

Article 3 Water

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I. Water System Design

A. General

1. Adoption of Standards by Reference
 - a) The AWWA Standards, The [Ten State Standards](#), and the [Public Services Rules and Regulations](#) shall be followed, except as modified herein.
 - b) All materials that will potentially be in contact with City potable water supply must comply with NSF/ANSI Standard 61 (Drinking Water System Components – Health Effects).
 - c) All plastic pipe and fittings that will potentially be in contact with City potable water supply shall also comply with NSF/ANSI Standard 14 (Plastics Piping System Components and Related Materials).
 - d) The 2015 IFC, or its latest City adopted edition, shall be followed for all fire hydrants and fire appurtenances except as modified herein.
2. Easement Requirements
 - a) All water main easements shall be a minimum of 40 feet in width, with the water main centered in the easement.
 - b) Where a 40-foot easement cannot be provided due to conflicts such as existing structure or natural features, the water main shall be installed in a casing pipe per Article 1 (General Standards), Section XXVI (Casing Pipe) of these Standards. In such case, mains shall be centered in a minimum 20-foot wide easement.
3. Plan Information Required
 - a) Plans shall include all general information required in Article 1 (General Standards), Section III (Content of Plans and Detailed Specifications) of these standards.
 - b) In addition, the following information shall be provided:
 - (1) Plan and profile shall be provided for all water mains and hydrant leads.
 - (2) The pipe material, size, pipe class and lengths between fittings shall be shown and labeled in the water main profile view.

- (3) All water main fittings and appurtenances shall be stationed and labeled in both the plan and profile views.
- (4) Proper trench detail as set forth in Article 12 (Standard Details), SD-TD-1 through SD-TD-5 of these Standards, shall be specified on the profile with a dimension showing the length each trench type is applicable.
- (5) All finished grade elevations of proposed fire hydrants shall be shown and labeled in the plan and profile views.

B. Design Criteria

1. Water Main Location and Required Extension

- a) See Article 5 (Streets), Section I (Street and Pavement Design), B.13., of these Standards, for utility location requirements.
- b) For Private Development Projects, water mains shall be extended to the property limits along all public rights-of-way.
- c) In addition, for Private Development Projects, the City may require additional extensions to other property lines.
- d) Such mains shall be extended by the Developer in like size (or larger as these Standards may require) of those to which the new main connects on adjoining properties.

2. Looping Required

- a) Each Private Development Project shall be either serviced by a double source of water supply ("looped main") or designed to be served by a double source of water supply when adjacent properties are developed, if such design is approved by the PSAA. The location and phasing shall be approved by the PSAA.

3. Terminal Dead-End Water Mains

- a) Terminal dead-end water mains with water service connections are discouraged and will not be allowed without the written approval of the PSAA.

- b) Approval for construction of terminal dead-end mains will only be granted if supporting data is furnished to demonstrate that the "average day demand" for the proposed main will result in a complete turnover of the water in the dead-end main within a 7-day period.
- c) Maximum proposed dead-end main size and length from the looping water main to which it connects must be in accordance with Table A below.

Table A Maximum Hydrant Lead Lengths and Dead-End Main Lengths				
Size of Existing Looped Main to Which Connection of New Hydrant Lead or Dead-end Main is Proposed	Size of Hydrant Lead or Dead-end Main Proposed to Connect to Existing Looped Main	Zoning of the area to be served is R-1 or R-2	Zoning of the Area to be Served is O, CL, CLB, or RE	Zoning of Area to be Served is R-3, R-4, R5, R6, CLA, CLA/R, C2, C3, D1, D2, M1, M2, ORL, PUD, TC-1, or other Zoning Classifications not Listed
8"	8"	600'	325'	100'
10"	8"	600'	475'	250'
12"	8"	600'	500'	290'
	12"	600'	500'	400'
16"	8"	600'	500'	300'
	12"	600'	500'	500'

- d) All dead-end water mains shall terminate with a complete fire hydrant assembly. This will be the only fire hydrant allowed on the dead-end main.

4. Water Main Size

- a) Required minimum size for water mains shall be governed by the underlying zoning classification of the property upon which the mains are being built unless otherwise approved by PSAA.
- b) For R1 and R2 Zoning, the standard minimum diameter of water mains shall be 8-inch where it completes a good gridiron, intersecting at lengths of no more than 1,200 feet.

