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. The most recent International Plumbing Code
C. The most recent 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.

1.4 DESIGN:

A. 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) for 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. Depth of cover shall be in accordance to the City of Boulder’s Design and Construction Standards, Chapter 5.

B. Pipe:

1. Comply with the City of Boulder’s Design and Construction Standards, Chapter 5.

C. Valves:

1. 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. A valve should be located with 10 feet of a fire hydrant.

2. Extensions Stems with a 2-inch square operating nut and a support for the upper end of the extension shall be provided for all valves installed more than 5 feet deep as per City of Boulder utility standards.

D. Separation of Utilities:

1. See UCB Section 02400, General Utility Requirements.

E. Cross Connection Regulations:

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

PART 2 - PRODUCTS

2.1. WATER PIPE AND FITTINGS:

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

2.2. 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.

2.3. 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.

PART 2 – EXECUTION

3.1 BACKFILL, TRENCHING, PIPE BEDDING, CLEANUP AND RESTORATION:

A. Follow requirements as specified in UCB Standard 02221

B. Restore the site as specified in the UCB landscaping standards and also the City of Boulder’s Design and Construction Standards, Chapter 9, Utilities Standards.

3.2 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:

1. If non-metallic piping is used then provide tracer wire and test stations in compliance with COB’s Design and Construction Standards.

2. Tracer wire shall be 12 gauge type UF, 600V single strand copper wire. Splices in tracer wires shall be “3M” Type DBY-6 low voltage for direct bury, and shall be waterproof gel cap type connectors.

3. Tracer wire test stations shall be C.P. Mini Box stations measuring 2-1/2 inches in diameter and 18 inches high, or an approved equal.

3.3 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. 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.

3.4 TAPPING PIPE:

A. Taps are only allowed on pipes 2” or smaller. Pipes larger than 2” diameter shall be fitted with a tee with valves (3) on each leg. Tapping on pipes larger than 2” diameter may be approved by UCB Utility Engineer.

B. 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.

C. All taps must be made using the wet tap method, unless other methods are approved.

D. All foreign matter shall be removed from the interior prior to installation of tapping valves.

3.5 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.

3.6 VALVES AND 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.

3.7 PIPE RESTRAINT

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

B. In addition to thrust blocks, pipes shall be restrained in every direction from fittings according to Technical Drawing C25.

END OF SECTION 02665