

WS 12-0491

WATER DISTRIBUTION - CONSTRUCTION SPECIFICATIONS

June 2015 Edition

**THE CITY OF ALCOA, TENNESSEE
PUBLIC WORKS & ENGINEERING DEPARTMENT
WATER AND SEWER SERVICES**

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DIVISION OF WATER RESOURCES
AND IS HEREBY APPROVED FOR CONSTRUCTION BY THE COMMISSIONER

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**Simon deVente, P.E.
Assistant Director/Chief Engineer**



FOREWORD

These specifications have been compiled to assist in the orderly design and construction of Alcoa's water distribution system. Combined with the construction specifications for the wastewater collection and street & drainage systems, documented procedures have been established that will benefit City of Alcoa staff, City Commission, Regional Planning Commission, and other City committees in the construction, operation, and maintenance of the City's infrastructure system. Just as important, these specifications provide a framework for developers, engineers, and others who are involved with the construction of street, drainage, water and sanitary sewer system improvements in private developments.

Any further reference to "the City" shall mean the 'City of Alcoa Public Works & Engineering Department'.

The development of these specifications was a combined effort. The basis for the water system construction standards are the Tennessee Department of Environment and Conservation Regulations and Guidelines and the American Water Works Association (AWWA) Standards. City staff reviewed and modified the requirements to closely fit the practices desired for the City service area. Key staff members involved in that work were:

- Simon deVente, P.E., Assistant Director/Chief Engineer
- **Shane Snoderly, Civil Engineer II**
- Kenneth Hendrix, Public Works Inspector II
- Danny Ogle, Utility Lead Worker
- Gary (Junior) Neeley, Utility Lead Worker
- Mark Ross, Construction Service Supervisor
- Randy Slagle, Utility Lead Worker
- Kenneth D. Wiggins, P.E. Public Works & Engineering Director

The assembly of comments and suggestions from each of these individuals resulted in these Water Distribution – Construction Specifications for the City of Alcoa Public Works & Engineering Department.

REFERENCE INDEX

The purpose of this Reference Index is to catalog by name and address those agencies, associations and others who are referred to in these Standards by their initials.

AASHTO	American Assn. of State Highway and Transportation Officials 444 N. Capitol St., NW http://www.transportation.org/	Washington, DC 20001
ANSI	American National Standards Institute 1819 L Street, NW, Suite 600 http://www.ansi.org/	Washington, DC 20036
ASTM	American Society for Testing and Materials 1916 Race Street http://www.astm.org/	Philadelphia, PA 19103
AWWA	American Water Works Assn. 6666 W. Quincy Ave., http://www.awwa.org	Denver, CO 80235
DIPRA	Ductile Iron Pipe Research Association 245 Riverchase Parkway, E., Suite 0 http://dipra.org/	Birmingham, AL 35244-1856
HI	Hydraulic Institute 30200 Detroit Road http://www.pumps.org/	Cleveland, OH 44145
NFPA	National Fire Protection Association 1 Batterymarch Park http://www.nfpa.org/	Quincy, MA 02169-7471
NSF	National Sanitation Foundation Testing Laboratory, Inc. P.O Box 1468 http://www.nsf.org/	University of Michigan Ann Arbor, MI 48106
TDEC	Tennessee Department of Environment and Conservation Division of Water Resources Tennessee Tower - 2nd Floor http://www.tennessee.gov/environment/water/	312 Rosa L. Parks Ave Nashville, TN 37243-1534
UL	Underwriters Laboratories, Inc. 333 Pfingsten Road http://ul.com/	Northbrook, IL 60062-2096

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**APPENDIX B – Water and Wastewater Construction Specifications – List of Cited Standards
Standard Drawings**

SECTION 1

WATER DISTRIBUTION SYSTEM

1.0 SYSTEM DESIGN

1.0.1 Description of System Layout

The layout of extensions of the City's water distribution system from a design concept, for convenience, will be the circle or belt system circumventing smaller crossover or grid systems.

1.0.2 Pre-Design Conference

Prior to design of extension of water system or service(s), the Engineer / Engineer of Record (hereafter referred to as "the Engineer") should first confer with the City Planner (or the Planner of the appropriate Planning region) in regard to the growth potential and density that may be expected in the general area of the extension being planned. A pre-design conference with the Public Works & Engineering Department's staff shall follow to discuss customer needs, system requirements and standards & specifications as well as any coordination or other issues related to the mains being extended.

1.0.3 Plans and Specifications Approval

- (a) Submittal of construction plans, hydraulic calculations and construction specifications for a proposed extension must be as noted below:
1. Hydraulic calculations must reference flow data or reference storage, static & residual pressure at highest and lowest elevations based on Needed Fire Flow (NFF) in accordance with Section 1.0.5 of these Standards.
 2. Initial submission(s) of plans, calculations, and specifications to the Alcoa Public Works & Engineering Department for approval. Additional review may be required for fire hydrant spacing by the Alcoa Fire Department for extensions within the Alcoa City limits.
 3. After approval by the City, submittals may be made to the Tennessee Department of Environment and Conservation, Division of Water Supply, for approval. Plans must be submitted to TDEC within 30 days of City approval.
 4. A copy of the TDEC-DWR approval letter and two (2) stamped approved sets of drawings must be submitted to the City. Approval shall expire twelve (12) months from the date of the TDEC approval date.
- (b) Each plan sheet shall bear an appropriate title block showing the name of the project, location, owner, engineer, date, scale in feet, true north where applicable, sheet

number, revision date, and other information as may be required. The title block must be located at the bottom or right hand side of the sheet, readable from the bottom or right hand side.

Each sheet shall contain a blank area at least 4 inches by 6 inches near the title block for imprinting the official "Approved for Construction" stamps of the Tennessee Department of Environment and Conservation and the Alcoa Public Works & Engineering Department. Plans shall be clear and shall conform to the requirements of the City Standards. Plans shall be on sheets 24 inches x 36 inches.

(c) Plans of Water Mains:

Plans shall comply with Rules of the Tennessee Board of Examiners for Land Surveyors, Chapter 0820-03 "Standard of Practice" and shall include information as provided in Section 0820-03-.07 (2) "Topographic Surveys". A plot plan of existing and proposed water mains shall be submitted for projects involving substantial additions to the existing water distribution system. The plan shall show the location and size of all proposed water mains. A vicinity map must accompany all water main extension plans. A project layout map showing the entire project shall also be required.

(d) Plan Details:

Plans should have a scale of not more than 100 feet to the inch and must show:

1. Streets and water mains, size of mains, location and size of service lines, material and type of pipe and all appurtenances.
2. Structures both above and known structures below ground which might interfere with the proposed construction, particularly sewer lines, gas mains, storm drains, etc.
3. Easements, lot and right-of-way lines and corners. Provide lot numbers, street names and proposed edges-of-pavement. Do not include pre-existing lot lines, show only those for the proposed build out or phase to be recorded.
4. Proposed water line stationing at 100-foot intervals and locations of all appurtenances by stationing. Use readily identifiable symbology with a legend defining each.
5. Elevations at the beginning, end(s), high point(s) and low point(s) of proposed water lines.
6. Location of maximum and minimum pressure(s). A hydraulic profile may be required.
8. Permanent Bench Mark based on USGS Datum referenced to Tennessee NAD 83 Coordinate System. Additional Bench Marks will be required when the project area exceeds 2000 feet in length.

Other utilities shall be drawn except for clarification or reference and shall be a reduced line weight and/or grey scale color from the design utility.

Residential split service connections are not acceptable. Service connections should be located at the front on the middle or corner of each lot. Manifold connections are allowed for commercial and high density residential only.

- (e) Upon completion of the project prior to sale(s) of individual service(s) and/or obtaining a Certificate of Occupancy (C.O.), the Engineer shall prepare detailed plans to reflect as constructed As-Built. As-Built plans as noted below shall be submitted to the City:
1. Two sets on reproducible sheets (e.g., mylar);
 2. In digital format, AutoCAD (dwg or dxf format) and in PDF format, compatible with the City's mapping system;
 3. Four (4) copies of applicable Operations & Maintenance manuals must be delivered prior to or with the as-builts;
 4. All applicable easement drawings/documents, recorded at the Blount County Register of Deeds' office.

Hand revised or cloud revision construction sheets will not be accepted as As-Builts.