- c) For all zoning classifications other than R1 or R2, the standard minimum diameter of water mains shall be 12-inch. However, 8-inch diameter mains shall be permitted in the circumstances as set forth in the following Subsections d) through f).
- d) For zoning classifications O, C1, C1B, and RE Zoning, an 8-inch diameter main may be used where the distance between intersecting or looping water mains of larger size is 1,000 feet or less.
- e) For zoning classifications, R3, R4, R5, R6, C1A, C1A/R, C2, C3, D1, D2, M1, M2, ORL, PUD, TC-1, or other zoning classifications not listed, an 8-inch diameter main may be used where the distance between intersecting or looping water mains of larger size is 800 feet or less, and where no major fire service connection (4" or greater) can be anticipated.
- f) Developer may be required by the PSAA to upsize mains from such standard minimum diameters where the City's water model indicates that fire flow will not be adequate.

5. Water Main Depth and Grade Adjustments

- a) Water mains shall be designed and constructed with 5 ½ feet of earth cover.
- b) Where changes in finish grade occur subsequent to installation of water mains, all valve boxes, air-relief boxes, curb stop boxes, hydrants, blow off valves, and other water main appurtenances shall be adjusted to the revised grade by the Developer at their expense.
- c) Where such changes in finish grade will result in a depth of cover of less than 5 feet or more than 6 ½ feet, the water main shall be re-laid by the Developer at their expense to a depth of cover of 5 ½ feet. No service connection will be made until corrective action is taken.

6. Separation Clearances

- a) There shall be a minimum of 10 feet of horizontal clearance and 18 inches of vertical clearance at perpendicular crossings between water mains and sanitary sewers, and between water mains and storm sewers, measured outside edge to outside edge of pipe.

- b) There shall be a minimum of 1 foot of vertical clearance at perpendicular crossings of water mains with utilities other than sanitary sewers or storm sewers.
- c) A minimum of 5 feet of horizontal clearance shall be maintained whenever possible between water mains and utilities other than sanitary sewers or storm sewers, measured outside edge to outside edge of pipe.

7. Water Valves – General

- a) Standard in-line valves shall be resilient seated gate valves in a gate well.
- b) Gate boxes will be permitted with the approval of the PSAA where physical constraints or other extenuating circumstances limit the ability to install a gate well.
- c) For water mains larger than 16-inch diameter, or where special conditions warrant, the PSAA may require a butterfly valve, check valve, or another appurtenance.

8. Water Valve Spacing and Locations

- a) In-line valve spacing, in general, will be regulated by the requirement that in any single case of accident, breakage, or repair, not more than one fire hydrant or the footage of main listed in Sections I.B.8.d) and I.B.8.e) of this Article will be removed from service by the resultant main shutdown.
- b) Exception will be allowed in the case of 12-inch and larger water mains, where not more than two fire hydrants may be out of service for such cause, provided that each such hydrant has a backup hydrant available within 500 feet of each such hydrant via an approved fire route.
- c) For mains 16-inch diameter and larger, consideration may be given by the PSAA to sharing the added cost of additional in-line valves required to accomplish the requirements of Section I.B.8.e) of this Article.
- d) For water mains less than 16-inch in diameter, in-line valves shall be installed so that in any single case of accident, breakage, or repair, an absolute maximum of 800 feet of water main will be removed from service. Within the boundaries of the Downtown Development Authority, this maximum shall be reduced to 500 feet.

- e) For water mains 16-inch or larger in diameter, in-line valves shall be installed so that in any single case of accident, breakage, or repair, an absolute maximum of 1,600 feet of water main will be removed from service.
- f) In order to obtain the maximum benefit from in-line valves and minimize the effect of any single main shutdown on a development or area, the valve spacing design must take into account the location of major building services.
- g) In-line valves shall be spaced such that during a shutdown, a fire service lead will be isolated from the hydrant serving a Fire Department Connection.
- h) Valves shall be installed for all water mains extending into cul-de-sacs or dead ends.
- i) Valves shall be located on the extension of street right-of-way lines at intersections, or if located mid-block or within an easement, shall be located 5 feet from main tees, preferably hydrant tees.
- j) Two valves shall be provided at main line tees and three valves at crosses and 4-leg intersections of water main.

9. Connecting New Water Mains

- a) A wet tap using a tapping sleeve and valve in well is the standard method of connection to connect a maximum size pipe of one standard pipe size smaller than the existing main. A wet tap to connect two mains of equal size is prohibited unless approved or directed by the PSAA.
- b) A dry tap may be used where approved by the PSAA provided the following minimum standards are met:
 - (1) Less than 1,600 feet of main will be taken out of service
 - (2) No research, commercial or industrial customer will suffer a loss of service which would result in the loss of research projects, serious loss of business, or the loss of production
 - (3) The shutdown will not result in an unacceptable loss of transmission capacity within the existing water system
 - (4) PSAA may require that such dry taps take place outside of regular business hours or overnight.

