SECTION 02665
WATER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:
   1. Water systems and appurtenances.

B. Related Sections:
   1. Section 02200 - Earthwork
   2. Section 02221 - Trenching, Backfilling, Compacting.
   3. Section 02400 – General Utility Standards
   4. Water service connections to building: Division 15 sections.

1.2 INTENT

A. The water systems standards establish minimum standards for providing and maintaining the University’s water utility distribution system.

B. All modifications to the University’s water utility distribution system shall conform to the University’s master plan.

1.3 CODES & STANDARDS

A. The most recent City of Boulder Design & Construction Standards are incorporated by reference into the University’s Standards. When there is a conflict between standards, the more stringent requirement shall apply. The University’s Civil Engineer must approve in writing any deviation from these standards prior to construction.

B. 2006 International Plumbing Code

C. 2006 International Building Code

D. NFPA Compliance: Install fire protection water systems in accordance with NFPA 24 “Standard for the Installation of Private Fire Service Mains and Their Appurtenances.”

E. UL Compliance: Provide fire hydrants that comply with UL 246 "Hydrants for Fire-Protection Service", and are listed by UL.

F. Contractor must obtain a permit to operate valves or hydrants from the University of Colorado at Boulder Utilities and Engineering Division. Where valves or hydrants are owned by a utility other than the University, Contractor must contact
the owning utility and follow that utility’s regulations for operating valves and hydrants.

G. Operation of Water System must at all times remain under the supervision of the University of Colorado at Boulder.

H. Use the City of Boulder’s Technical Drawings for standard details.

PART 2 – DESIGN

2.1 DESIGN FLOW

1. Follow the design guidelines specified in the City of Boulder Design and Construction Standards.

2. Fire flows shall be in accordance with the types of structures planned for the development and shall be reviewed and approved by the University Fire Marshal. Minimum fire flows shall be 1,500 gallons per minute (gpm) fully sprinklered multi-family dwellings, and 3,000 gpm for commercial and industrial buildings. All mains conveying water for potable consumption shall be sized to deliver adequate fire protection in accordance with the design criteria.

3. Network modeling shall be conducted with EPANet software, or an acceptable alternative hydraulic analysis program approved by the University. Friction losses shall be computed using the Hazen-Williams equation with all pipes set to a friction coefficient of C=130. The following model output shall be provided in the design report submitted in accordance with Section 02400 of these standards.

   a. Schematic of the system layout, preferably color-coded by diameter, identifying all labels (junctions, pipes, etc.).

   b. Fire flow report tabulating the residual pressure at each node in the system. Fire flows shall correspond to the highest hazard building represented at each node.

   c. Junction reports for the maximum hourly design condition and the maximum daily plus fire condition associated with the lowest residual pressure determined during the fire flow analysis. Results shall include, but not be limited to, junction label, elevation, pressure, and hydraulic grade line (HGL).

   d. Pipe reports for the maximum hourly design condition and the maximum daily plus fire condition associated with the lowest residual pressure determined during the fire flow analysis. Results shall include, but not be limited to, pipe label, length, diameter, Hazen-Williams C, flow rate, velocity, headloss, and friction slope.
4. The potable water main network shall be fully looped such that all service lines are supplied from at least two directions, unless otherwise approved by the University’s Utility Engineer. If approval is granted for a particular dead-end main, under no conditions shall the dead-end exceed 600 feet.

5. The minimum depth of cover for potable water mains and service lines shall be 4.5 feet over the top of water pipe. The minimum and maximum depths of cover to top of pipe for new installations shall be 5.0 and 8.0 feet, respectively, unless otherwise approved by the University Engineer. Where grade changes are made to the ground surface over existing potable mains, the minimum cover shall be 4.5 feet and the maximum bury depth 8 feet, unless otherwise approved by the University Engineer.

2.2 MATERIALS AND INSTALLATION

1. Construction of water-related public improvements shall be in compliance with these Standards. All pipe shall be of adequate strength to support the trench and AASHTO HS-20 highway loadings. The type of pipe to be installed shall comply with these Standards, and shall be based upon applicable design flows, pressures, site conditions, corrosion protection, and maintenance requirements.

2.3 VALVES

1. Separation: Valve separation along mains shall be no greater than 600 feet, measured along the alignment of the main.

2. Valve Locations: Valves shall be located near pipe intersections along all branches of the potable water main network, resulting in 3 valves at a tee and 4 valves at a cross with the following exception: Where no service connections exist between two adjacent tees or crosses in a network, and the distance in between is less than 600 feet, one valve may be omitted unless otherwise required by the University. A valve shall be the same nominal size as the water main on which it is installed.

