Part VII - Water Mains and Service Laterals

ARTICLE 701 - GENERAL

701.1 Definition.

(1) Whenever the term "Engineer" is used with respect to water main or water service lateral construction, it shall be understood to include the General Manager of the Madison Water Utility and all duly authorized representatives thereof.

(2) All other definitions as described in Article 101.

701.2 General.

(1) Unless otherwise ordered by the Engineer, specified in the Contract Documents or shown on the approved drawings, conform to the requirements of the Specifications herein. In case of discrepancy, conform to the hierarchy as described in Article 104.

701.3 Emergency Contact.

(1) Furnish the Engineer with a local telephone number where a duly authorized representative can be contacted in case of an emergency at night or on weekends.

701.4 Warranty of Water System Installations.

(1) In addition to the requirements of Section 105.16 – Guarantee, the Contractor shall further guarantee water system installations, including water lateral installations, against damage and repairs resulting from leaks or breaks for a period of two-years from the date of Substantial Completion.

(2) During this period, any expenses associated with the repair or replacement of new water installation materials and resulting restoration work resulting from water leaks or main breaks shall be done at the Contractor's expense.

(3) This extended guarantee period against water main breaks and leaks does not require further extension of the Payment and Performance Bond beyond the standard requirements of Section 105.16 – Guarantee.

ARTICLE 702 - MATERIALS

702.1 General.

(1) Conform to the requirements specified herein for the type and class of material named. The Engineer reserves the right to reject any materials not meeting these Specifications as being defective.

(2) Prior to use, obtain approval in writing from the Engineer for any proposed substitutions of equivalent material.

(3) Ensure that the manufactured year of all materials is the current or previous year.

(4) Madison Water Utility receives funding assistance through the Wisconsin Department of Natural Resources Safe Drinking Water Loan Program on some Public Works infrastructure projects. These projects are required to comply with American Iron and Steel (AIS) provisions to use iron and steel products that are produced in the United States, including documentation of compliance. When AIS provisions are required, these requirements will be identified and established through project-specific special provisions in the Contract documents.

(5) Inspect all materials when delivered to the job site. Promptly remove from the worksite any materials that are rejected by the Engineer due to cracks, flaws, or other defects. The City will not be held liable for project delays that occur due to rejected materials.

(6) Unload, haul, and distribute all materials near their respective point of installation. Unload any City-furnished pipes and accessories in an area that is deemed acceptable to the Engineer as accessible and convenient to the job site. Handle the materials with care to avoid damage. Do not drop or bump materials against the ground.

(7) Protect the interior of all water system materials from potential contamination sources, including exposure to weather and debris; keep all open ends sealed and covered until time of installation.

702.2 Equipment.

(1) Ensure that all equipment and tools necessary for performing any specified work are satisfactory to design, capacity, and mechanical condition for the purposes intended.

(2) Repair, improve, replace and/or supplement any equipment which is not maintained in full working order, or which as used is inadequate to obtain the results prescribed by the Contract Documents.

(3) Use of any unpowered hand tools is considered incidental.

702.3 Ductile Iron Water Main & Accessories.

702.3.1 Ductile Iron Pipe:

(1) Ductile iron pipe and accessories shall conform to the requirements of American National Standard for Ductile Iron Pipe, Centrifugally Cast, for Water (ANSI/AWWA C151/A21.51 - latest revision).

(2) Ductile iron pipe shall be manufactured in the United States. Upon request by the Engineer, Contractor shall furnish data certified by the manufacturer that all pipe is of domestic manufacture.

(3) Pipe requirements:

1. Class 52 ductile iron.
2. Cement lined.
3. Push-on joint.
4. Furnished with all necessary accessories.
5. Electrical conductivity.

    i. Electrical conductivity shall be established through each joint by means of welded bonding strap connection, mechanical bonding strap connection, conductive-tip pipe joint gaskets, armor-tip mechanical joint gaskets, or serrated bronze conductivity wedges. Bonding straps shall be minimum 2 gauge copper wire capable of transmission of at least 500 amps, or Engineer approved equivalent.

    ii. Serrated bronze wedges may be used with push-on joint pipe. Install pipe manufacturer approved wedges, two per joint, for 3-inch through 12-inch pipe; four for larger diameter pipe. Each wedge is driven into the opening between the plain end and the bell until snug. When four wedges are used, they are inserted side by side, in pairs.

    iii. Any damage to asphaltic or epoxy coating materials and/or bonding strap connections require at least 2 mils of a corrosion resistant, bituminous, or rubberized undercoating material installed per manufacturer's recommendations.

(4) Gaskets shall conform to the requirements of American National Standard for Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings (ANSI/AWWA C111/A21.11 - latest revision).

(5) Gasket Requirements:

1. Plain rubber gaskets.
2. Conductive gaskets

    i. Conductive-tip/armored-tip gaskets may be used to establish conductivity through push-on pipe joints in lieu of bonding straps, or conductivity wedges.

    i. Conductive gaskets must be rated to accommodate electrical transmission of at least 500 amps.

    i. Conductive gaskets must be certified as compliant for use with the furnished pipe by the associated material manufacturer.

3. Restrained-joint locking gaskets.

    i. Use restrained joint locking gaskets when electing to *or* are otherwise required to meet thrust-restraint requirements by means of restrained-joint pipe.

ii. Restrained-joint locking gaskets must be certified as compliant for use with the furnished pipe material by the pipe manufacturer.

4. Nitrile or Fluorocarbon gaskets may be required if water mains are near contaminated soils.

702.3.2 Polyethylene Encasement:

(1) Polyethylene encasement materials shall conform to the requirements of the American National Standard for Polyethylene Encasement for Ductile Iron Pipe Systems (ANSI/AWWA C105/A21.5 - latest revision).

(2) Polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than eight mils. The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of antimicrobial compound to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.