- c) Where a dry tap is proposed, the PSAA may, as a condition of approval, require the use of a line stop or installation of a permanent in-line valve. The cost for this work shall be borne by the Developer and/or Contractor.
- d) Where a dry tap is utilized, a tee fitting and solid sleeve shall be utilized and a gate valve in box or well per Section I.B.7. (Water Valves - General) of this Article shall be installed 5 feet from the tee or at the right-of-way line if so directed by the PSAA.
- e) Where the main to be tapped is a concrete or asbestos cement main, all details of such tap are subject to approval of the PSAA.

10. Fire Hydrant Locations – General

- a) Hydrants shall be located in highly visible and accessible locations.
- b) Hydrants shall be placed such that the total pipe length to the nearest looping main is held to the minimum.
- c) Hydrants shall be installed at street intersections 10 feet back from the extended street right-of-way line, offset from the property line, and set to grade.
- d) Where hydrant spacing standards set forth in Section I.B.11 (Fire Hydrant Spacing and Coverage) of this Article require intermediate hydrants, they shall be placed on the extension of side lot lines.
- e) At intersecting streets where both street rights-of-way are 100 feet or wider and buildings or residences are facing the street, hydrants shall be located alternately on both sides of the intersecting street that does not receive the proposed water main.
- f) The centerline of a hydrant must be between 4 feet and 10 feet from the face of a curb or the edge of a paved area unless otherwise approved by the PSAA.

11. Fire Hydrant Spacing and Coverage

- a) Hydrants are required at all street intersections and at intermediate locations on looping mains so that hydrants are no more than 500 feet apart via public right-of-way or approved fire route.

- b) For Private Development Projects, unless otherwise approved by the Fire Marshal, hydrants shall be located such that all buildings and structures in the development are within a 250-foot radius of a hydrant and the “hose lay” to any external portion of a structure via an approved fire route does not exceed 400 feet. In residential areas zoned R-1 or R-2 the radius requirement is 350-feet and the 400-foot hose-laying requirement does not apply.
- c) An accessible hydrant shall be required within 100 feet of a Fire Department Connection (FDC) via an approved fire route. For residential buildings three stories or less in height and for which an internal sprinkler system is installed under NFPA 13R the maximum separation distance shall be increased to within 150 feet of a FDC.
- d) Hydrants shall be located at least 15 feet from all structures. A larger separation may be required by the Fire Marshal based on the use and type of the structure.
- e) The spacing and coverage outlined in this Section I.B.11. (Fire Hydrant Spacing and Coverage) of this Article are minimum standards. In addition to these requirements, additional hydrants shall be installed as required by the Fire Marshal to comply with the 2015 IFC and any applicable NFPA publications and City Standards.

12. Fire Hydrant Access

- a) Hydrants will be placed such that proper access is not restricted by proposed structures and parking.
- b) A minimum 20-foot wide approved fire-lane shall be provided up to a hydrant.
- c) No parking shall be allowed within 15 feet of each side of a fire hydrant. An exception to parking restrictions may be allowed behind a fire hydrant when the hydrant is located on a landscape island in a parking lot and it does not affect fire access.
- d) A clear space shall be maintained around the circumference of hydrants in compliance with the 2015 IFC.
- e) Fire routes used for access to hydrants shall be provided and maintained for vehicular travel unless otherwise approved by the Fire Marshal.

13. Fire Hydrant Leads and Valve Openings

- a) All hydrant leads shall be minimum 8-inch diameter.
- b) Maximum allowable lead length shall not exceed that shown in Table A of this Article.
- c) All hydrant leads shall be valved at a point 3 feet from the hydrant and a reducer installed per Article 12 (Standard Details), SD-W-1 (Fire Hydrant Assembly) of these Standards.

14. Domestic Water Service Connections

- a) Domestic water service connections to an existing main shall only be permitted where the water main is adequate to serve the required flow for such a connection.
- b) The City must review and approve service sizes before any domestic water service connection is constructed. For all non-single family uses, a design flow calculation shall be required.
- c) The maximum diameter domestic water service connection permitted shall be one standard size smaller than the diameter of the water main to which it connects.
- d) The Owner is responsible for the installation and maintenance of domestic water service connections from the curb stop or service valve to the building.
- e) Domestic water service connections 2-inch diameter or smaller must be installed from the main to the curb stop exclusively by the Public Works Unit.
- f) Where a domestic water service connection to an existing water main is larger than 2-inch diameter:
 - (1) The Owner shall submit a plan showing the proposed service and indicating all pertinent details of the installation to the Engineering Unit for review and approval.