1.0.4 Minimum Distributor Pipe Size

- (a) The minimum size pipe should be 8-inch diameter except for the following instances:
1. 6-inch pipe will be permitted when looped in a grid and no leg of such grid exceeds 600 feet in length.
 2. Dead-end 6-inch lines may be permitted at lengths of 600 feet and less provided the minimum flow requirements of Section 1.0.4 (b) of these Specifications are met, and provided it has been determined by the Alcoa Public Works & Engineering Department that a future need for its extension is unlikely.
 3. Two-inch pipe may be permitted for serving (1) cul-de-sacs having lengths of 300 feet or less and/or (2) certain rural areas of the City's service area provided the Alcoa Public Works & Engineering Department has determined that a future need for its extension is unlikely and that two-inch pipe should be adequate to provide potable water service in the area. No more than 12 services shall be connected to a two-inch line and/or where the last service to be connected to the line does not achieve a minimum 20 psi pressure at the meter.

- (b) The size of pipe shall be justified by hydraulic analysis performed by an engineer who holds a valid license to practice in the State of Tennessee. Distributor pipes should be capable of providing a minimum flow of 750 gallons per minute except in cases (1) of extending 2-inch pipes as provided under Section 1.0.4 (a) of these Standards and/or (2) where there is no need (present or future) for fire protection. The distributor pipe, including any 2-inch pipes, should be designed to maintain a minimum pressure of 30 psi at ground level at all points in the system under all conditions of flow.
- (c) All assumptions and any flow data used by the Engineer must be clearly documented and submitted with the hydraulic calculations. If actual flow data are not available, theoretical calculations shall be based on all storage facilities being half-full and the appropriate Hazen and Williams friction factor shall be applied for the type pipe being used, but in no case shall such friction factor be greater than 130.
- (d) Distributor pipes should be sized for an instantaneous peak demand of 750 gallons per minute except in cases where 2-inch pipe is used as provided for under Section 1.0.4 (a) of these Standards. When using 2-inch pipe, an instantaneous peak demand of (1) 26 gallons per minute or (2) 5 gallons per minute per connection (which ever is greater) shall be assumed.

1.0.5 Fire Protection

- (a) Fire hydrants should not be connected to distributor pipes which are less than 6-inches in diameter and/or are not capable of providing a flow of 750 gallons per minute at a residual pressure of 30 psi.
- (b) When fire protection is being provided, fire hydrants shall be located at points designated by the local fire department. At minimum fire hydrants shall be placed along streets at a spacing of no greater than 750 feet for light residential and 600 feet for congested areas.

Fire hydrants shall be valved as provided in Section 1,1,9 (a) & (b) of these specifications.

- (c) The minimum standards for privately-owned sprinkler service lines shall be the following:
 1. Constructed of the same material(s) specified herein for water mains but subject to applicable prevailing codes and the review and approval of the local fire department.
 2. A check valve or backflow prevention device shall be installed.
 3. A locking drop lid valve box assembly must be provided at the point of service with the public water main.
 4. Fire hydrant(s) and the line(s) serving them on property required by the

responsible Fire Marshall/Fire Department shall become incorporated into the public water distribution system with a recorded easement.

- (d) Fire hydrants should be located a minimum of 2 feet and no greater than 8 feet from the face of curb to the Pumper Nozzle Cap.

1.0.6 Dead Ends

- (a) Dead ends shall be minimized.
- (b) Water lines within residential, commercial, and industrial developments shall be looped within the development and/or extended to the exterior property line(s) where the Alcoa Public Works & Engineering Department has determined that there may be a future need for their extension.
- (c) Water lines within residential, commercial, and industrial developments shall be extended and connected to lines within the existing water distribution system when required to achieve the flow requirements of Section 1.0.4 (b) of these Standards.
- (d) Where dead end distributor pipes occur, they shall be provided with a fire hydrant when fire protection is being provided or an approved blow-off assembly for flushing purposes.

1.0.7 Valves

- (a) Unless otherwise specified by the Public Works & Engineering Department, gate valves shall be placed at all intersections of distributor pipes. A minimum of two valves shall be placed at each tee; one installed in the run and the other installed in the branch. No less than three valves shall be placed at each cross. Valves should be positioned approximately 3 feet distance from the tee or cross.
- (b) Valves at no time shall be placed greater than 3,000 feet apart unless otherwise specified and/or approved by the Public Works & Engineering Department.
- (c) Valves shall be placed on lead-outs approximately 3 feet from fire hydrants except those having lead-outs to be connected to fire hydrant type tees, in which case, the valves may be connected to such fire hydrant tee.
- (d) Butterfly valves maybe used on 12 inch and greater sized lines. Under special circumstances and with prior approval of the City, butterfly valves may be used on smaller diameter lines.

1.0.8 Bends

Bends on water mains shall be minimized. They should be placed in distributor pipes only in making necessary vertical or horizontal changes in pipe direction. Unless the situation requires them, use of $11\frac{1}{4}^{\circ}$ bends shall be minimized and tees shall be instead of 90° bends.

1.1 DETAILS OF DESIGN AND CONSTRUCTION OF DISTRIBUTOR MAINS

1.1.1 Pipe Support

Adequate support shall be provided for all pipes.

1.1.2 Pipe Bedding

Continuous and uniform trench bedding shall be provided for all buried pipe.

1.1.3 Pipe Cover

All distributor mains shall be provided with sufficient earth or other suitable cover to prevent freezing and to provide protection to the pipe. The cover, measured from the top of the pipe, shall not be less than 36 inches for 8-inch and smaller pipe, 42 inches for 10-inch and 12-inch pipe and as greater depth conditions warrant for pipe greater than 12-inches in diameter.

1.1.4 Pipe Alignment

Alignment of pipe shall be as true as practical. When it becomes necessary to deflect pipe alignment, such deflection shall be limited to 5 degrees per pipe joint when using ductile iron pipe. Deflection / curvature of PVC pipe shall comply with the manufacturer's specifications. However, in no case shall the radius of curvature when using 2-inch PVC pipe be less than 50 feet.

1.1.5 Separation of Water Mains and Sewers

- (a) Horizontal Separation: Water mains should be installed at least 10 feet from any existing or proposed sanitary sewer. Should local conditions prevent a lateral separation of 10 feet, a water main may be placed closer to the sewer if 1) it is laid in a separate trench and 2) the elevation of the top of the sewer pipe is at least 18 inches below the bottom of the water pipe.
- (b) Vertical Separation: Whenever a water main must cross a sanitary sewer line, the water main shall be laid at such elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the water main cannot meet the above requirement, the water main shall be (1) relocated to provide the separation or (2) reconstructed with ductile iron pipe for a minimum distance of 10 feet on each side of the sewer. At least one full length of water main should be centered over the sewer so that both joints shall be as far from the sewer as possible.
- (c) When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both the water and sewer mains shall be constructed to water line standards and shall be pressure-tested to assure water tightness.

- (d) Sanitary Sewers:
No water pipe shall pass through or come into contact with any part of a sanitary sewer line or sewer manhole.

1.1.6 Surface Water Crossings

Surface water crossings, both under and over water, present special problems which shall be discussed with the Alcoa Public Works & Engineering Department; the Tennessee Department of Environment and Conservation, Divisions of Water Resources; and the U.S. Army Corps of Engineers before plans are prepared. Should permits be required, the Engineer shall apply for the required permits and submit required fees.

- (a) Above Water Crossings - The pipe shall be:
1. Shall not impair natural and/or flood flow;
 2. Adequately supported;
 3. Protected from damage and freezing;
 4. Installed with valves on either end of the crossing for isolation;
 5. Accessible for repairs and replacement.
- (b) Subsurface Water Crossings:
1. The pipe shall be of special construction, having flexible, watertight joints;
 2. Valves shall be provided at both ends of the water crossing so that the section can be isolated for test or repair; the valves shall be easily accessible and not subject to flooding;
 3. Sampling taps should be available at each end of the crossing;
 4. Permanent taps should be made for testing and locating leaks.

1.1.7 Cross Connections

- (a) There shall be no physical connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contaminating materials may be discharged or drawn into the system unless such connections are protected using a reduced pressure backflow prevention device, air gap, or other approved backflow prevention measure.
- (b) The approval by the City of Alcoa shall be obtained for interconnections between potable water supplies.

- (c) Neither steam condensate nor cooling water from engine jackets or other heat exchange devices shall be returned to the potable water supply.

1.1.8 Water Services and Plumbing

- (a) All Service Lines shall meet AWWA Standards C-800
- (b) Water services and plumbing shall conform to the Standard Plumbing Code as may be revised and adopted from time to time by the City.

1.1.9 Fire Hydrants

- (a) Fire hydrant installations must include an isolation valve located approximately three (3) feet distance from the hydrant.
- (b) Fire Hydrants should be located at minimum of two (2) feet and no greater than eight (8) feet from the face of curb. When curbing does not exist the distance should be a minimum of four (4) feet and no greater than fourteen (14) feet from the edge of pavement.
- (c) When a fire hydrant is installed in an area where damage from vehicles or other motorized equipment is possible, concrete-filled bollards (constructed of ductile iron pipe at least six (6) inches in diameter) shall be installed for protection. **Bollards shall be painted safety yellow and match the paint color of the fire hydrant.** The number and configuration of the bollards shall be approved by the City.