(3) Polyethylene Encasement Requirements:

1. V-Bio Enhanced Polyethylene Encasement, or Engineer approved equivalent.

2. Furnish in either tube or sheet form.

702.4 Fittings & Accessories.

702.4.1 Mechanical Joint Fittings:

(1) Mechanical joint fittings are to conform to the requirements of either:

1. American National Standard for Ductile Iron and Gray Iron Fittings, 3-inch through 48-inch, for Water (ANSI/AWWA C110/A21.10 - latest revision).

- OR -

2. American National Standard for Ductile Iron Compact Fittings, 3-inch through 64-inch for Water (ANSI/AWWA C153/A21.53-11 - latest revision).

(2) Mechanical Joint Fitting Requirements:

1. Class 250 mechanical joint pipe fittings.

2. Cement lined.

3. All bells.

4. Entire fitting tarred.

~~5. Conductive mechanical joint (no lead).~~

6. Establish conductivity across fittings by means of mechanical or field-welded bonding straps, and any associated coating repairs per Section 702.3.1 (5) – 'Electrical Conductivity.' Bonding straps shall be minimum 2 gauge copper wire capable of transmission of at least 500 amps, or Engineer approved equivalent.

7. Furnished with all necessary accessories (rubber gaskets, flanges, bolts, etc.).

702.4.2 Mechanical Joint Restraints:

(1) EBAA Iron Inc. - MEGALUG® Series 1100.

(2) Star Pipe Products – Stargrip® Series 3000.

(3) Or, engineer approved equal.

702.4.3 Nuts and Bolts:

(1) Comply with AWWA C111/A21.11. - latest revision.

(2) Nuts and bolts shall be supplied with baked-on ceramic fluorocarbon resin, or coated with at least 7-mil. fusion bonded epoxy.

(3) Ensure that bolts are of sufficient length such that a minimum of ½-inch of threads are exposed beyond the end of the nut when tightened.

(4) Refer to the following table for the numbers, diameters, and lengths of bolts to be used:

Pipe Diameter (inches)	No. of Bolts Required	Bolt Diameter (inches)	Bolt Length (inches)	Bolt Length for MEGALUG® (inches)
3	4	5/8	3	3-1/2
4	4	3/4	3-1/2	4
6	6	3/4	3-1/2	4
8	6	3/4	4	4-1/2
10 - 12	8	3/4	4	4-1/2
14	10	3/4	4-1/2	5
16 - 18	12	3/4	4-1/2	5
20	14	3/4	4-1/2	5

702.4.4 Solid Sleeves:

(1) Comply with requirements of Section 704.2.1 - Mechanical Joint Fittings.

702.4.5 Solid Repair Sleeves:

(1) Solid repair sleeves may only be used when standard mechanical joint solid sleeves will not fit over existing pipe without major modification, such as significant grinding of pipe.

(2) Furnish solid repair sleeves with fluorocarbon or epoxy coated bolts per Section 702.4.3 – 'Nuts and Bolts.'

(3) Establish conductivity through the solid repair sleeve by means of mechanical or field-welded bonding strap and any associated coating repairs per Section 702.3.1 (5) – 'Electrical Conductivity.'

(4) Allowable Repair Sleeves:

1. Rockwell 441.
2. Ford FC1 Flex Coupling, for matching outside diameters, per nominal pipe size.
3. Ford FC2A Flex Coupling, for dissimilar outside diameters, per nominal pipe size.
4. Powerseal 3501.
5. Hymax Grip Restraint Coupling.
6. Romac Alpha Restraint Coupling.

702.5 Services and Stops & Accessories.

702.5.1 Service Laterals:

(1) 2-inch diameter and smaller laterals:

1. Type K soft copper tubing.
2. Straight length sections for 1½ -inch and 2-inch sizes.

(2) 4-inch diameter and larger laterals:

1. Class 52 ductile iron in accordance with Section 702.3.1 – Ductile Iron Pipe.

702.5.2 Saddles:

(1) Saddles are required at:

1. All 1-½-inch and 2-inch service lateral taps which are not directly tapped into the main.
2. All service lateral taps on PVC, HDPE, or CIPP-lined water mains.

(2) Saddles shall be stainless steel, full circle, one piece, tapped repair clamps.

(3) Saddle width must equal or exceed pipe diameter.

(4) Approved saddles:

1. Smith-Blair 372 Double Bolt, Stainless Steel Service Saddle (tapped repair clamp).
2. Smith-Blair 317 Double Stainless Steel Strap (new service taps).
3. Smith-Blair 397 Wide Stainless Steel Strap (recommended for PVC).
4. Mueller 520/530 Servi-Seal Clamp.
5. ROMAC SS1 Tapped Repair Clamp.
6. Ford FCD202-xxx-TAP Dual Band Epoxy Coated Service Saddle (new service taps).
7. Ford FC202-xxx-TAP-Q Double Band Epoxy Coated Service Saddle (new service taps).
8. Ford FS1 Stainless Steel Tapped Repair Clamp.

9. Ford SS1 Tapped Repair Clamp.
10. Cascade CRT1 Stainless Steel Repair Clamp w/ Tapped Outlet.
11. Hymax Versa Stainless Steel Coupling.
12. A.Y. McDonald 435 Series Tapped Repair Clamp.
13. A.Y. McDonald 4855A Ductile Iron Epoxy Coated Double Strap Saddle (new service taps).

702.5.3 Couplings:

(1) Couplings shall be copper-to-copper fittings.

(2) Allowable couplings:

1. Mueller H15403N.
2. Ford C44-XX-Q-NL (XX denotes size).
3. AY McDonald 74758Q (Q CTS x Q CTS)

702.5.4 Corporation Stops & Service Fittings:

(1) Installation of ¾-inch corporation stops requires authorization by Engineer, unless specifically noted on the plans. Standard minimum corporation stop and copper tubing diameter is 1-inch with a transition coupling at the point of connection with existing ¾-inch copper tubing.