- (2) Where disruption of service caused by future water main shutdowns, water main breaks, or other such occurrence will create an unbearable inconvenience to the customer, the customer should consider installation of water main isolation valves on each side of their service or double service connections.
- g) Such services shall be installed by the Owner's Contractor after obtaining all necessary City permits and approvals.
- h) In Private Development Projects where new water main is to be constructed:
 - i) Domestic water connections 2-inch diameter or smaller will be installed by the Public Works Unit from the main to the curb stop or service valve upon completion of new water main construction, testing, and acceptance, but before street pavement is placed.
 - j) Domestic water service connections larger than 2-inch diameter shall be constructed to within 5 feet of the serviced building by the Developer and shall be tested in conjunction with the water main that is under construction.
 - k) Domestic water service connections, once installed, whether located on public or private property, are the property of the City from the main to service valve or curb stop and shall be maintained by the Public Works Unit.
 - l) Where the water main lies in a public right-of-way, the domestic water service connection shall extend from the water main to a point in the lawn extension between the curb and sidewalk abutting the street, normally 7 feet from the front property line, which shall be the location of the curb stop.
 - m) Where the water main lies in an easement, the domestic water service connection shall extend approximately 5 feet from the main, unless otherwise determined by the City. The service valve or curb stop must lie within the easement outside of a paved area. Where copper service valves fall within a paved area SD-GU-6 shall be followed.
 - n) **Booster Pumps on Domestic Water Services**
 - (1) In the case of tall buildings where marginal pressure requires the use of a booster pump on a domestic service, the pump shall be of the variable speed-constant pressure type except as noted below.

- (2) Fixed speed pumps of not greater than one horsepower are allowed if the PSAA determines the water main development will support such an installation without undue interference with other customers.
- (3) Fixed speed pumps must be equipped with receiver tanks which ensure cycling of not more than 10-15 times per hour. Such tanks shall be equipped with a sight glass to insure against waterlogging and also with a means of adding compressed air.
- (4) All boosted water systems shall include pressure gauges and a low-pressure cut-off switch which will discontinue operation of the boosted system if the pressure of the City water main is lowered 10 psi from its normal static pressure, or to a pressure of 35 psi, whichever pressure is greater.
- (5) A person proposing to use a booster pump shall, prior to installation, submit pump, piping, and installation data to the PSAA for approval.
- (6) Failure to receive approval of a boosted water system prior to use shall constitute grounds for discontinuance of water service by the City.
- (7) Pressure loss resulting from deterioration of an existing service connection shall not be considered justification for installation of a domestic service booster pump.

15. Domestic Water Service Separation

- a) When under a single ownership, separate houses, buildings, living or business quarters on the same parcel may be served at the option of the Owner either through a separate service connection and meter to each or any unit/building, or through a single service connection and meter to the entire parcel.
- b) The responsibility for payment of water charges for all service furnished to multiple units, supplied through a single service connection, must be assumed by the Owner.
- c) Separate parcels shall be supplied through individual service connections and meters.

16. Fire Service Connections

- a) The maximum fire service connection size shall be one standard size smaller than the water main to which it connects.
- b) Fire system water supply must have an in-line check valve and/or fire pump and check valve and must be maintained at a pressure sufficiently greater than system pressure to ensure that the check valve remains closed at all times except in case of fire.
- c) Fire system pressure shall be maintained by use of a metered by-pass booster pump (jockey pump) with appurtenances installed in accordance with Article 12 (Standard Details), SD-MT-2 (Fire Service Metering - Fire Pump System) of these Standards. Alternatively, a metered detector check valve may be used. Fire pumps shall have a low-pressure alarm bell and light, which will indicate when the pressure on the suction side of the fire pump reaches 20 psi or less.
- d) The applicant shall submit for approval to the City, proposed plans and specifications covering the fire service connection, gate valves, check valves, pipes, and appurtenances, along with certified pump curves.
- e) Fire service connections 2-inch diameter or smaller must be installed from the main to the service valve or curb stop exclusively by the Public Works Unit.
- f) Where a fire service connection to an existing water main is larger than 2-inch diameter:
 - (1) The Owner shall submit a plan showing the proposed service and indicating all pertinent details of the installation to the Engineering Unit for review and approval.
 - (2) Where disruption of service caused by future water main shutdowns, water main breaks, or other such occurrence will create an unbearable inconvenience to the customer, the customer should consider installation of water main isolation valves on each side of their service or double service connections.
- g) Such services shall be installed by the Owner's Contractor after obtaining all necessary City permits and approvals.