1.1.10 Booster Pump Stations

- (a) Booster pump stations shall be located and controlled in a manner that does not cause negative pressure to occur in any location in the distribution system.
- (b) Pressure in the suction line to the pump station shall be maintained at or above 20 psi and controlled as needed by a pressure sustaining or low-pressure cutoff device.
- (c) The pump station must have at least two (2) pumps, each able to provide ample pumpage to carry the peak demand. Each pump shall have gauges on the suction and discharge sides of the pumps.
- (d) The pump station shall include adequate valves to allow continuous operation, maintenance and repair of the equipment.
- (e) Unless specifically exempted, the design and construction of all booster pump stations shall include:
 - 1. Paved (asphalt or concrete) driveway
 - 2. Minimum 8-foot high 9-gauge chain-link barbed top fence enclosing the site,

3. Minimum 12-foot wide gate for access
 4. Frost-proof hose bib
 5. Security detection installed
 6. SCADA monitoring installed
 7. Underground electrical service as approved by the City.
- (f) SCADA outputs, inputs and controls shall be provided as specified by the Alcoa Public Works & Engineering Department.
 - (g) All electrical equipment shall conform to the latest AIEE and NEMA standards and shall be UL approved.
 - (h) The pump station shall have heating, ventilation, and lighting necessary for the safe and recommended operation of the equipment..
 - (i) The pump station shall have adequate access, safety devices and equipment for the proper maintenance and replacement of equipment.
 - (j) The location of the pump station must be one (1) foot above the highest recorded flood elevation and made accessible at all times.

1.1.11 Underground Vaults & Appurtenances

Underground structures typically used for metering, monitoring, housing of control valve assemblies and other operations shall be traffic rated regardless of location. These structures must meet or exceed ASHTO HS-25 requirements and provide for drainage of rainfall or runoff intrusion. Underground vaults shall include a drain line which day-lights to a non-flooding location or have installed a sump to remove water with a portable pump.

Where the entry point allows for elevation adjustment, concrete or manufactured polymer grade rings shall be allowed. Concrete grade ring wall thickness shall be a minimum of 5 inches. Grade rings shall not be greater than 9 inches in height. The combined height of stacked grade rings shall be a maximum of 12 inches. Polymer grade rings must be installed with a sealing agent to eliminate leakage

1.1.12 Easements

Easements are required when lines are installed within property not considered public domain or right-of-way. When this occurs area is needed to provide access to conduct maintenance on the utility lines. Plans must show a delineation of this access by the use of easements. Easements must be acquired and recorded in the Register of Deeds Office prior to final approval of plans by the City. A letter of intent and agreement to conditions must be provided

with the property owner's signature.

Easement widths vary with depth of the utility line due to the necessary working space to avoid structural damage and to safely access and maintain the lines. The following are guides to easement widths:

TABLE 1.1.12.1		
Depth of Line	Width	Distance from Centerline
Minimum to 5 Feet	10 Feet	5.0 Feet
5 Feet to 15 Feet	15 Feet	7.5 Feet
Greater than 15 Feet	Special Case Design	

1.2 PRODUCTS

1.2.1 General

- (a) All products shall be NSF and AWWA approved for use in potable water systems.
- (b) Packing and jointing materials used in the joints of pipe shall meet the Standards of the American Water Works Association. Either mechanical joints or slip-on joints with rubber gaskets are required for pipe.
- (c) Unless previously approved all materials used in the construction **should** be new materials manufactured no earlier than one year prior to the current year. When project material is stored long-term prior to use, it must be done to manufacturer's requirements, in a way to prevent contamination and is subject to rejection due to **damage**, mishandling and improper storage.
- (d) All materials must be approved by the City per Section 1.3.1(d) of these construction specifications.
- (e) Manufacturers may be excluded from use due to non-performance or other material quality issues; the manufacturer shall be notified in writing and a period of performance review shall be conducted by the City. Reinstatement is the burden of the manufacturer who must provide assurances, a quality improvement plan and extended **suitable** warranty on all supplied materials in writing
- (f) All materials shall be manufactured and assembled in the U.S.A. (domestic) or under **U.S. standards (non-domestic) as provided by but not limited to the agencies listed in the reference index of these specifications. Manufacturers of non-domestic materials shall supply documentation/certification of quality control procedures and meeting required standards herein. Submittals for all materials shall be supplied by the material manufacturer and must show or disclose adherence to required standards within these specifications; additionally manufacturers of materials shall include the name and address of the point of manufacturing. When a manufacturer supplies both domestic and non-domestic manufactured materials, domestic manufactured materials are the preferred source by the City.**
- (g) Ductile iron pipe and fittings, unless otherwise specified herein, shall be manufactured by American Cast Iron, U.S. Pipe, Griffin, McWane Pipe, Clow, or approved equal. Mechanical joint, plain-end, and other ductile iron or cast iron fitting specified herein shall be manufactured by American Cast Iron, U. S. Pipe, Griffin, McWane Pipe, Tyler Union, Sigma, Clow, or approved equal.
- (h) Restrained joint fittings may be required in certain applications / installation conditions.

1.2.2 Pipe

- (a) Except as noted below, pipe having a diameter of six (6) inches or greater shall be of ductile iron meeting the latest requirements of AWWA Standards C150 and C-151. Pipe shall be minimum Class 50 thickness, cement-mortar lined meeting the latest requirements of AWWA Standard C-104 and NFPA 13 for fire protection, with either mechanical joints or slip-on joints with rubber gaskets. Class 200 C900 PVC pipe may be approved for use as four- (4-), six- (6-), and/or eight-(8-)inch water lines where (1) systems static pressure is 100 psi or less and (2) the water line is not located in close proximity to a booster pump station.
- (b) PVC pipe having a diameter of two (2) inches, when permitted to be used under Section 1.0.4 (a) of these Standards, shall be SDR-21, Class 200 pressure rated and may be used where the working pressure does not exceed 135 psi. The pipe must meet the requirements set forth in ASTM Standard D2241 for 2-inch through 12-inch pipe designated SDR-21. The pipe must bear the National Sanitation Foundation Testing Laboratories, Inc. seal of approval for potable water or an approved equal.
- (c) High density polyethylene (HDPE) pipe may be used when directional drilling is approved for installation of a water main six (6) inches or greater. HDPE Pipe shall meet the requirements of AWWA Standard C906 & ASTM D3350 for 200 psi pressure class rating. Approved pipe shall have a standard designation code of PE4710 and shall be DR 11 or greater. Pipe must bear material code, dimension ratio, pressure class and production date. Pipe shall be for potable water and NSF 61 approved.
- (d) Except for special installations, pipe shall be bell-end type.
- (e) Gaskets and lubricants intended for use with PVC pipe shall be made from materials that are compatible with the plastic material and with each other when used together. Gaskets shall meet all applicable AWWA Standards and NSF 61 approval. Gaskets shall be the elastomeric type and shall be manufactured to conform to the requirements of ASTM F477.
- (f) Solvent cemented joints in the field are not permitted.
- (g) Pipe lengths shall be no greater than 20 feet.

1.2.3 Tees, Crosses and Bends

- (a) Tees, crosses, and bends for use with ductile iron and PVC pipe shall be cement-mortar lined, all mechanical joint.
- (b) Tees, crosses, and bends for use with ductile iron and PVC pipe shall be either 250 psi pressure rating cast iron meeting the latest requirements of AWWA Standard C-110 or 350 psi pressure rating ductile iron meeting the latest requirements of AWWA Standard C-153.

- (c) Bends for use with 2-inch PVC pipe shall be bell-type, factory welded and shall meet the requirements for bells of pipe as set forth in ASTM Standard D2241 for 2-inch through 12-inch pipe designated SDR-21.
- (d) Mechanical joint locked hydrant tees or tapping tees may be permitted.

1.2.4 Reducers

- (a) Reducers for use with ductile iron and PVC pipe shall be cement-mortar lined mechanical joint.
- (b) Reducers for use with ductile iron and PVC pipe shall be either 250 psi rating cast iron meeting the latest requirements of AWWA Standard C-110 or 350 psi rating ductile iron meeting the latest requirements of AWWA Standard C-153.
- (c) Reducers for transition from 6-inch or larger pipe to 2-inch PVC pipe shall be accomplished by use of a mechanical joint plug which has been provided with a 2-inch tap. A 2-inch bell and 2-inch NPT PVC transition fitting meeting the requirements as set forth in ASTM Standard D2241 for 2-inch through 12-inch pipe designated SDR-21 connected to the tapped plug will effect an approved reduction.