(2) ¾-inch to 2-inch diameter, 90-degree ball valve, AWWA inlet, swivel flare outlet Corporation Stops:

1. A.Y. McDonald 74701BL-X (X denotes size), ball style flare corp, less nut.
2. Ford FB1000-X-C16198-Y-NL, ballcorp AWWA to CTS Quick Joint 45-deg Angle, -ANWT-

   (X denotes corp inlet size, Y denotes corp outlet size, includes integrated bend fitting).
3. Mueller B-25000N, AWWA inlet, copper flare outlet ball corporation valve.

(3) Service Fittings (1/8th bend), female flare inlet with swivel, CTS compression outlet:

1. A.Y. McDonald 74750SQ (size), Q CTS compression x female copper flare service fitting.
2. Ford (included as part of corporation stop assembly specified above).
3. Mueller H-15075N, conductive compression CTS x female copper with swivel service fitting.

(4) Supply all Service Fittings (1/8 bends) with a copper gasket.

702.5.5 Curb Stops:

(1) ¾-inch to 2-inch diameter, quarter-turn, ball valve curb stops:

1. A.Y. McDonald 76100 (size), Q CTS flared.

2. A.Y. McDonald 76100Q (size), Q CTS compression.
3. Ford B22-XXX-NL (XXX denotes size, flared).
4. Ford B44-XXX-Q-NL (XXX denotes size, compression).
5. Mueller B-25204N (flared).
6. Mueller B-25209N (compression).

702.5.6 Curb Boxes:

(1) Ensure that all curb boxes are complete, with covers marked "WATER."

(2) Curb Box Assemblies shall include the following:

1. Brass screws.
2. 2½-inch new style flush fit cover.
3. 54-inch rods and guide rings.
4. 2½-inch screw type shaft.
5. 37-inch bottom section.
6. 29-inch top section.
7. 16-inch center section.

(3) 1-inch diameter Curb Boxes:

1. Bingham and Taylor 94 F.

(4) 1½-inch and 2-inch diameter Curb Boxes:

1. Bingham and Taylor valve box per Section 704.6 – 'Furnish & Install Water Valve'.
2. No rods or rings.

702.5.7 Service End Caps:

(1) Copper service end cap requirements:

1. Push-to-Connect copper tube size (CTS) fitting.
2. NSF/ANSI 61 and ASSE 1061 certified product.
3. Minimum 200-psi pressure rating.

(2) Ductile iron service end cap and plug requirements:

1. Mechanical joint fittings in accordance with Section 702.4 – 'Fittings & Accessories.'

702.6 Disinfection Chemicals.

(1) Dry chemicals:

1. Chloride of Lime.
2. HTH.
3. Pittchlor.
4. Or equal (65 % available Chlorine), granular form only.

(2) Liquid:

1. Only to be used with Engineer's written authorization.
2. Sodium hypochloride.

ARTICLE 703 - CONSTRUCTION METHODS

703.1 General.

(1) Construct water main and appurtenances in accordance with AWWA C600 - latest revision except when otherwise required in these Specifications.

(2) Working on or near pressurized water systems may pose significant risks to workers. Never assume sufficient thrust restraint mechanisms are properly employed on existing water system infrastructure. Implement all necessary worker safety and protection methods whenever required, all in accordance with current local, state and federal laws, codes and ordinances. Protect the integrity (physical and operational) of the existing water system during all construction activities.

(3) In case of discrepancy between these Specifications and the approved drawings and/or Contract Documents, conform to the hierarchy as described in Article 104.

(4) All existing and new water valves are to remain visible and accessible at all times.

(5) Valves and hydrants may only be operated in the presence of, and with the authorization of the Engineer.

(6) Work done in the vicinity of any tree located in City property or public right-of-way is to be done in accordance with Article 107 of these Specifications.

(7) If unanticipated soil contamination is encountered within 50-feet of any proposed water mains, immediately notify the Engineer in accordance with Article 110.7 of these Specifications. Water main installation may not proceed in these areas until authorized by the Engineer in writing.

(8) Conform to the requirements of Article 203 of these Specifications for all existing pipes, structures, attached parts, and connections that are approved by the Engineer to be removed.

(9) Utility trench patches are to be done in accordance with the requirements of Article 502 of these Specifications and the Standard Detail Drawings except for trench-foot measurement of irregularly shaped utility trench patches related to Water Utility installations shall assume one (1) trench-foot unit to be equal to an area measurement of six (6) square-feet.

(10) Utility line openings, as required in the Contract Documents or as ordered by the Engineer, are to be done in accordance with Article 508 of these Specifications.

703.2 Installation Tolerance and Utility Separation Requirements.

703.2.1 Line and Grade:

(1) Do not install new water main and appurtenances without field-staked line and grade. Install water main and appurtenances to the line and grade depicted on the approved drawings.

(2) Allowable installation tolerance:

1. Horizontal: 0.1 feet.
2. Vertical: 0.1 feet.

(3) Work performed without line and grade, beyond the allowable installation tolerance, or Extra Work performed without authority, will be considered unauthorized and may not be measured or paid. The Violation consequences for unauthorized work are subject to Article 105 and Article 703 – 'Repairs and Alterations'.

(4) The lines, grades, locations, and dimensions shown on the plans are subject to adjustment by the Engineer during construction per Article 105. It shall be understood that the elevations for water mains as shown on the drawings are subject to revisions to accommodate field conditions as necessary. The Engineer reserves the right to adjust profile grades within 2-feet of the elevations shown on the approved drawings without adjustment in compensation.

(5) Before installing any proposed variance from the approved drawings, obtain authorization in writing from the Engineer per Article 703 - 'Repairs and Alterations' and Article 105 of these Specifications.

703.2.2 Utility Separation Requirements:

(1) Maintain clearance from existing and proposed utilities as specified in these Standard Specifications, as shown on the construction drawings, or as otherwise required by the Engineer.