- h) Plans for all internal fire systems must be reviewed and approved by the Fire and Building Departments.

17. Water Meters

- a) All premises using City water shall be metered.
- b) All domestic services shall be metered with a meter furnished and installed exclusively by the City.
- c) Prior to any meter being set, all water connection related charges must be paid in full according to the latest Public Services Area Schedule of Fees. The meter remains the property of the City.
- d) The City reserves the right to size and to determine the type of meter to be set for each meter installation based on maximum domestic flow rates.
- e) Single-family dwellings and other small buildings being served by a 1-inch diameter water service qualify to receive a $\frac{3}{4}$ " x $\frac{3}{4}$ " short lay length meter.
- f) For premises to be served by a 1 $\frac{1}{4}$ inch diameter or larger service, the builder, plumber, or their agent, shall provide to the City a complete itemized building fixture count and maximum flow rate needed (in gallons per minute) for use in the sizing of the meter and service.
- g) For large diameter non-residential meters, the City offers a meter specifications and requirements packet to assist builders and plumbers and their agents and works to coordinate meter drop off for installation by those parties.
- h) Meter horns and/or meter flanges for 2-inch diameter and smaller meters are required for meter installations. The meter horns and/or meter flanges are available at Customer Service and are to be installed by the plumber prior to requesting the meter installation.
- i) Premises served shall only be allowed one domestic meter per service or a combination of one domestic meter and one water-only meter, except as allowed in Section B. 17. j) of this Article. To assist with their internal billing for multi-family dwellings, Owners may purchase sub-meters which are not read by the City.

- j) Domestic service may be sub-metered only in mixed-use buildings that are under a single ownership and tied to one Parcel ID. In such cases, two City meters may be installed within the same building, one serving residential or multi-family use and the other serving non-residential commercial use. This would include one domestic water service lead from the public main, which would be split inside the building.
- k) Water meters shall be set in basements, utility rooms, or boiler or mechanical rooms. The meter shall be positioned a maximum of 2 feet from the service entrance outside wall and located a minimum of 18 inches to a maximum of 48 inches above the basement or lowest floor.
- l) Unmetered connections or taps are not permitted upstream of the meter assembly.
- m) The meter shall always be set in an easily accessible area that is heated and protected from the weather. The setting of water meters in such areas as crawl spaces and under kitchen sinks, etc., is not considered an easily accessible area.
- n) Nothing shall be stored or placed in the area of the meter which would hinder a meter reader or repair person from walking up to the meter for the purpose of reading, inspecting, repairing, or replacing it. New meter installations shall provide a minimum of 36 inches of clear space in front of the meter. Persons desiring to box-in, finish off, or camouflage the meter installation may do so only with written City approval.
- o) Each water meter installed shall be sealed by the City. No person except a City employee shall break or injure the seal or change the location of, tamper with, alter or interfere in any way with the water meter under penalty of the City Code.
- p) Required routine maintenance or replacement of water meters shall be performed by City personnel. Meters requiring replacement or repairs due to hot water damage, freezing, or vandalism shall be made at the customer's expense.
- q) All new meter installations shall be equipped with a remote readout furnished as part of the service expense.

18. Tracer Wire

- a) A detectable tracer wire adequate for future location efforts shall be installed the entire length of water mains and shall terminate in the gate wells located at each end of the water main installation, or as directed by the City Engineer.
- b) Tracer wire shall be extended to all hydrants, blowoffs, dead ends, and post indicator valves, or as directed by the City Engineer.
- c) Tracer wire terminations shall be located at a maximum spacing of 600 feet, or as directed by the City Engineer. If an additional termination is required, a ground level tracer wire access point shall be installed.

19. Pipe Bursting and Water Main Lining

- a) Pipe bursting and water main lining shall be permitted as rehabilitative techniques only with approval of the PSAA. In such cases, all techniques and materials shall be subject to review and approval.

20. Sacrificial Anodes

- a) Sacrificial anodes shall be placed at the direction of the PSAA when any existing water main is exposed during construction. For 12" and larger water mains, 32 LB anodes shall be used. For under 12" water mains, 17 LB anodes shall be used.

