line and Sewer Line Extensions or Improvements
https://www.municode.com/library/ok/tulsa/codes/code_of_ordinances?nodeId=CD_ORD_TIT11-CWASE_CH10APWALISELEXIM

APPENDIX B



DEFINITIONS AND TERMS

Whenever in this manual the following terms are used, the intent and meaning shall be interpreted as follows:

Backfill: Material placed in an excavated space to fill such space. For trenches, this space will be the area from one (1) foot above the top of the pipe or conduit to the existing or proposed finished grade.

Backflow: The flow of water or other liquids, mixtures, gases, or other substances into the distributing pipes of a potable supply of water, from any source or sources other than the City potable water system.

Backflow Prevention Device - Approved: An air-gap, double check valve assembly, reduced pressure principle backflow prevention device or other backflow prevention device or method approved by the Building Official of the City of Tulsa.

Bedding: The material placed in the area from the bottom of the trench to one (1) foot above the top of the pipe or conduit.

Building: Any structure built for the support, shelter or enclosure of persons, animals or movable property.

Building Code: A regulation adopted by the Tulsa City Council establishing minimum standards of construction for the protection of the public health, safety, and welfare in terms of measured performance rather than in terms of rigid specification of materials and methods.

Building Official: The Assistant Director of the Planning and Development Department in charge of the Building Service Branch, or their authorized representative.

Building Sewer: The extension from the building drain to the building connection or other place of disposal.

City: The City of Tulsa

Council: The City of Tulsa City Council.

Cross Connection: Any physical connection or arrangement between two otherwise separate piping systems, one of which contains potable water and the other water of unknown or questionable safety or steam, gas or chemical whereby it is possible there may be a flow from one system to the other, the direction of flow depending on the pressure differential between the two systems.

Developer: Any person engaged in the organizing and financing of an improvement or addition to a water, reclaimed water or wastewater system forming a part of the City of Tulsa systems. A Developer may be a land owner, subdivider or legally constituted improvement district.

Director: The Director of the Water and Sewer Department or the Director's authorized deputy, agent or representative.

Discharge: The disposal of sewage, water or any other liquid or liquid/solids mixture by any sewer user into the sanitary sewer system.

Distribution Mains: Water mains 16-inches and smaller in diameter.

Distribution System: Water mains under 16-inches in diameter together with all appurtenant and necessary valves, fire hydrants, taps, meters, service pipes, and associated materials, property, and equipment receiving potable water from transmission mains and distributing it to individual consumers.

Engineer: The person appointed as City Engineer by the Council or the Board of Supervisors, acting directly or through their duly authorized representative. Also, the design engineer of the improvements, whether or not this person is the City Engineer.

Fire Line: A fire line is a private pipe system connected directly to the City of Tulsa water system. A fire line shall be utilized for fire protection only and shall serve only a single property.

Flag Lots: A single-family detached development with lots having a shared or common access drive between single-family detached lots. Clusters typically have six or eight lots with only one point of access.

Force Main: Wastewater main operating under pressure induced by mechanical pumping.

Irrigation System: An irrigation system is a private pipe system connected directly to the City of Tulsa water system through a metered service connection. An irrigation line is utilized for irrigation only.

Interceptor Sewer: Sanitary sewers 15-inches and larger usually at the lowest elevations in the wastewater system into which tributary sewers discharge. Interceptors usually transport the wastewater to the treatment facilities.

Maintenance: Keeping the water and wastewater works in a state of repair, including expenditures necessary to maintain the capacity and capability for which said works were designed and constructed.

Manhole: A means of access to utilities such as sewer mains for the main purpose of inspection and cleaning.

ODEQ: The Oklahoma Department of Environmental Quality.

Permit: The license to do construction in public rights-of-way and/or easements issued by the City of Tulsa to a Contractor working for another party.

Person: Any individual, partnership, firm, company, corporation, association, joint stock company, trust, state, municipality, Indian tribe, political subdivision of the state or federal governmental agency or any other legal entity, including their legal representatives, agents or assigns.

Plans: All approved drawings or reproductions thereof pertaining to the work and details therefore.

Private Accessway: A private street within a development built to City standards with a homeowners' association established for maintenance primarily for single family residential use.

Private Sewer and Lift Station: A privately owned piping system designed expressly for the purpose of collecting wastewater generated within a private development site and transporting it to the public sanitary sewer system.

Project: A specific coordinated construction or similar undertaking identified by a single project number and bid and awarded as one contract. On occasion two or more projects with multiple project numbers may be bid and awarded as a single contract.

Public Sewer: A sanitary sewer controlled and maintained by the City of Tulsa.

Reclaimed Water: Water that has been treated or processed by a wastewater treatment plant or an on-site wastewater treatment facility.

Relief Sewer: A sewer built to carry the excess flows of an existing sewer with inadequate capacity.

Right-of-way: A general term denoting land, property or interest therein, usually in a strip, acquired for or devoted to a street, highway or other public improvement.

Roadway: The portion of the right-of-way intended primarily for vehicular traffic and including all appurtenant structures and other features necessary for proper drainage and protection. Where curbs exist, it is that portion of roadway between the faces of the curbs.