(2) Water mains shall be laid at least 8-feet horizontally from any existing or proposed sanitary sewer main, storm sewer main, or sanitary or storm sewer manhole. The distance shall be measured center to center.

(3) If water mains cross over sanitary or storm sewer mains, the water main shall be laid at such an elevation that the bottom of the water main is at least 6-inches above the top of the sewer main.

(4) If water mains cross under sanitary or storm sewer mains, a minimum vertical separation distance of 18-inches shall be maintained between the top of the water main and the bottom of the sewer main.

(5) At sewer crossings, the water pipe shall be centered above or below the sewer so that both joints will be as far from the sewer as possible.

703.2 Repairs and Alterations:

(1) This section covers:

1. Emergency repairs of the water system.
2. Proposed alterations of the water system.
3. Unauthorized tampering of the water system.
4. Proposed deviations from the approved water main construction drawings or Contract Documents.

703.2.2 Requirements:

(1) Per Madison General Ordinance Section 13.205, make no unauthorized alterations to the water system. Only when properly authorized to proceed may any work on the water system occur.

(2) When authorized, this work is subject to but not limited to the following requirements:

1. Perform all work in accordance with these Specifications.
2. Safeguard and protect all Madison Water Utility facilities at all times.
3. Do not operate valves or hydrants without direction from the Water Utility Inspector.
4. Provide proper water shut-off notification to affected customers in accordance with these Specifications.
5. Perform all field-cuts with an approved mechanical pipe cutter or power saw. All field-cuts shall be made straight, true, and without damaging the pipe.
6. Concrete encasement pipe repairs are not permitted. Concrete encasement for other purposes, such as a concrete collar, requires written approval from the Engineer.
7. Perform a complete clean-up of the work area and completely restore all disturbed surfaces to original condition, or better.

703.2.3 Notice and Approval of Work:

(1) For anticipated repair work, including the raising or facing of hydrants, notify the Engineer a minimum of 2-working days prior to the proposed beginning of such work.

(2) To propose an alteration of the existing system or a deviation from the approved water main construction plan or Contract Documents, submit the request in writing a minimum of 3-working days prior to when work will be needed. The variance request shall include a sketch that effectively depicts the proposed revision. The Engineer will review the request and respond within 3-working days.

(3) Emergency repairs or planned work may be authorized by the Engineer with less notice or verbal approval at their discretion.

703.2.4 Violation Consequences:

(1) Be subject to a forfeiture per Madison General Ordinance Section 13.205 for each day or partial day of violation.

(2) Unauthorized work may not paid for by the City and may be ordered to be removed or replaced at the Contractor's expense as specified in Article 105.

(3) Risk loss of prequalification status with the City of Madison.

(4) Be liable for all damages, claims, lawsuits, and/or other associated costs including Water Utility costs for labor, equipment and materials.

703.3 Excavation.

(1) Construct water mains and appurtenances in open trenches and in a manner to protect the pipe and appurtenances from unusual stresses at all times.

(2) When permitted by the Engineer in writing, water mains may be installed by tunneling and/or jacking methods in lieu of open trenching. Prepare and submit to the Engineer in writing, the details of construction including a bore pit plan and according to Article 703 – 'Repairs and Alterations'.

703.3.1 Trench Excavation:

(1) Provide all sheeting, bracing and/or shoring necessary to protect the work, existing property, utilities, pavement, etc., and to provide safe working conditions in the trench. All costs of sheeting, bracing and/or shoring is considered incidental to any work which necessitates it.

(2) When not in use, remove sheeting and bracing, unless permission to leave in-place has been given in writing by the Engineer.

(3) Excavate trenches in conformity with the required alignment and grades as shown on the drawings and as laid out in the field by the Engineer.

(4) Remove all vegetation and topsoil along the trench line to the width of the proposed trench before beginning excavation.

(5) Deposit material excavated from the trench on the sides of the trenches and excavations, beyond the reach of slides. Transport material to spoil banks as an alternative.

(6) Properly dispose of surplus material at no additional cost to the City. Surplus material includes but is not necessarily limited to:

1. Vegetation from the trench line.
2. Excavated rock or cobbles in excess of 6-inches in diameter.
3. Boulders (per Article 704).
4. All other material from excavation not needed or suitable for backfilling trenches.

(7) For water main construction, the width of the trench shall be such as to leave a clear space of not less than 6-inches between the earth wall, or the supporting sheeting or bracing where such is used, and the sides of the pipe. The trench width established by this pipe clearance, measured at the spring line, shall be applicable to that portion of the trench from 1-foot above the top of the pipe to the bottom of the trench.

(8) On streets opened to traffic, on restricted easements, and other specified locations, minimize the width of the trench at the ground surface to the extent possible to accommodate the pipe installation and any necessary sheeting or bracing.

(9) The Engineer reserves the right to limit the extent of excavation depending on the nature of the soil and other conditions.

(10) As ordered by the Engineer due to trees, fences, buildings, shrubs, etc., dig trenches by hand.

703.3.2 Excavation in Poor Soils:

(1) If, in the opinion of the Engineer, an artificial foundation is necessary because of the nature of the excavated material, excavate the unsuitable material and replace with suitable specified material to produce an acceptable pipe foundation.

(2) The undercut depth shall be as directed by the Engineer but shall be a minimum of 1-foot below the bottom of the pipe. Any work involved in forming a satisfactory foundation at depths of 1-foot or less below the bottom of pipe will be considered to be incidental to the work.

(3) Backfill this portion of the trench with specified approved bedding material and mechanically compact the select fill prior to laying the pipe. Limit the width of the trench excavation to the outside diameter of the pipe plus 2-feet, plus the amount necessary for sheeting and/or bracing.

(4) Excavation beyond the allowable 1-foot shall be considered undercut and will be paid as specified for undercut.