II. Water Materials

A. Water Main Pipes, Joints, and Fittings

1. Allowable Water Main Pipe Materials

- a) Ductile iron pipe conforming to requirements of ANSI/AWWA C151/A21.51 (Ductile-Iron Pipe, Centrifugally Cast). Pipe shall be a minimum of Pressure Class (PC) 350 for 12-inch and smaller, PC 250 for 14-20-inch, and PC 200 for 24-inch or as specified by PSAA.

- b) Polyethylene pressure pipe conforming to requirements of AWWA C906, (Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 65 in. (100 mm Through 1,650 mm) for Waterworks), shall be permitted only for bored applications and if approved by the PSAA. If approved, pipe shall be PE-4710, SDR 11. All pipe shall be Ductile Iron Outside Diameter (DIOD) sized.
- c) Ductile iron pipe crossing under a railroad, river, or interstate highway shall be Special Thickness Class 56.

2. Coatings and Wrapping for Ductile Iron Pipe and Fittings

- a) Ductile iron pipe and fittings shall be manufactured with a cement-mortar lining (cement lined CL) with seal coat conforming to ANSI/AWWA C104/A21.4 (Cement-Mortar Lining for Ductile-Iron Pipe and Fittings).
- b) Ductile iron pipe and fittings shall be coated outside conforming to ANSI/AWWA C151/A21.51 (Ductile-Iron Pipe, Centrifugally Cast).
- c) Ductile iron pipe and fittings shall be wrapped with polyethylene meeting the requirements of ANSI/AWWA C105/A21.5 (Polyethylene Encasement for Ductile-Iron Pipe Systems).

3. Pipe Joints, Joint Restraint, Fittings, and Lubricants

- a) Ductile Iron Pipe
 - (1) Ductile iron pipe joints shall be push-on rubber gasket joints conforming to the requirements of ANSI/AWWA C111/A21.11 (Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings), unless otherwise specified herein.
 - (2) All ductile iron pipe joints for diameters 16 inches and larger shall be restrained push-on rubber gasket joints conforming to the requirements of ANSI/AWWA C111/A21.11 (Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings), unless otherwise specified herein..
 - (3) All ductile iron fittings, of any pipe diameter, shall utilize restrained push-on rubber gasket joints for all ductile iron fittings, unless otherwise specified herein.

- (4) The required length of restrained joint pipe shall be determined using the Ductile Iron Pipe Research Association's Thrust Restraint Design Procedure for Ductile Iron Pipe, or other approved method. A copy of these design calculations shall be submitted with the construction plans. The limits of restrained joints at tie-in locations to existing mains shall meet the required calculated restrained length.
 - (a) Where concrete thrust blocks are required refer to Article 10 (Construction Specifications), Section II. K. (Installation of Water Main) Subsection 5, of these standards.
 - (5) Ductile iron fittings shall conform to requirements of ANSI/AWWA C110/A21.10 (Ductile-Iron and Grey-Iron Fittings), or ANSI/AWWA C153/A21.53 (Ductile-Iron Compact Fittings).
 - (6) Mechanical joints, where required, shall conform to the requirements of ANSI/AWWA C111/A21.11. (Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings). Mechanical joints may be used, subject to approval of Engineer, at tie-in locations to facilitate the constructability and to ensure water-tight joints upon pressurization. Such fittings shall be restrained with a retainer gland and utilize high strength, low alloy, ceramic-filled fluorocarbon resin coated bolts only. The use of retainer glands with set screws is expressly prohibited.
 - (7) For ductile iron river crossing pipe per Section II.A.1.c) (Allowable Water Main Pipe Materials) of this Article, a push-on boltless flexible ball and socket joint with rubber gasket shall be utilized. The joint shall be capable of a 15-degree full turning deflection without separation, leakage, or restriction of the pipe flow. Joint restraint shall be provided by a boltless means that is locked against accidental disengagement of the restraining component.
 - (8) For pipe in contaminated soils, special gaskets such as fluorocarbon or acrylonitrile butadiene gaskets may be required by the PSAA depending on the nature of the contaminant.
- c) Polyethylene pressure pipe
- (1) Polyethylene pressure pipe joints and fittings shall be as recommended by the pipe manufacturer and shall conform to requirements of AWWA C906.

d) Lubricants

- (1) Lubricants used in joints shall be supplied by the pipe manufacturer and such joints shall be coupled in accordance with manufacturer's requirements.