2.4 SEPARATION OF UTILITIES:

Comply with the City of Boulder’s Design and Construction Standards, Chapter 4, General Utilities Design.

2.5 CROSS CONNECTION REGULATIONS:

Comply with the City of Boulder’s Design and Construction Standards, Chapter 5, Section 5.11, Cross Connection Regulations.

PART 3 – CONSTRUCTION
PRODUCTS

3.1 Water Pipe and Fittings:

Comply with the City of Boulder’s Design and Construction Standards, Chapter 9, Utilities Standards.

3.2 Accessories:

A. Water Meters:

1. Refer to UCB Standard 15430, Section 1.03, A.14
2. All water meters shall have the capability to be field calibrated.
3. All meters shall comply with AWWA and ANSI/NSF 61 standards.
4. All meters shall be equipped with automatic meter reading capability.
5. All Other Locations: Provide meter acceptable to the City of Boulder Water Department.

3.3 Gate valves, butterfly valves, and fire hydrants:

A. Comply with the City of Boulder’s Design and Construction Standards, Chapter 9, Utilities Standards.

B. Refer to City of Boulder’s Standard Details. The hydrant must comply with NFPA requirements for minimum distance from a building.

EXECUTION

3.4 Backfill, Trenching, Pipe Bedding, Cleanup and Restoration:

A. Follow requirements as specified in Section 02221

B. Backfill: Place and compact cover material starting at top of pipe bedding extending upwards to a distance of 1 ft. above top of pipe. Place in lifts which achieve a density of 95%, ASTM D1557 at a point 6" above top of pipe.

C. Restore pavements, curbs and gutters, utilities, fences, lawns, vegetation and other improvements to condition equal to or better than before work began and to satisfaction of Owner’s Representative.

D. Complete topsoil and reseeding of site, if required.

E. Remove and legally dispose of all excess waste materials off the Owner’s property.

3.5 Identification:
A. Underground Line Marker:

1. During backfilling and top-soiling of underground piping, install continuous underground line markers, located at two (2) depths, 1’ below grade and 2’ above pipe.

2. Manufacturer's standard permanent, bright-colored, continuous-printed tape with metallic core, intended for direct-burial service; not less than 6" wide x 4 mils thick. Furnish blue tape with black printing reading "CAUTION WATER LINE BURIED BELOW".

B. Non-Metallic Piping Label:

1. If non-metallic piping is used:
   a. Provide engraved plastic laminate label permanently affixed to main electrical meter panel stating "THIS STRUCTURE HAS A NON-METALLIC WATER SERVICE".
   b. Provide tracer wire and test stations.

3.6 Pipe Installation:
A. Comply with the City of Boulder’s Design and Construction Standards, Chapter 9, Utilities Standards.

B. Install copper pipe in accordance with CDA Copper Tube Handbook.

C. Care shall be taken to prevent contaminating materials from entering the water mains during construction or repair. Such materials that may accidentally enter the main shall be removed by flushing. This flushing shall be done prior to disinfection unless tablet method of disinfection used. If, in the opinion of the Owner’s Representative, the contaminated material that has entered cannot be removed by flushing, the interior of the pipe shall be cleaned by mechanical means and then swabbed with one (1) percent hypochlorite solution.

D. Handle pipe carefully to ensure delivery in a sound, undamaged condition. Inspect pipe for cracks, dents, abrasions or other flaws. The Owner’s Representative will reject damaged pipe on site. Contractor shall replace damaged pipe at no additional expense to the Owner. Do not store materials directly on ground.

3.7 Tapping Pipe:

A. Use experienced workers to make direct taps with tools in good repair and proper adapters for size of pipe being tapped. Drilling and/or tapping machines must be acceptable to Owner. Where the pipe to be tapped is owned by a utility other than the University, the Contractor shall contact and follow the regulations of the utility owner.

B. All taps must be made using the wet tap method, unless other methods are approved.
All foreign matter shall be removed from the interior prior to installation of tapping valves.

3.9 Field Quality Control:

A. Notify Architect, Owner and governing authorities (if any) at least 8 working hours in advance of pipe being laid in any trench and 16 working hours in advance of testing. Do not cover pipes until observed by Architect and approved by Owner and governing authorities (if any).


1. Pipe shall not be pressure tested until bacteriological testing meets the governing agency requirements. Pipe shall be backfilled prior to pressure and leakage tests.

3.10 Valves & Hydrants

A. Valves and hydrants shall be tagged “out of service” until the water system is operational. It is the responsibility of the contractor to notify the Boulder Fire Department regarding the location of the tagged hydrants.

END OF SECTION 02665