703.3.3 Dewatering:

(1) In accordance with Part V of these Specifications, remove by pumping, bailing, or otherwise, any water that may accumulate or be found in the trenches and other excavations.

(2) Form all dams, flumes or other works necessary to keep the trenches or excavations entirely clear of water while the water mains and their appurtenances are being installed.

(3) Direct all water from excavations, so as not to flow over or damage private or public property.

(4) All costs of dewatering are considered to be incidental to the associated work.

703.4.4 Removal of Conflicting Utility Pipes:

(1) Abandoned utilities which conflict with new water main installations are to be removed from the trench and properly disposed of. Utility pipes to be removed that are in the same trench as new water main will not be additionally compensated, and are considered to be part of the new pipe installation. This applies to any abandoned pipe or conduit that is identified on the plans for removal, or any unidentified abandoned pipe or conduit that is smaller than 10 inches in diameter. Removal of unidentified abandoned pipe or conduit that is 10 inches in diameter or larger will be considered as Extra Work.

(2) If the utility to be removed ends along a pipe run, as opposed to ending at a structure, end the removal with a saw cut of the existing pipe and plug the remaining end(s) as directed by the Engineer. Refer to bid item “Pipe Plug for Water Main Installation” for applicable practice.

703.4.5 Trench Bottom:

(1) The trench bottom must be true and even to fully support the bedding material and the pipe along its entire length.

(2) As necessary, remove and replace poor subgrade materials, including loose sand, in accordance with Section 703.4.6, Excavation in Poor Soils.

703.4.6 Bell Holes:

(1) Provide holes for pipe bells at each joint.

(2) Holes should be no larger than necessary for joint assembly, including installing the required overlaps for polyethylene encasement, and assurance that the pipe will lay flat within the trench.

703.5 Temporary Support.

(1) Under no circumstances shall new water main pipe be used to support any underground facilities, structures or any other objects. If new water main pipe is used for support, the pipe will be rejected,

tagged by the City as rejected pipe, and will be immediately removed from the job site. The rejected pipe shall not be used on any other City projects.

703.5.1 Temporary Water Main Support:

(1) Temporarily support water mains whenever 12 or more lineal-feet of main is exposed for a period of 48-hours or longer. Exposure may be perpendicular, parallel or at any angle to an opening or trench.

(2) Submit a support plan designed and stamped by a State of Wisconsin Licensed Professional Engineer to the Engineer a minimum of 2 working days before the exposure is anticipated to occur.

(3) The Engineer reserves the right to require immediate temporary support of any exposed pipe in the case of a justifiable concern for the integrity of the pipe, worksite or public safety.

(4) The Engineer reserves the right to pressure test or re-test any pipe which has been subjected to temporary support. In the event of a failed test, correct any defects until the pipe passes pressure testing at no additional cost to the City.

703.6 Backfilling and Compaction.

703.6.1 Pipe Bedding and Cover:

(1) Properly construct water pipe bedding material in the trench pipe zone to prevent settlement of pipes and/or fittings and to avert excessive pressure on the pipes. As depicted in Standard Detail Drawing 7.01 – Typical Water Pipe Trench, the pipe zone extends from the trench bottom, located at least 6-inches below the bottom of the pipe, to the top of the cover material, located at least 12-inches above the top of pipe.

(2) Install water pipe bedding and cover material in accordance with the following requirements:

1. Bedding material shall be either washed gravel, clear stone, limestone screenings or sand, in meeting the requirements of Section 502.1(d) of the Standard Specifications. Crushed stone is not acceptable bedding material for water pipes unless authorized by the Engineer.

2. Prior to laying the pipe, place at least 6-inches of compacted bedding material to form the base of the pipe zone. Compact to at least 95% maximum density.

3. Prepare bell holes, as necessary, in accordance with Section 703.4.5 of the Standard Specifications.

4. After the water main has been laid, place bedding material to the spring line of the pipe and manually chuck/work material around the base of the pipe to form a secure pipe foundation. Use of mechanical compaction equipment is not permitted while forming the pipe foundation. Use caution to avoid damaging the pipe and/or the polyethylene encasement.

5. After the pipe foundation is formed, place bedding material to the top of the pipe zone, located 12-inches above the top of pipe (minimum). Compact bedding and cover material using a hand-operated mechanical compactor to a minimum of 95% maximum density.

703.6.2 Trench Backfill Requirements:

(1) Backfill trenches and excavations immediately after the water main and appurtenances have been installed and placement of the bedding and cover material has completed.

(2) Close trenches at the end of every day.

(3) Backfill to the original surface elevation or otherwise specified elevation. In the event of a shortage of material to perform this work, including replacement as may be required by rock excavation or removal of boulders, provide the necessary fill material at no cost to the City.

(4) Except as may be necessary in compacting and backfilling, do not walk or work on installed pipe until the trench has been backfilled to an elevation at least 2-feet above the top of the pipe. Do not take backfill material from trench walls below an elevation 2-feet above the top of pipe.

(5) Evenly place backfill material so that no unbalanced pressures are placed upon the water system. Backfill material may be dumped directly into the trench from trucks when the amount of material to be dumped is controlled by proper equipment.

(6) Deposit, spread and level backfill material in layers not exceeding 12-inches in thickness before compacting. Compact each layer to the density specified herein before placing the succeeding layer. When the material being compacted is of a granular nature and the compacting equipment is adaptable for the purpose, the thickness of the layer may be increased to a maximum of 24-inches at the Engineer's discretion, provided the required compaction density is obtained.

(7) Only use heavy equipment in the trench for compaction or other purposes if the pipe is adequately protected and the Engineer approves. Trucks, vehicles, or other equipment are not allowed within the limits of the trench prior to the completion of the backfilling operations.

(8) Dump imported backfill material along the top of the trench beyond the reach of slides. Do not store imported material such that it increases the stresses on the trench section.

(9) Carefully draw and remove any required sheathing and bracing such that it will not disturb the completed work. Carefully fill and compact any voids created by the removal of sheathing and bracing with approved backfill material.