4. Pipe and Fittings Marking

- a) Ductile iron pipe shall be marked in conformance with the requirements of ANSI/AWWA C151/A21.51 (Ductile-Iron Pipe, Centrifugally Cast).
- b) Ductile iron pipe fittings shall be marked in accordance with the requirements of ANSI/AWWA C110/A21.10 (Ductile-Iron and Grey-Iron Fittings) or ANSI/AWWA C153/A21.53 (Ductile-Iron Compact Fittings).
- c) Polyethylene pressure pipe shall be marked in accordance with the requirements of AWWA C906 (Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 65 In. (100 mm Through 1,650 mm) for Waterworks). It must also be marked in accordance with NSF/ANSI Standard 14 (Plastics Piping System Components and Related Materials).

5. Manufacturer's Certification

- a) All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with these Standards.
- b) Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished.
- c) These certificates shall be submitted to the City Engineer and must be pre-approved prior to the start of construction.

6. Materials Handling and Inspection

- a) All pipe furnished shall be subject to inspection on arrival at the job site by the PSAA. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Standards.

- b) The Contractor shall notify the PSAA sufficiently in advance so that an Inspector can be on the job site during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.
- c) Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor without cost to the City.
- d) All pipe shall be stacked on pallets on flat grade and restrained to prevent rolling. The ends of the pipe shall be bagged.
- e) All polyethylene pressure pipe shall be stacked on pallets on flat grade, restrained to prevent rolling, and protected from ultraviolet exposure with light-colored opaque tarps. The ends of the pipe shall be bagged.
- f) All water pipe material shall be subject to rejection for any of the following reasons:
 - (1) Variation in any dimension exceeding the permissible variations given in the material specifications.
 - (2) Any signs of physical damage or poor manufacturing that might render the material unsuitable for its intended use.
 - (3) Variation of more than $\frac{1}{16}$ inch per lineal foot in alignment of pipe intended to be straight.
 - (4) Damaged ends where, in the judgment of the PSAA, such damage would prevent making a satisfactory joint.
 - (5) Improper handling during delivery, unloading, or installation.
- g) In addition to the general grounds for rejection listed in Subsection f) above, ductile iron pipe or fittings shall be subject to rejection for any crack or defect in the lining which, in the opinion of the PSAA, is non-repairable, including but not limited to loose, uneven, or "hollow" lining.
- h) In addition to the general grounds for rejection listed in Subsection f) above, polyethylene pipe and fittings shall be subject to rejection for any scratches, blisters, chips, fractures or cracks.

B. Valves, Boxes, and Gate Wells

1. Resilient wedge gate valves shall conform to requirements of AWWA C509 (Resilient-Seated Gate Valves for Water Supply Service), or C515 (Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service), and shall have an operator for buried service with 2-inch square operating nut, opening right.
2. Joints shall be restrained single gasket push-on joints conforming to the requirements of ANSI/AWWA C111/A21.11 (Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings), unless otherwise specified herein.
3. Where required, butterfly valves and operators shall conform to requirements of AWWA C504 (Rubber-Seated Butterfly Valves), and shall have an operator for buried service with 2-inch square opening nut, operating right.
4. Valve boxes shall be Size D, screw type, 3-piece, 5 ¼ inch shaft with a #6 base for valves 8-inch diameter or less, and a #8 base for valves 12-inch diameter or larger.
5. The word "Water" shall be cast in raised letters on the valve box cover.
6. Curb stop boxes shall be Buffalo type, Size 95E, screw type, 2-piece, 2 ½ inch shaft, extendable from 4 ½ feet to 6 ½ feet.
7. All valves and boxes must be marked, certified, and inspected per Section II.A.4.-6 of this Article.
8. See Article 10 (Construction Specifications), Section II. (Utilities), DD.3. for external chimney seal requirements and specifications for gate wells.

C. Tapping Sleeves and Valves

1. Tapping sleeves and valves shall be designed for water service with a minimum working pressure of 150 psi.
2. Stainless steel tapping sleeves shall conform to ANSI/AWWA C223, (Fabricated Steel and Stainless-Steel Tapping Sleeves). For size-on-size water taps, where approved per Section I.B.9. (Connecting New Water Mains) item d of this Article, sleeve shall be as directed by PSAA.
3. Tapping valves shall meet the requirements for resilient seated gate valves as set forth in Section II.B.1. (Valves, Boxes, and Gate Wells) of this Article and shall have a mechanical joint outlet.