Service Connection: A private connection to the public water or sewer system. For domestic/landscape water, the meter is the point of connection. For a private fire line, the point of connection is the fire line valve nearest to the public water main.

Sewage: Any liquid or water carried pollutant or waste including industrial discharge, which is introduced into the wastewater system from any dwelling, commercial building, industrial facility or institution together with such inflow as, may be present. Also known as sanitary sewage.

Sewer: A pipe or other conduit that carries wastewater (sewage). Sewers are classified by function rather than size.

Sewer Tap: The wye, saddle or other device placed on a public sewer to receive a building connection.

Shop Drawings: Drawings or reproductions depicting detailing, fabrication and erection of structural elements, false work and forming for structures, fabrication of reinforcing steel, equipment and installation

of such equipment or other supplementary plans or similar data for specified construction that the Contractor is required to submit for approval prior to fabrication, installation or construction.

Sidewalk: That portion of the right of way primarily constructed for the use of pedestrians.

Specifications: The descriptions, directions, provisions, and requirements for performing the work as contained in the Contract Documents.

Standard Details: Uniform detail drawings of structures or devices adopted as Standard Details by the Engineering Department.

Standard Specifications: Uniform general specifications adopted as Standard Specifications by the Engineering Department.

Storm Sewer: A sewer that carries storm runoff, other surface water, street wash, other wash waters or drainage but excludes domestic wastewater and industrial wastes. Also called storm drain.

Street: Streets, avenues, alleys, highways, crossings, lanes, intersections, courts, places, and grounds now open or dedicated or hereafter opened or dedicated to public use and public ways.

Structures: Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, end walls, sewers, service pipes, under drains, foundation drains, fences, swimming pools, and other features, which may be encountered in the work and not otherwise classed.

System Design Capacity: The system capacity for normal operation as established by accepted engineering standards.

Transmission Main: A water main 16-inches and larger in diameter.

Transmission System: The system of water mains generally larger than 16 inches in diameter together with all necessary valves and other equipment required for delivering potable water to the Distribution System.

Utility: Pipe lines, conduits, ducts, transmission mains, overhead or underground wires, railroads, storm drains, sanitary sewers, irrigation facilities, street lighting, traffic signals, and fire alarm systems, and appurtenances of public utilities and those of private industry, businesses or individuals solely for their own use or use of their customers which are operated or maintained in, on, under, over or across public right-of-way or public or private easement.

Water System (Consumer's Potable): That portion of the privately owned potable water system lying between the service connection to the public potable water meter and the point of use. This system includes all pipes, conduits, tanks, receptacles, fixtures, equipment and appurtenances used to produce, convey, store or use potable water. Generally all equipment on the customer's side of the meter.

Wastewater (Sewage): The combination of the liquid and water-carried wastes from residences, commercial buildings, industrial plants and institutions together with any inflow that may be present.

Waterworks System (Water Supply System): The reservoirs, pipelines, wells, pumping equipment, purification works, transmission and distribution mains, service pipes, and all related appliances and appurtenances utilized in the procurement, transportation and delivery of an adequate, safe, and palatable water supply for the City.

Wastewater System: The pipelines, manholes, junction structures, lift stations, force mains, and appurtenances utilized in the collection, transport, and delivery of wastewater (sewage) to wastewater treatment facilities.

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APPENDIX C



ACRONYMS

The following is a listing of primary acronyms used in this manual. All references to documents, manuals, standards or specifications of other agencies or organizations (i.e. AWWA C400) refer to the latest edition or revision thereof unless specifically annotated to the contrary:

AWWA	American Water Works Association
CCP	Concrete Cylinder Pipe
CC&R's	Conditions, Covenants, and Restrictions
CIP	Cast Iron Pipe or Capital Improvement Project or Program
COT	City of Tulsa
DOF	Development Occupation Fees
DIP	Ductile Iron Pipe
ESD	Engineering Services Department
FPS	Feet per Second
FT	Foot or Feet
GIS	Geographical Information System
GPM	Gallons per Minute
GPD	Gallons per Day
HDPE	High Density Polyethylene
IDL	Inter Dispersal Loop
IDP	Infrastructure Development Project
IFC	International Fire Code
IPC	International Plumbing Code
INCOG	Indian Nations Council of Governments
OAC	Oklahoma Administrative Code
OD	Outside Diameter
ODEQ	Oklahoma Department of Environmental Quality
PC	Point of Curvature
PCCP	Pre-stressed Concrete Cylinder (Steel) Pipe
P&DD	Planning and Development Department
PRV	Pressure Regulating or Reducing Valve
PSI	Pounds per Square Inch
PT	Point of Tangency
PVC	Polyvinyl Chloride Pipe
Q	Rate of Flow
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
TCO	Tulsa Code of Ordinances
TMUA	Tulsa Metropolitan Utility Authority
TMAPC	Tulsa Metropolitan Area Planning Commission

UPC Uniform Plumbing Code
VCP Vitrified Clay Pipe
WSD Water Services Department



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