(10) Backfilling of structures shall be done in accordance with Article 301 – 'Protection of the Concrete'.

(11) Whenever possible, backfill trenches and other excavations with materials excavated during the course of the work.

(12) Do not include vegetation, stones, or fragments of broken rock in excess of 6-inches in any dimension in the backfill.

(13) Note that the Engineer may reject material due to:

1. Unacceptable moisture content.
2. Unacceptable gradation or composition
3. The presence of frozen material.
4. Remove all rejected materials from the site.

703.6.3 Compaction Requirements:

(1) Mechanically compact backfill layers in trenches and excavations to thoroughly consolidate the material to the density specified and to not damage or disturb the pipe or other structures.

(2) See Section 703.6.1 – Pipe Bedding and Cover, for compaction requirements of the bedding and cover material in the pipe zone of the trench.

(3) Begin mechanical compaction of the trench zone backfill material when the depth of the backfill material is 2-feet above the top of the pipe. (In the case of structures, begin compaction of the backfill material with the placing of the first layer of backfill material).

(4) The Engineer will perform compaction testing as necessary to verify uniformity of compaction.

(5) Compaction Density Requirements:

1. From 2-feet over the pipe to within 3-feet of the bottom of subgrade:

   A minimum of 90% of maximum density.

2. Within 3-feet of the bottom of subgrade:

   A minimum of 95% of maximum density.

(6) Determine maximum density in accordance with the Standard Method of Test for the Moisture-Density Relations of Soils, ASTM Designation: D 1557, Method D, latest revision. Replace the fraction of material retained on a ¾-inch sieve, with No. 4 to ¾-inch material.

(7) Determine the density of compacted backfill in accordance with one of the following: Test for Density of Soil-in-Place by the Sand-Cone Method, ASTM Designation: D 1556, latest revision, or Test for Density of Soil and Soil-Aggregate in Place by Nuclear Methods, ASTM Designation: D 2922, latest revision.

(8) In the event that the material in the density sample differs in percentage of aggregate retained on a No. 4 sieve from that in the sample upon which maximum density was determined, adjust the maximum density in accordance with approved procedures.

(9) In the event of inadequate moisture in the backfill materials, add water as necessary to obtain the required compaction.

(10) Whenever the work of installing water pipes takes place during freezing weather, follow the specifications for trench compaction above, if practicable. If the specified compaction cannot be achieved, and the Engineer determines that the work may not be suspended until more favorable weather conditions exist, proceed as follows:

1. Remove all frozen material in the trench at the beginning of the day's work.

2. Do not compact frozen materials.

3. Compact material in 6-inch maximum lifts.

4. Compact to densities specified herein.

(11) If the top 3-feet of material does not meet 95% of maximum density, remove the material and place Select Fill using 6-inch maximum lifts and compact to 95% of maximum density.

(12) As a guideline, no construction will be permitted when the temperatures are too cold to achieve the specified compaction of the backfill. Ensure that temperatures are at least 15ºF and rising, with winds less than 10 mph, before considering working in freezing conditions.

703.6.4 Embankments:

(1) Where the grade of the water main is such that the top surface of the pipe requires protection, construct an embankment over the pipe.

1. Embankment height:

   Specified by the Engineer and adequate to provide proper protection.

2. Embankment width:

   Minimum of 2-feet wider than the external diameter of the pipe at the top.

(2) Embankment side slopes:

(3) A ratio of not less than 2-feet horizontal to 1-foot vertical from the top of the embankment to the existing ground surface.

(4) Use surplus acceptable excavated material or, if required, furnish other approved material for embankment construction. Placing and constructing the embankment over the pipe is incidental.

(5) If imported material is required by the Engineer to complete the embankment over the pipe, only the authorized imported fill quantities will be paid for as provided herein.

(6) Compact embankment material as required in Article 202 – 'Standard Compaction'.

703.7 Connecting to Existing Water Mains.

(1) There are three types of connections to existing mains:

1. A plug-removal connection is a connection that requires the removal of a slip or mechanical joint plug from an existing fitting or the end of a water main. Perform all work associated with the plug removal connection per Article 704 - 'Cut-In or Connect-To Existing Water System'.

2. A cut-in connection is a connection that requires the installation of a new fitting or valve in an existing water main. Perform all work associated with the cut-in connection per Article 704 - 'Cut-In or Connect-To Existing Water System'. Cut-in connections to HDPE water mains shall also be constructed in accordance with Article 704 - 'Horizontal Directional Drill Pipe'.

3. A live-tap is a connection in which the main is tapped under pressure and in-service while a tapping valve is installed by the City. Furnish the ditch as necessary for the City to make the tap and perform the associated cut-off and cap of the existing water main per Article 704 'Furnish Excavation and Ditch for Live Tap'. Isolate and depressurize all live-tap connections on any PVC, HDPE and CIPP-lined water mains prior to providing the ditch to the City.

(2) Install a high potential galvanic anode per Section 704.31 – 'Furnish and Install Anode' at all water main connections consisting of new ductile iron water main connecting to a dissimilar existing water main material, including unwrapped ductile iron pipe, or as otherwise directed by the Engineer.

1. Anode installations are not required at locations where new ductile iron pipe connects to service lateral piping, including large-diameter service lateral piping, unless otherwise specified on the plans or required by the Engineer.

703.8 Water Main Shutoffs.

(1) Do not interrupt water service without prior notification to all affected residents and property owners. Ensure that all street-facing and/or visible entrances and all addresses of multi-unit properties are included separately in the notification distribution.

(2) With notification distributions, it is recommended to include a request to avoid using water fixtures, faucets or water-sensitive appliances during the service interruption, and then opening an outside spigot or cold water faucet on the lowest level of the property after service has been restored.