1.2.5 Caps and Plugs

- (a) Caps and plugs for use with ductile iron and PVC pipe shall be mechanical joint except for slip-on type plugs which shall be restrained type, with cast lugs and furnished with a minimum of four restraining cap screws.
- (b) Mechanical joint caps and plugs shall be either 250 psi pressure rating cast iron meeting the latest requirements of AWWA Standard C-110, or 350 psi rating ductile iron meeting the latest requirements of AWWA Standard C-153.
- (c) Caps for 2-inch PVC pipe may be fabricated by using a 2-inch galvanized NPT cap and a 2-inch PVC plain end and 2-inch NPT transition fitting meeting the requirements as set forth in ASTM Standard D2241 for 2-inch through 12-inch pipe designated SDR-21.

1.2.6 Sleeves

- (a) Sleeves for use in connecting ductile iron or PVC pipe shall be mechanical joint.
- (b) Sleeves shall be 250-psi pressure rating cast iron meeting the latest requirements of AWWA Standard C-110 or 350 psi pressure rating ductile iron meeting the latest AWWA Standard C-153.
- (c) Approved manufacturers are American, Ford, Smith-Blair & U.S. Pipe. Other

manufacturers are subject to approval by the City and must show testing in accordance with and adherence to AWWA and Factory Mutual standards.

1.2.7 Valves

- (a) Gate valves shall be mechanical joint, resilient-seat type, iron body, non-rising stem, "O"-ring, stem seal type, 2-inch square operating nut, open counter- clockwise.
- (b) Gate valves shall meet the latest requirements of AWWA Standard C-509 or C-515. Butterfly valves shall meet the latest requirements of AWWA Standard C-504.
- (c) Gate valve pressure ratings shall be 200 psig.
- (d) Gate valves meeting the latest requirement of AWWA Standard C-509 shall be either Mueller Company, Model A-2360; U.S. Pipe & Foundry Company, Model No. 5460; McWane Pipe and Foundry, Model F-6100; Clow Company, Model Number 5065; Waterous Company, Series 500; M & H Company, Model 3067-01; and American Cast Iron Company, American Darling, or any succeeding Model numbers, or approved equal.
- (e) Rubber-seated butterfly valves meeting the latest requirements of AWWA Standard C-504 will be acceptable for use on 12-inch or greater pipe. Rubber-seated butterfly valves shall be open counterclockwise, furnished with a 2-inch operating nut, mechanical joint type, Class 150-B.
- (f) Butterfly valves specified herein shall be manufactured by American Flow Control, Pratt, Mueller, DeZurik or approved equal.

1.2.8 Valve Boxes

- (a) Valve boxes shall be the two-piece Buffalo screw type, 5-1/4-inch diameter shaft, capable of extending from valve stuffing box to ground surface, constructed of cast iron and compliant with ASTM A48 requirements.
- (b) Valve box lids shall be provided with the word "WATER" embossed in the lid surface. Lids shall be compatible with the box lid receptacle. Lids shall include a skirt of at least 1-1/2 inches and weigh no less than 12 pounds. Where valve boxes are installed in public streets / roads having a classification of major collector or greater, lids shall have a skirt of at least 2-1/2 inches and weigh no less than 15 pounds.
- (c) The assembled valve box weight (including lid w/ 1-1/2 inch skirt) shall be no less than 60 pounds for 18-inch to 24-inch extension; 80 pounds for 24-inch to 36-inch extension; 90 pounds for 36-inch to 48-inch extension.
- (d) Shop drawings of valve boxes shall be submitted to the Alcoa Public Works & Engineering Department for approval.

- (e) Valve boxes installed in grassed or landscaped areas shall be set in a 4-inch pad of concrete, approximately 24" x 24" square. Precast concrete pads may be used if reviewed and approved by the Alcoa Public Works & Engineering Department.

1.2.9 Blow-off Assemblies

- (a) Blow-off assemblies for dead-end pipe less than 6-inch diameter shall be assembled by installing a 2-inch size flushing-type fire hydrant, 2-inch post-type flushing hydrant, or 2-inch flush-style flushing hydrant equipped with one 2-1/2-inch hose nozzle having National Standard Hose Coupling threads. Hydrant bury shall be a minimum of 36 inches. Hydrants should have 2-inch NPT screwed in connection, minimum 150 psi or 1.5 times working pressure, open counterclockwise, operating nut. The operating nut and 2 1/2-inch hose nozzle shall be installed either above-ground or in an approved ground-level enclosure. A shop drawing of the hydrant shall be submitted to the Alcoa Public Works & Engineering Department for approval. Blow-offs shall be the Mueller 2-inch post-type fire hydrant; Kupferle Mainguard No. 77, GIL Industries Aquarius 2-inch post-flushing, or approved equal. Alternative blow-off assemblies may be submitted to the Alcoa Public Works & Engineering Department for approval.
- (b) A 2-inch gate valve meeting the requirements set forth under Section 1.2.7 (a) of these Standards shall be installed in the 2-inch PVC pipe approximately three feet from the blow-off hydrant.
- (c) Blow-off assemblies for dead-end 6-inch and greater pipe shall be assembled by the installation of a 3-way fire hydrant meeting the requirements under Section 1.2.10 of these Standards. A gate valve meeting the requirements under Section 1.2.7 of these Standards with a valve box meeting the requirements under Section 1.2.8 of these Standards shall be located approximately three feet from the installed blow-off hydrant.

1.2.10 Fire Hydrants

- (a) Hydrant shall conform to the latest requirements of AWWA Standard C-502.
- (b) Hydrant shall be equipped with two 2-1/2-inch hose outlet nozzles and one 4-1/2-inch pumper outlet nozzle.
- (c) Nozzle thread shall conform to NFPA 1963 for Standard for Fire Hose Connections
- (d) Size of hydrant main valve shall be 5-1/4-inch nominal diameter.
- (e) Size of hydrant inlet shall be 6-inch MJ with one set of MJ accessories.
- (f) Operating nut shall open counterclockwise.
- (g) The operating nut shall be pentagonal in shape. The nut shall not be less than one-inch in height, measuring 1-1/2-inches from point to flat at the base of the nut and 1-

7/16-inches at the top.

- (h) The finish paint shall be an oil base and the color of the finish paint above the ground line shall be OSHA Yellow. Hydrants shall be delivered from the manufacturer painted yellow. **An additional coat of paint maybe required** after installation to repair scratches, nicks, and chips that occurred during shipping, handling, and installation **subject to inspector approval.**
- (i) Hydrant shall be equipped with harnessing lugs.
- (j) Outlet nozzle-cap chains will not be required.
- (k) Depth of bury to be 42 inches (from ground line to bottom of pipe). The center of the pumper nozzle and hose outlets shall be a minimum of 18-in. above final grade (ground line).
- (l) Hydrant shall be the M & H Valve Co. No. 129; the Mueller Company, Centurion, Catalog No. A-423; or the American Cast Iron Pipe Company, American-Darling, Catalog No. B-84-B.

1.2.11 Thrust Blocking

- (a) Thrust forces are created in a pipeline at changes in direction, tees, dead-ends or where changes in pipe size occur at reducers. Acceptable restraint measures include concrete thrust blocks, thrust restraints, restrained joints and tie rods.

Thrust restraint must be installed in accordance with AWWA, DIPRA and manufacturers specifications to degree that provides the greater protection.

Unless conditions prevent, concrete thrust blocks must be used. The details and dimensional data for concrete thrust blocks for 100 psi working pressure and soil bearings at 1000 pounds per square foot are given in Standard Drawing Thrust Blocking - 1, -2. For greater pressures or less soil bearing capacity, the quantities required should be calculated in accordance with DIPRA "Thrust Restraint Design for Ductile iron Pipe". When using thrust restraints, installation must be conducted to manufacturers' specifications.

- (b) **Threaded tie rods, when used, shall meet AWWA C111/ANSI 21.11 and ASTM A307.** All parts of such tie rods exposed to soil or weather shall be given a final coating of asphalt for protection. Asphalt coating will not be required for stainless steel materials. Tie rods shall not be less than nominal 3/4-inch in diameter. A minimum number must be calculated based on working pressure plus one (1) additional rod. **Under adverse environment conditions, materials may be required to meet ASTM A193 B7, (ALLOY STEEL), B8 (304 SS), OR B8M (316 SS).**
- (c) When using concrete with mechanical thrust restraint(s), the mechanical restraint(s) and fittings must be wrapped in plastic.