D. Fire Hydrants

1. All fire hydrants shall conform to ANSI/AWWA C502 (Dry Barrel Fire Hydrants), and shall have a minimum working pressure of 250 psig.
2. Hydrants shall have one 3 $\frac{3}{8}$ inch threaded Ann Arbor standard pumper connection with 7 $\frac{1}{2}$ threads per inch and 4.05-inch outside diameter and one 5-inch Storz pumper connection.
3. A 1 $\frac{3}{8}$ inch pentagon operating nut and cap nuts shall be utilized (1 $\frac{3}{8}$ inch point-to-flat at top and 1 $\frac{7}{16}$ inch point-to-flat at base) and shall open left.
4. A breakable traffic flange shall be utilized.
5. All hydrants shall have a 6-inch hydrant valve opening with traffic flange.
6. No barrel drain shall be utilized.
7. Push-on rubber gasket joints conforming to the requirements of ANSI/AWWA C111/A21.11 (Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings), shall be required for fire hydrant assemblies.
8. Hydrants shall be painted red unless separated from the distribution system by an approved backflow prevention device.
9. Depth of bury from finished grade to the bottom of the hydrant lead pipe shall generally be 6 feet but may vary depending on specific conditions.
10. The pumper nozzle shall be 21 inches $\pm$ 3 inches above finished grade.
11. The breakable traffic flange shall be between finished grade and 8 inches above finished grade.
12. Fire hydrant extensions used shall be as furnished by manufacturer.
13. All fire hydrants shall be certified for compliance with NSF/ANSI Standard 61 (Drinking Water System Components – Health Effects).

E. Casing Pipe

1. Casing pipe shall conform to Article 1 (General), Section XXVI (Casing Pipe) of these Standards.

F. Tracer Wire

1. General Requirements

- a) All tracer wire shall have HDPE insulation intended for direct bury, color coded blue per APWA standard.
- b) Direct bury wire connectors shall be 3-way twist-lock or lock-down connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion and shall prevent exposure of uninsulated wire.

2. Access Points

- a) Hydrant access points shall be blue polypropylene two-terminal access points with a jumper connection available for connection to the grounding wire. The access point shall have integral mounting system to a standard hydrant flange bolt and be designed to connect to 1-inch rigid PVC conduit.
- b) Tracer wire ground level access points shall be designed to be installed at grade and consisting of an ABS rigid plastic base with cast iron top section for pavement installation and a total depth of at least 14-inches. Access point shall include a blue locking cover labeled water with pentagon head bolt, integral two-terminal connection with grounding switch and an encapsulated magnet for detection by a ferrous metal detector.

3. Grounding

- a) An 18-inch long magnesium grounding rod with AWG 12 connecting wire shall be installed at all hydrants and ground level access points along the proposed tracer wire. Grounding rod connection shall be made at the identified (or bottom) terminal at all access points

4. Open Trench Application

- a) Tracer wire to be used on open cut pipe shall be AWG No. 12 copper clad steel tracer wire with blue 30 mil HDPE insulation suitable for direct burial installation. Tracer wire shall have a minimum average break load of 450 lbs and minimum conductivity of 21%.

5. Directional Drilling/Boring Application

- a) Tracer wire to be used on directional drill pipe shall be AWG No. 10 extra high strength copper clad steel tracer wire with blue 45 mil HDPE insulation suitable for direct burial installation. Tracer wire shall have a minimum average break load of 2,000 lbs and minimum conductivity of 21%.

6. Pipe Bursting

- a) Tracer wire to be used with pipe bursting shall be 7 x 7 stranded copper clad steel tracer wire with blue 50 mil HDPE insulation suitable for direct burial installation. Tracer wire shall have a minimum average break load of 4,700 lbs and minimum conductivity of 21%.

G. Sacrificial Anodes

- 1. Anodes shall be high potential magnesium anode ingots with packaged backfill. Anode ingot shall meet or exceed ASTM B843, GRADE M1C for high-potential magnesium anodes.
- 2. Anode shall come furnished with minimum 10 feet of coiled #12 AWG solid copper lead wire with TW, THHN or THWN insulation, firmly attached to the galvanized steel core of the anode. The core cavity shall be filled with electrical sealing compound to assure a fully insulated and protected connection. Magnesium anode and backfill shall be pre-packaged into a single unit in a permeable cloth bag.
- 3. Connection of anode lead wire to cast iron or ductile iron pipe or fittings shall be made by the thermite weld method. Thermite weld materials shall consist of wire sleeves, weld mold and weld cartridges according to the weld manufacturer's recommendations for the specific wire and pipe sizes and materials. Weld materials from different manufacturers shall not be interchanged. Weld molds shall be graphite molds. Ceramic "one-shot" molds will not be acceptable.