(3) When requested and furnished by the Engineer, post terrace signs as part of the notification distribution. Carefully remove and return all posted terrace signs to the Engineer upon completion of the service interruption.

(4) In the case of an emergency or an unplanned shut-off, notify all affected residents and property owners during or immediately after the water is turned off.

(5) Minimum requirements for all planned shut-offs:

1. Provide 2 working days notice to affected water users.
2. The shut-off may not begin earlier than 8:00 AM.
3. The shut-off may not exceed 8-hours.

(6) In the event a planned shut-off is anticipated to require more than 8-hours, re-notify all affected water users prior to the expiration of the time limit listed on the original notification.

(7) Perform all shut-offs as proposed in the Contract Documents. The proposed shut-offs are provided for reference purposes to aide planning connection point isolation and preparing water user notification lists for planned outages. Propose any alternative connection methods which differ from the proposed shut-off in accordance with Article 703 – 'Repairs and Alterations'.

(8) Obtain prior authorization from the Engineer and be responsible for all valve turnings. Be properly equipped at all times for doing such work.

(9) Any water service or plumbing problems which arise as a result of either planned or emergency water main shutoffs or any associated work, are the Contractor's responsibility to promptly resolve at no cost to the City or Madison Water Utility.

(10) To reduce the likelihood of draining private water systems and/or associated private plumbing problems, it is required to close all service valves and/or curb stops on all 1.5-inch or larger laterals prior to removing the main from service.

(11) Additionally, it is required to close all service valves and/or curb stops at properties without accessible hose spigots or other outside plumbing connections.

703.9 Mechanical Joint Pipe and Fittings.

(1) A mechanical pipe joint is made by compressing a rubber gasket between a bell, cast on the end of one pipe, and a gland that slides along the plain end of the pipe to be joined. The joints are tightened using nuts and bolts.

(2) Assemble mechanical joints in accordance with AWWA C600 – latest revision.

(3) Restrained joints using mechanical joint-restraint retainer glands shall have bolts tightened in accordance with the manufacturer's installation specifications.

(4) Before slipping the gland and the gasket onto the plain end for joint assembly, lubricate both the gasket and the plain end of the pipe with an approved pipe lubricant meeting the requirements of ANSI/AWWA C111/A21.11 - latest revision.

(5) Place the gland on the plain end with the lip extension toward the joint, followed by the gasket with the narrow edge toward the joint. Insert the pipe into the bell and press the gasket firmly and evenly into the gasket recess in the bell keeping the joint straight during assembly. Push the gland toward the bell and center it around the pipe, with the flange lip against the gasket. Insert bolts and hand tighten nuts. Deflect pipe after assembly, but before tightening bolts.

703.10 Thrust Restraint.

(1) Where required, provide thrust restraint by one of two methods:

1. A combination of concrete thrust blocking and mechanical joint restraint.
2. A combination of push-on restrained joint pipe, or other approved restrained joint pipe, and mechanical joint restraint.

(2) Regardless of the restraint method employed, restrain all mechanical joints using mechanical joint-restraint retainer glands per Section 702.4.2 – 'Mechanical Joint Restraints,' installed per the manufacturer recommendations. Additionally include concrete blocking at all hydrant installations, cut-in connections, branch tee connections and live-tap connections, per Standard Detail Drawing 7.13.

(3) Any water main stub without horizontal anchoring connections within 20-feet of the dead-end, or service lateral pipe stub greater than 4-inches in diameter requires restrained joint pipe along all pipe joints of the stub.

(4) Any pipe joints located within 10-feet of a valve connection must utilize restrained joint pipe.

703.10.1 Concrete Thrust Blocking:

(1) Where concrete blocking serves as the thrust restraint method, block all hydrants and fittings, except vertical down bends, per the required bearing area in the table below and Standard Detail Drawing 7.13. Block vertical down bends per Standard Detail Drawing 7.14. Restrain per Standard Detail Drawing 7.15 only where specified or approved by the Engineer.

Required Undisturbed Bearing Area of Concrete Thrust Blocking (Square Feet)					
Fitting Size(In)	**Tee, Wye, Hydrant, Plug or Cap**	**90º Horizontal Bend, Plugged Cross or Tee (Plugged on Run)**	**45º Horizontal Bend**	**22-1/2º Horizontal Bend**	**11-1/4º Horizontal Bend**
4	0.9	1.3	0.7	0.4	0.2
6	2.1	3.0	1.6	0.8	0.4
8	3.8	5.3	2.9	1.5	0.4
10	5.9	8.3	4.5	2.3	1.2
12	8.5	12.0	6.5	3.4	1.8
16	15.1	21.3	11.5	6.0	3.2
20	23.6	33.3	18.0	9.4	4.9
24	33.9	48.0	26.0	13.5	7.1
30	53.0	75.0	40.6	21.1	11.1
Note: Listed areas are based on a test pressure of 150 psi and an allowable soil bearing pressure of 3,000 pounds per square foot. To compute bearing areas for different test pressure, use the following equation: Bearing area = (Test Pressure ÷ 150) x (Table Value)					

(2) Concrete thrust blocking must be at least two-feet thick over the entire bearing area.

(3) On hydrants and fittings requiring less than 4-square feet bearing area use either cast-in place concrete, precast concrete thrust block or solid concrete blocks placed between the appurtenance and the undisturbed wall of the trench. Fill all voids with compacted clear stone or screenings.

(4) For fittings requiring 4-square feet bearing area or greater, use only precast concrete thrust block or cast-in-place concrete meeting the requirements of Article 301 of these Specifications and a minimum strength of 3,000 psi at 7-days. Protect the concrete from freezing for a minimum of 24-hours after placement.

(5) Do not perform pressure testing within 72-hours of pouring the thrust block. A 9-bag concrete mix may be authorized by the Engineer upon request.

(6) Do not extend the concrete blocking beyond the joint. Protect all nuts and bolts from the concrete during pouring so they can be removed without damaging the thrust block.