1.2.12 Tapping Sleeves and Valves

- (a) Tapping sleeves shall be of cast iron or stainless steel construction with mechanical joint ends rated for 200 psi working pressure. Cast iron end gaskets shall be duck-tipped type. Tapping sleeves shall be appropriately sized for use on O.D. pipe to be tapped. Tapping sleeves should be provided with tapped bosses for testing purposes. Side flange bolts and pipe shall be of corrosive resistant material. Tapping sleeve shall be U. S. Pipe Company, type 9 mechanical joint cast iron with non-corrosive bolts and nuts, duck-tipped gaskets or approved equal. Stainless steel tapping sleeves may be used with prior approval of the Alcoa Public Works & Engineering Department.
- (b) Tapping valves shall meet all requirements for gate valves under Section 1.2.7 of these Standards except flanged valve inlets Class 125 and mechanical joint outlets shall be provided. Tapping valve shall be U. S. Pipe Company, Hydragate No. 6860, or approved equal, and any succeeding catalog numbers for the same.

1.2.13 Cut-in Sleeves and Valves

- (a) Cut-in sleeves shall be cast iron mechanical joint and plain end, class 200 pressure rated with duck-tipped gaskets. M.J. gland should be provided with set screws for bonding. Cut-in sleeves shall be Mueller Company H-842, or approved equal.
- (b) Cut-in valves shall be cast iron mechanical joint for use in ductile iron and cast iron pipe. Gaskets shall be duck-tipped and meet AWWA C-151 requirements. All other requirements for gate valves under Section 1.2.7 of these Standards shall be met. Cut-in valves shall be Mueller Company H-862, or approved equal.

1.2.14 Repair Sleeves

- (a) Full circumferential stainless steel band-type couplings having appropriate pipe diameter range may be used only for repairing circumferential breaks in ductile iron pipe. Stainless steel band-type repair couplings must be capable of withstanding test pressures of 300 psi at a torque of 70 foot pounds for 5/8-inch bolts and 90 foot pounds for 3/4-inch bolts; equipped with malleable iron lugs meeting ASTM A47 Grade 32510, or ductile iron per ASTM A536, Grade 60-40-18; with supporting side fingers, furnished with Grade 30 specially compounded rubber of new materials with ingredients to produce superior storage characteristics, performance and resistance to set after installation; bolts of high strength steel with heavy hexagon nuts meeting the latest requirements of AWWA Standard C-111.
- (b) Repair of 2-inch PVC pipe shall be accomplished by replacing damaged pipe using 2-inch PVC pipe and either PVC couplings meeting the requirements as set forth in ASTM Standard D-2241 for 2-inch through 12-inch pipe designated SDR-21, or compression couplings of iron having galvanized protection with rubber gaskets having 5-inch minimum length.

1.2.15 Tubing for Service Lines

(a) **Copper Tubing**

1. Copper tubing shall be seamless, type K soft tempered and shall meet AWWA Standards C-800

2. Copper tubing shall meet the requirements as set forth in ASTM Standard B88 and AWWA Standard C-800 Appendix A for type K.

(b) **Cross-Linked Polyethylene (PEX)**

1. PEX pipe shall meet the latest requirements of AWWA Standard C-904 and AWWA C-800.

2. Pipe shall be permanently marked with identification as provided in the Standard and shall not be used if not legible.

1.2.16 Corporation Stops

(a) Corporation stops shall meet the latest requirements of AWWA Standard C-800.

(b) Corporation stop inlets shall have AWWA threads, and the outlet shall have tapered threads conforming to ANSI B2.1. Outlets shall have male ends sufficient to accommodate copper flare coupling nuts.

(c) Coupling nuts for use with flared type K copper service tubing shall meet the latest requirements of AWWA Standard C-800.

(d) Corporation stops shall be limited to size 3/4-inch and 1-inch.

(e) Corporation stops shall be Mueller Company, Catalog No. H-15000; The Ford Meter Box Company, Catalog No. F600, or approved equal, or any succeeding Catalog numbers.

1.2.17 Copper Service Unions

(a) Unions for copper service tubing shall be the copper service thread, three-part type meeting the latest requirements of AWWA Standard C-800. The coupling nuts of the unions shall have copper service threads and shall meet the latest requirements of AWWA Standard C-800. Compression unions may be permitted with prior approval of the Alcoa Public Works & Engineering Department.

(b) Copper service unions shall be used when coupling copper service tubing.

1.2.18 Tapped Saddles (For PVC Pipe)

- (a) Saddles shall be used in connecting 3/4-inch and 1-inch service taps to PVC pipe.
- (b) Saddles shall meet AWWA C800 standards for materials of underground service lines, valves and fittings..
- (c) Saddles shall be double strap, two-part type. The upper and lower castings may be hinged together with a stainless steel pin. The screws connecting the upper and lower castings shall be of bronze. The lower casting shall be tapped to accept the screws. Saddles shall be designed to form a hydraulic seal between the pipe and a rubber gasket shall be furnished with each saddle.
- (d) Outlets of saddles shall be tapped 3/4-inch or 1-inch AWWA thread for installation of a corporation stop.
- (e) Saddles shall be designated to be satisfactory for use with water up to 145 psi in accordance with Section 3, General Design under the latest requirements of AWWA Standard C-800.
- (f) Saddles shall be The Ford Meter Box Company, Inc., Design "B" Catalog No. S70-203 for 3/4-inch AWWA thread; S70-204 for 1-inch AWWA thread; Mueller Co. for 3/4-inch or 1-inch AWWA thread; Hayes Pipe and Supply Co. for 3/4-inch or 1-inch AWWA thread; or approved equal, or succeeding catalog numbers covering same.

1.2.19 Service Fittings

- (a) Adapters:
 - 1. Service fittings for use in 3/4-inch and 1-inch copper service tubing shall meet the latest requirements of AWWA Standard C-800.
 - 2. Adapters for use in 3/4-inch and 1-inch copper service tubing may be straight, quarter bend, or eighth bend.
 - 3. Adapter inlets shall be flared copper except for corporation stop adapters.
 - 4. Adapters having 3/4-inch inlets shall have either male or female iron pipe thread outlets of either 3/4-inch or 1-inch size.
 - 5. Adapters having 1-inch inlets shall have either male or female iron pipe thread outlets of 1-inch.
 - 6. Corporation stop adapters shall have inlet threads compatible with old type corporation stop threads. Outlets of corporation stop adapters shall be copper flare with copper service threads. Gaskets used with corporation stop

adapters shall be copper. Corporation stop adapters shall be used only for corporation stop sizes 5/8-inch, 3/4-inch, and 1-inch.

7. Threaded pipe nipples for use in setting 2-inch and greater meters shall be of nominally 85% copper and 5% each of tin, lead, and zinc. Pipe nipple threads shall be NPT.
- (b) Tees for copper service pipe shall be flared copper to copper. Sizes shall be limited to 3/4-inch and 1-inch. Tees may have a combination of 3/4-inch and 1-inch branches and runs when deemed appropriate.
 - (c) Brass plugs of either 5/8-inch, 3/4-inch, or 1-inch size having AWWA threads shall be used to plug taps where corporation stops have been removed from service.

1.2.20 Water Meters

- (a) Water meter sizes 5/8-inch and 1-inch:
 1. Shall be the positive displacement type.
 2. Shall be the frost-proof type with cast iron bottom plate.
 3. Casing shall be of copper alloy containing not less than 75 percent copper.
 4. Register shall be Encoder-Type Remote Registration meeting the requirements of AWWA C-707. Register shall be the hermetically sealed magnetic type, straight reading, U. S. Gallons, with test hand.
 5. Shall meet the latest requirements of AWWA Standard C-700.
 6. 5/8-inch meters shall be Badger Meter, Inc., Recordall, Model 25; Sensus International 5/8-inch SR, and any succeeding model numbers, or approved equal.
 7. One-inch meters shall be Badger Meter, Inc. Recordall, Model 40; Sensus International 1-inch SR; and any succeeding model numbers, or approved equal.
- (b) Water meter size 2-inch:
 1. Shall be the compound, single register magnetic flanged type.
 2. Casings shall be of copper alloy containing not less than 75 percent copper and shall be furnished with tapped boss for field testing purposes.
 3. Shall be furnished with oval companion flanges of copper alloy containing not less than 75 percent copper, gaskets, bolts, and nuts. Thickness of oval

flanges shall be as required for Class 125 round flanges.

4. Register shall be Encoder-Type Remote Registration meeting the requirements of AWWA C-707. Register shall be the hermetically sealed type, straight reading, U. S. Gallons, with test hand.
 5. Shall meet the latest requirements of AWWA Standard C-702.
 6. Unless otherwise approved, a bypass will be required.
 7. Two-inch meters shall be Badger Meter, Inc. Recordall, Model 40; Sensus International 1-inch SR; and any succeeding model numbers, or approved equal.
- (c) Shop drawings and performance data for water meters greater than 2-inch size shall be submitted to the City for approval. Flow demand, head loss, and range of user's expected flows will be considered by the City in making evaluation of such meters. All meters greater than 2-inch shall be of the compound design and shall be installed with a bypass.

1.2.21 Meter Yokes

(a) 5/8-inch and 1-inch Meters

1. Shall meet the latest requirements of AWWA Standard C-800 and certified to NSF 61.
2. The inlet shall have an all bronze inverted angle ball valve close-coupled to the yoke piece.
3. The outlet shall have an all bronze check valve close-coupled to the yoke piece.
4. Yokes shall be used for all 5/8-inch and 1-inch meter settings.

(b) 1 1/2-inch and 2-inch Meters

1. Shall meet the latest requirements of AWWA Standard C-800 and certified to NSF 61.
2. The inlet shall have an all bronze inverted angle ball valve close-coupled to the yoke piece.
3. The outlet shall have an all bronze check valve close-coupled to the yoke piece.
4. When supplied, bypass shall be a full port ball valve locking wing.

1.2.22 Meter Boxes

- (a) Meter boxes for 5/8-inch and 1-inch meter settings shall be medium duty heavy wall plastic with 10-inch by 15-inch opening. The cover shall be a flat, one-piece cast iron cover, or approved equal, with an AMR recess opening.
- (b) Meter boxes for 1 ½ -inch meter settings shall be medium duty heavy wall plastic with 17 inch by 30 inch opening. The ring and cover shall be the Ford X4, or approved equal, with a 21-inch opening. The cover shall be a flat, one-piece cast iron cover, or approved equal, with an AMR recess opening.
- (c) The minimum depth of meter box sections for setting 5/8-inch meters shall be 18 inches and 24 inches for 1-inch meters.
- (d) Meter box sections shall be designed for receiving covers. Covers and upper meter box sections shall be designed for easy cover removal and such that cover top surface when set will be flush with that of the upper meter box section rim.
- (e) Meter boxes for a 2-inch meter setting not requiring a by-pass shall be medium duty heavy wall plastic with 17 inch by 30 inch opening. The cover shall be a flat, one-piece cast iron cover, or approved equal, with an AMR recess opening.
- (f) 2" meter settings requiring a by-pass shall be all inclusive and plumbed by the factory or vendor into a concrete vault with copper inlet and outlet. Vault to include aluminum hatch with handle and locking mechanism.
- (g) Meters greater than 2-inch size shall be set in vaults. Drawings of the proposed vaults shall be submitted to the Public Works & Engineering Department for approval. Vaults in general shall be of precast reinforced concrete construction, poured-in-place reinforced concrete or of masonry construction having a minimum depth of 36 inches. The cover may be of reinforced concrete provided with an easy means for reading and removal of the meter and/or appurtenances. Factory type covers will be considered by the Public Works & Engineering Department.

1.2.23 Pressure Regulating, Flow Regulating and Relief Valves

- (a) Air Release, Air Vacuum and Combination Air Valves (AR, AV, ARV)
 - 1. Shall meet the latest requirements of AWWA Standard C512. The air release valve shall be of the float operated, direct lever or compound lever design, and capable of automatically releasing accumulated air from a pressurized fluid system while it is in operation.
 - 2. Air Release Valves are typically installed at highpoints in pipelines and at regular intervals of approximately 1/2 mile along uniform grade line pipe. Mount the unit in the vertical position on top of the pipeline with an isolation valve installed

below each valve in the event servicing is required. A concentric manhole section with casting, adequate venting and drainage shall be supplied per approval by the City.

3. Shall be Crispin Valves, Cla-Val Co. and Ross Valve or equal.

(b) Altitude Valve (ATV)

1. Shall meet the latest requirements of ASTM Standard A536 and ANSI B16.42. This valve shall control the high water level in reservoirs without the need for floats or other devices. It shall be a non-throttling type valve and remain fully open until the "shut-off" point in the reservoir is reached. This valve is designed for one-way flow only.
2. The altitude valve and piping assembly will be entirely housed in a Precast concrete vault with traffic bearing top, access hatch, adequate venting and drainage per approval by the City.
3. Shall be Golden Anderson (GA), Cla-Val Co. and Ross Valve or equal.

(c) Flow Limiting Valve (FLV)

1. Reserved

(d) Pressure Reducing Valve (PRV)

1. Shall meet the latest requirements of ASTM Standard A536 and ANSI B16.42. The Pressure Reducing Valve with Low Flow By-Pass automatically reduces a higher inlet pressure to a steady lower downstream pressure regardless of changing flow rate. The low flow by-pass capability is achieved by using a balanced Direct Acting Pressure Reducing Valve as an integral part of the main valve.

Main Valve The valve shall be hydraulically operated, single diaphragm-actuated, globe or angle pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed, and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.

2. The Pressure reducing valve and piping assembly will be entirely housed in a Precast concrete vault with traffic bearing top, access hatch, adequate venting and drainage per approval by the City.
3. Shall be Golden Anderson (GA), Cla-Val Co. and Ross Valve or equal.

1.2.24

Concrete Materials

Concrete used in conjunction with the installation or repair of water lines and appurtenances shall meet the requirements of the City Street & Drainage Construction Specifications, Section 03001 Concrete Work, Class "A" Concrete:

1. Minimum compressive strength: 28 days, 4,000 psi. When cylinders are required for testing, a minimum of three (3) cylinders is required.

1.3 **CONSTRUCTION / EXECUTION**

All construction on the City's water distribution system that is not performed by the Public Works & Engineering Department shall be executed by a person, firm, or corporation licensed to engage in contracting as set forth in the Tennessee Contractors Licensing Act of 1976 (TCA 62-601), as may be amended from time to time. This requirement shall apply to all construction regardless of the amount of work involved. These requirements apply also to pipeline subcontractors who may be engaged to conduct any part or all of the line installation work.

1.3.1 Pre-Construction Activities

Prior to commencement of **work the contractor or developer:**

- (a) May be required to provide a cash deposit, bond, certified check, or other acceptable form of security for the amount of the work to be completed or a portion thereof pursuant to the approved construction plans. The amount of the security shall be determined by and at the discretion of the Public Works & Engineering Director. Should the work not be performed according to these Standards and/or other applicable requirements, the City may execute the security for the purpose of remediation of any deficiencies and/or for the completion of the project. Within sixty (60) days of the completion and acceptance of all provisions of the approved plans, cash deposits or other legal arrangements, or unexpended or unobligated funds thereof, shall be refunded or terminated.
- (b) Shall supply two (2) complete sets of construction drawings, copies of all applicable permits (excluding City of Alcoa) and licenses to the City.
- (c) **Shall coordinate and** attend a mandatory Pre-Construction meeting with the City of Alcoa Public Works & Engineering staff. Responsible representatives for the contractor, subcontractor(s) & owner/developer must attend. Attendance of the Engineer is optional unless required by the City.
- (d) Shall supply material submittal sheets on all materials to be installed. Submittal sheets must contain manufacturer, required standards to be met, with marks or highlights to indicate model, size, type and material of material proposed for the project. All submittals must be approved prior to start of construction.
- (e) Shall supply copy of Construction Start Notification submitted to the Division of Water Supply, Tennessee Department of Environment & Conservation to the Public Works & Engineering Department.
- (f) Shall request a dig/locate request from the Tennessee One Call system 72 hours prior to commencement of excavation activities.

1.3.2 Soil Erosion Control

Unless otherwise specified, the Contractor shall be responsible for erosion control and slope stabilization relative to the construction of water system improvements. The contractor shall be responsible for installation and maintenance of all necessary temporary and permanent control measures. As a minimum, the Contractor shall construct and maintain all components shown in the Plans or directed by the Engineer during the life of the Contract to control erosion and pollution. Such measures may include, but not be limited to, berms, dikes, dams, sediment basins, fiber mats, netting, mulches, grasses, slope drains, temporary silt fences, and other control devices.

All work must be in compliance with applicable federal, state and local Stormwater Management Rules and Regulations.

(a) Materials

Erosion and Sediment Control are measures and materials required during the construction of utilities or utility improvements are 'Management Practices' or "BMP"s as provided in the State of Tennessee Erosion and Sediment Control Handbook.

Use and application of these Management Practices are subject to approval and inspection by the City. Failure of one practice to perform adequately to satisfy applicable regulations and permits may warrant the use of greater practices until discharge limits are achieved.

(b) Construction Requirements

1. Unless otherwise specified, the Contractor shall be responsible for acquisition of all Federal, State, and local erosion control, water pollution, and other such permits applicable to construction of the sanitary sewerage improvements.
2. The City may limit the area of erodible soil exposed by clearing and grubbing operations, excavation, and other operations and may direct the Contractor to provide immediate permanent or temporary pollution control measures. The Contractor shall be cognizant of and strive to protect from pollution adjacent watercourses (streams, creeks, etc.), and impoundments (e.g., lakes, ponds). Cut and fill slopes and other excavated areas shall be seeded and mulched as work progresses.
3. The Contractor shall incorporate all erosion control features into the project at the earliest practicable time.
4. The area of erodible soil exposed at one time should not exceed 43,560 square feet (1 Acre) without approval of the City. The area of excavation operations in progress shall be limited to the Contractor's ability to finish

grade, mulch, seed, and/or construct other such permanent pollution control measures. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be constructed.

5. In the event of conflict between these requirements and pollution control laws, rules or regulations, or other Federal, State or Local agencies, the more restrictive laws, rules or regulations shall apply.

1.3.3 Preparation

- (a) Precautions and permit to excavate:
 1. Abide by each utility company's requirements when repairing, replacing or disturbing existing facilities.
 2. Prior to trench excavation being performed within any public right-of-way, including public alleys, a permit shall be obtained from the governing authority to perform such excavation. As a minimum, the trench backfill and street repair shall be made in accordance with the Alcoa Public Works & Engineering Department's Street & Drainage – Construction Specifications.
- (b) Protect all vegetation and other features to remain.
- (c) The Engineer shall stake in the field the alignment of the water line and the location of all fire hydrants, valves, bends, crosses, and other appurtenances identified on the plans. All survey points shall be protected.
- (d) Trench excavation:
 1. Perform in such a manner as to form a suitable trench in which to place the pipe and so as to cause the least inconvenience to the public.
 2. To permit the proper installation of the pipe, allowing room for assembling joints and tamping backfill, the trench width at the crown of the pipe should be 2 feet plus the nominal diameter of the pipe. Unless approved by the Engineer, no trench less than 24-inches wide will be allowed.
 3. Cut pavements along neat, straight lines with either a pavement breaker or pavement saw.
 4. Trench depth shall be sufficient to provide a minimum cover in accordance with Section 1.1.3 of these Standards.
 5. Align trench as shown on the plans and in accordance with Section 1.1.4 of these Standards.
 6. Shape the bottom of the trench to provide uniform bearing of the pipe on

undisturbed earth throughout its entire length. Dig bell holes to aid in securing uniform support of the pipe.

7. When unstable soil is encountered at the trench bottom, remove it to a depth required to assure support of the pipeline and backfill to the proper grade with AASHTO M-43, Size 3 or 4 course aggregate (stone).
 8. Remove rock encountered in the trench excavation to a depth of 6 inches (for 24 inch pipe or less) and 9 inches (for 30 inch pipe or greater) below the bottom of the pipe barrel, backfill with suitable earth, and compact to uniformly support the pipe.
 9. When ashes, cinders, refuse, organic materials or other unsuitable material is encountered during excavation; this material must be removed to a depth of no less than 6 inches below any point of the bottom of the pipe and replaced with clean, stable backfill material. Should the potential exist for the pipe to come into contact of corrosive materials the pipe is to be encased with approved protective sheeting.
- (e) Sheeting, shoring and bracing: When necessary or when directed by the Design Engineer , put in place and maintain sheeting, bracing, etc., as may be required to support the sides of the excavation and to prevent movement. Remove all sheeting, shoring and bracing after backfill has been placed to a depth of 18 inches over the pipeline.
 - (f) Before placing pipe in the trench, field inspect for cracks or other defects. Remove defective pipe from the construction site.
 - (g) Swab the interior of the pipe to remove all undesirable material.
 - (h) Prepare the bell end and remove undesirable material from the gasket and gasket recess.

1.3.4 Installing / Repairing Distribution Pipes

- (a) Lay all pipe in a straight line on a uniform grade and in accordance with Section 1.1.4 of these Standards.
- (b) After applying gasket lubricant, extreme care should be taken to keep the spigot end from contacting the ground.
- (c) Hone the pipe with suitable tools or equipment.
- (d) Field modifications such as field rounding or re-rounding of pipe in order to assemble to other pipe joints or fittings is not allowable for pipe less than 30 inches in diameter. All pipe during assembly must meet AWWA C111 dimensions and tolerances.

- (e) As a minimum, the manufacturer's instructions for laying and joining pipe shall be followed.
- (f) Cut pipe for installing valves, fittings, etc., in a neat and workmanlike manner without damaging the pipe so as to leave a smooth end at right angles to the axis of the pipe.
- (g) Locate water lines in relation to other piped utilities in accordance with Section 2.1.10 of these Standards.
- (h) Means of Detecting Pipe: When pipe is installed, a minimum size 12 gauge copper wire shall be installed along the pipe, regardless of the material. The ends of the wire shall terminate in a valve box or other acceptable location – having an excess length of at least two (2) feet **beyond the valve box opening or other access point** – whereby detection equipment may be attached.
- (i) The repair of pipe shall include the repair or replacement of detection wire.
- (j) .
- (k) All valve operations must be conducted under the presence and direct supervision of authorized City personnel.
- (l) **Unless specifically exempted and approved, all tapping and modifications to the existing Public Water System shall be conducted by the City.** All connections to the Public Water system must be conducted in the presence of authorized City personnel. The City reserves the right to require temporary connections in accordance with AWWA Standard C651 to be installed prior to testing to insure isolation from the Public Water System and must remain until all testing is completed and accepted.

1.3.5 Installing Appurtenances

- (a) Securely plug open ends of pipe at the close of each work day and during temporary discontinuance of pipe laying.
- (b) Set all valves, fittings, fire hydrants, and other special fittings in a neat workmanlike manner.
- (c) Use thrust blocks, restrained joints, and tie rods in accordance with Section 1.2.11 of these Standards.
- (d) Erect fire hydrants to stand plumb with the pumper nozzle facing the street or in a direction as may be directed by the City Fire Department **(or the fire department serving the area if the hydrant is located outside of Alcoa).**
- (e) Effect drainage of fire hydrants by using a minimum of 6 cubic feet of Size No.2 or No.3 crushed stone.

- (f) Close dead ends with caps or plugs meeting the requirements of these Standards and equip with blow-off assemblies, where shown on the drawings, in accordance with Section 1.2.9 of these Standards.

1.3.6 Installing / Repairing Water Lines in Street, Highway, and Railroad Rights-of-Way

- (a) Permits as may be required for crossing streets, highways, and railroads and performing other work within their rights-of-way shall be obtained from the appropriate authorities.
- (b) As a minimum, boring and jacking methods shall be in accordance with Section 02305 of the current City Street and Drainage Construction Specifications.
- (c) When working within or in close proximity to the right-of-way of any street or highway the contractor shall install and maintain traffic control devices in accordance with the standards of the Manual of Uniform Traffic Control Devices.

1.3.7 Water Line Pressure & Leakage Tests

- (a) After the pipe has been laid, subject all newly laid pipe or any valved section thereof, to a hydrostatic pressure test. Testing must be coordinated and conducted in the presence of authorized City personnel.

Pressure and leakage tests for ductile iron pipe shall be performed in accordance with AWWA Standard C-600 and as summarized below. PVC pipe shall be tested in accordance with Uni-Bell PVC Pipe Association Publication #9, Installation Guide for PVC Pressure Pipe, and as summarized below. Tests shall only be performed after sufficient backfill material has been placed over the pipe prior to filling with water and testing to prevent lifting of the pipe. Test pressures shall not exceed:

1. The pipe or thrust restraint design pressures.
2. Twice the rated pressure of closed valves or fire hydrants included in the test section.
3. The rated pressure of resilient seated butterfly valves.

- (b) Ductile Iron Pipe – The procedure for ductile iron pipe is generally described below:

1. The test pressure of the installed pipe shall be a minimum of 150 psi or 1.5 times the working pressure, whichever is greater.
2. Allowable leakage shall be no greater than as calculated in the formula $L=SD[\text{Sqrt.}(P)]/133,200$, where:
 - L = allowable leakage in gallons per hour,
 - S = length of test section in feet,

- D = the pipe diameter in inches, and
- Sqrt. = Square Root,
- P = the average test pressure in psi. Pressure shall not fluctuate more than 5 psi.

3. The test shall be for duration of no less than 2 hours. Test pressure shall not drop more than 5 psi.

(c) PVC Pipe – The procedure for simultaneous pressure and leakage testing of PVC pipe is generally described below:

1. The test pressure of the installed pipe shall be 150% of working pressure at the point of test but not less than 125% of normal working pressure at the highest elevation. Duration of the test shall be no less than two (2) hours.
2. The maximum allowable pressure drop during the 2-hour test duration is 5 psi. Allowable leakage shall be no greater than as calculated in the formula $L=ND[\text{Sqrt.}(P)]/7400$, where:
 - L = allowable leakage in gallons per hour,
 - N = Number of joints in the length of pipeline tested,
 - D = nominal pipe diameter in inches,
 - Sqrt. = Square Root, and
 - P = average test pressure in psi.

Hydrostatic test makeup water allowance per 1,000 ft (gallons per hour) for pressure PVC pipe systems are shown in the following table.

Nominal Pipe Size (inches)	Average Pressure in Line (psi)				
	50	100	150	200	250
2	0.09	0.13	0.16	0.19	0.22
4	0.19	0.27	0.33	0.38	0.43
6	0.29	.041	.050	.057	.064
8	.038	.054	.066	.076	.085

(d) Filling & Pressurization:

1. Under the supervision of City personnel, slowly fill each valved section of pipe with water.
2. Before applying the specified test pressure, expel air completely from the pipe, valves, and hydrants.
3. Install air release valves at all points where entrapment of air occurs.

4. After all the air has been expelled; close corporations stops and apply the test pressure.
 5. Apply the specified test pressure, by means of a pump connected to the pipe, based on the elevation of the lowest point of the line or section under test, and correct to the elevation of the test gauge.
 6. At the conclusion of the pressure test, remove the corporation stops and plug or leave in place as directed by the Public Works & Engineering Dept.
- (e) Examination:
1. Carefully examine all exposed pipe, fittings, valves, fire hydrants, and joints.
 2. If the test of any section of line discloses leakage greater than that allowed under these Standards, locate and replace / repair the defective material until the leakage is equal to or less than the allowable amount.
 3. Repair all visible leaks regardless of the amount of leakage.

1.3.8 Cleaning and Disinfection of Water Lines

All newly installed lines shall be adequately flushed, disinfected, and bacteriological tested. Disinfection shall also be performed when cutting into or repairing lines when mains are wholly or partially dewatered.

- (a) Flush water lines clean prior to disinfection.
- (b) Thoroughly disinfect water lines in accordance with AWWA Standard C651 prior to placing in service.
 1. Use chlorine disinfecting agent. Hypochlorite or other disinfection solution may be swabbed on the interior of the pipes or introduced by flushing and/or slug chlorination as appropriate.
 2. Allow water to escape from the ends of all lines to cause dispersion of the chlorine solution into all parts of the system.
 3. Operate all valves and fire hydrants during the time disinfection is occurring.
 4. Retain the chlorine solution in the lines for a period of 24 hours.
 5. At the end of the 24-hour period, the residual chlorine must be a minimum of 25 ppm. Otherwise, repeat the disinfection procedure again.

6. Once a new line has been disinfected, flush the lines until system residual is achieved. Take bacteriological samples as required by TDEC-PWS, Chapter 0400-45-01-17 (8)(b) of the Rules. Should the sample results result in a favorable test, then the lines maybe connected to the water system. Otherwise, repeat the disinfection procedure until acceptable samples are obtained
7. Leaks or breaks that are repaired with clamping devices while mains remain full of water under pressure require no disinfection.
8. When disinfection is completed and the disinfectant is flushed from the line, the water containing the disinfectant must be neutralized (See Appendix C, AWWA C651). Discharging directly to a receiving stream is prohibited and all federal, state and local regulations must be flowed. Contact appropriate agencies as required.

1.3.9 Water Service Line Connections

- (a) Where practical, tap water mains in the upper half of the pipe.
- (b) Maintain a distance of at least 24 inches between taps, measured along the axis of the water main.
- (c) Used tapped saddles for all taps on PVC mains.
- (d) Service line and meter setting sizes shall be at the discretion of the Public Works & Engineering Director or his/her designee.
- (e) Unless specifically exempted and approved, service lines shall be installed by the Public Works & Engineering Department from the water mains to the edges of the street right-of-way lines or to the edges of easements provided for such water mains.
- (f) Meter setting locations shall be at the discretion of the City. Meters 2-inch and larger shall be installed in a location free of vehicular traffic. Whenever possible, 5/8-inch and 1-inch meters should be set in a non-traffic area.

1.3.10 Warranty Inspection

Twelve (12) months following acceptance of the water system improvements, a follow-up inspection will be made to determine if any failures/deficiencies have occurred as a direct result of the contractor's work and/or materials. Present at this inspection should be a representative(s) of the Public Works & Engineering Department and of the developer and/or contractor. The developer and/or contractor will be responsible for correction of all failures/deficiencies that have occurred during the first year of service.

1.4 STANDARDS FLEXIBILITY

1.4.1 Interpretations of these Standards and Design Criteria

Interpretations of these Standards and Design Criteria or the determination of any other Public Works & Engineering Department standards and design criteria not covered under these Standards shall be at the discretion of the Public Works & Engineering Director. The decision of the Public Works & Engineering Director shall be based on past practices, traditional policies, widely accepted professional principles and practices of the industry.

1.4.2 Right of Appeal

Any disagreement with the interpretations or determinations made by the Public Works & Engineering Director with respect to these Standards or any other standards not covered herein may be appealed to the Alcoa City Manager.

APPENDIX A
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APPENDIX B

CITY OF ALCOA WATER & WASTEWATER CONSTRUCTION SPECIFICATIONS LIST OF CITED STANDARDS

- AASHTO** American Assn. of State Highway and Transportation Officials
M 198 Same As ASTM C990
M-43 Sizes of Aggregate (*Stone*) for Road and Bridge Construction
- ANSI** American National Standards Institute
B2.1 Pipe Threading (except Dryseal)
A21.11 same as AWWA C111
- ASTM** American Society for Testing and Materials
A47 Standard Specification for Ferritic Malleable Iron Castings
A48 Standard Specification for Gray Iron Castings
A139 Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
A307 Standard Specification for carbon Steel bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength
A536 Standard Specification for Ductile Iron Castings
B88 Standard Specification for Seamless Copper Water Tube
C150 Standard Specification for Portland Cement
C443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
C478 Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
C828 Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines
C923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
C990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
C1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test prior to Backfill
D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
D1784 Standard specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
D1785 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120
D2122 Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

- D2241 Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
- D2321 Standard Specification for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- D2665 Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- D3034 Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- D3350 Standard Specifications for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
- F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F1417 Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air

AWWA

- American Water Works Association
- C-104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
 - C-110 Ductile-Iron and Gray-Iron Fittings
 - C-111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 - C-150 Thickness Design of Ductile-Iron Pipe
 - C-151 Ductile-Iron Pipe, Centrifugally Cast
 - C-153 Ductile-Iron Compact Fittings
 - C-502 Dry-Barrel Fire Hydrants
 - C-504 Rubber-Seated Butterfly Valves, 3 In. (75 mm) through 72 In. (1,800 mm)
 - C-509 Resilient-Seated Gate Valves for Water Supply Service
 - C-512 Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
 - C-515 Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
 - C-600 Installation of Ductile Iron Water Mains and Their Appurtenances
 - C-651 Disinfecting Water Mains
 - C-700 Cold-Water Meters--Displacement Type, Bronze Main Case
 - C-702 Cold-Water Meters - Compound Type
 - C-707 Encoder-Type Remote-Registration Systems for Cold Water Meters
 - C-800 Underground Service Line Valves and Fittings
 - C-900 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. Through 12 in.
 - C-904 Cross-Linked Polyethylene (PEX) Pressure Pipe
 - C-906 Polyethylene (PE) Pressure Pipe and Fittings, 4in through 63 for Water Distribution and Transmission.

DIPRA

- Ductile Iron Pipe Research Association
 "Thrust Restraint Design for Ductile iron Pipe".

HI

- Hydraulic Institute
 ANSI-HI Pump Standards

NFPA

- National Fire Protection Association
- 13 STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS
 - 1963 Standard for Fire Hose Connections

NSF National Sanitation Foundation Testing Laboratory, Inc.
61 Drinking Water System Components

TDEC Tennessee Department of Environment and Conservation
Chapter 0400-45-01 Public Water Systems
Community Public Water Systems Design Criteria

Tennessee Department of Environment and Conservation
Chapter 0400-40-01 thru 0400-40-02 Water Pollution Control
Design Criteria for Conveyance and Treatment of Wastewater
Tennessee Erosion and Sediment Control Handbook

Rules of the Tennessee Board of Examiners for Land Surveyors: Chapter 0820-03
“Standard of Practice”

UL Underwriters Laboratories, Inc.
50 Standard for Enclosures for Electrical Equipment
50E Enclosures for Electrical Equipment, Environmental Considerations