(7) Do not backfill over thrust restraint blocking until it has been inspected by the Engineer. If backfilling takes place prior to the inspection of the blocking, the Engineer may require the blocking to be re-exposed for inspection at no additional cost to the City.

703.10.2 Joint Restraint:

(1) Where joint restraint serves as the thrust restraint method, with the exception of vertical bends, restrain all push-on joints within the lengths specified in the 'Required Joint Restraint Distance from Fitting' table below. Restrain vertical bends per Standard Detail Drawing 7.16.

(2) Restrain push-on joints with the pipe manufacturer's approved joint restraint locking gasket per Article 702.

(3) Restrain all joints in both directions beyond all mechanical joints per Article 702 and Article 703 – 'Mechanical Joint Pipe and Fittings,' including temporary mechanical joint connections.

REQUIRED JOINT RESTRAINT DISTANCE FROM FITTING (FEET)								
FITTING TYPE	**4-IN**	**6-IN**	**8-IN**	**10-IN**	**12-IN**	**16-IN**	**20-IN**	**24-IN**
TEE: RUN OR CROSS: PLUGGED	10	10	10	10	10	20	20	20
TEE: BRANCH	10	10	10	10	10	10	10	10
DEAD END (*Valve/Cap/Plug/Hydrant/etc.*)	30	45	60	70	80	110	140	160
90° HORIZONTAL BEND	10	15	20	25	25	30	40	50
45° HORIZONTAL BEND	5	10	10	10	15	15	20	25
22.5° HORIZONTAL BEND	5	5	5	5	10	10	10	15
11.25° HORIZONTAL BEND	3	3	3	3	5	5	5	5
REDUCER: SIZE x 4"	-	25	45	60	75	100	130	150
REDUCER: SIZE x 6"	-	-	25	45	60	90	120	145
REDUCER: SIZE x 8"	-	-	-	25	45	80	110	135
REDUCER: SIZE x 10"	-	-	-	-	25	65	100	125
REDUCER: SIZE x 12"	-	-	-	-	-	50	85	115
REDUCER: SIZE x 16"	-	-	-	-	-	-	50	90
REDUCER: SIZE x 20"	-	-	-	-	-	-	-	50
HYDRANT	RESTRAIN ALL JOINTS ON HYDRANT LEAD							
NOTES: SOIL TYPE = GM (SILTY GRAVELS & GRAVEL/SILT/SAND MIXES) DEPTH OF BURY = 6-FT SAFETY FACTOR = 1.5 TRENCH TYPE = 4 TEST PRESSURE = 150 PSI								

703.10.3 Alternate Restraint Methods:

(1) For locations where the Engineer determines one of the two approved restraint methods will not provide adequate thrust restraint or is impractical, the Engineer may require an alternate means of restraint. Alternate thrust restraint methods include those shown in Standard Detail Drawings 7.15 and 7.17. Alternate thrust restrain methods are to be used only when specifically authorized.

(2) Requirements:

1. Where pipe is used for an anchor, provide a sufficient length to fully restraint the fitting.
2. When using threaded rod for restraint use ¾-inch 304 stainless steel threaded rod with stainless steel nuts and washers.

(3) The contractor may propose alternate restraint methods in accordance to Article 703 – 'Repairs and Alterations'.

703.11 Polyethylene Encasement.

(1) Encase all ductile iron pipe, joints, and fittings in polyethylene wrap installed per the requirements of the American National Standard for Polyethylene Encasement for Ductile Iron Pipe Systems (ANSI/AWWA C105 - latest revision) and the manufacturer's requirements. All cuts and repairs to the polyethylene wrap shall be in accordance with ANSI/AWWA C105 and the manufacturer's requirements.

(2) Install polyethylene encasement with a minimum overlap of 1-foot at all joints. Tape the polyethylene wrap every 3-feet and at joints to prevent soil from coming into contact with the pipe.

(3) Carefully place backfill material to prevent tears and punctures in the polyethylene encasement. Promptly repair any tears and punctures per the manufacturer's recommended procedures.

(4) When connecting to or tapping into existing or new polyethylene encased pipe, wrap two or three layers of tape completely around the pipe at the connection/tap location. Mount the tapping machine on the taped area and make the tap directly through the tape and polywrap. Install the corporation stop and inspect the area for damage, repair prior to backfilling, as necessary.

(5) Consult the Engineer if it is determined that a proposed connection may not be performed as described above. Upon authorization, repair or replace any polyethylene wrap which was cut away to allow for the connection or tap. Include the required overlap and taping requirements as described herein.

703.12 Copper Service Laterals.

(1) Provide and install saddles on all service lateral taps on new or existing PVC, HDPE, or CIPP-lined water mains. Use a standard valve box in lieu of a curb box, with no rod or rings required, for all 1-1/2-inch and 2-inch services.

(2) Direct tap all 1-inch service laterals into ductile iron or cast iron water mains.

(3) Service saddles are required for all 1-1/2-inch and 2-inch service connections. Service saddle material requirements are identified in Section 702.5.2 - Saddles.

(4) Use a pipe cutter to cut all copper tubing. Hacksaws or other such devices to cut copper tubing are not permitted.

(5) Excavate and expose the area on the water main for new service connections, as noted on the drawings or as otherwise instructed by the Engineer. Maintain a separation distance of at least 18-inches between adjacent service taps and between a service tap and a pipe joint or fitting. Locate the tap on the upper half of the main between a 45º and 60º angle from the vertical plane, perpendicular to the water main and on the side of the main to which the service extends.

(6) Tap the water main and install the corporation stop using a tapping machine specifically designed to tap water main under pressure. No other method of tapping the water main will be allowed. Tap the main through two or three layers of polyethylene adhesive tape wrapped around the main and/or repair and replace any cut or removed polyethylene encasement following the tap to ensure that the water main is fully protected.

(7) A 45-degree service bend fitting is required to be attached directly to the flare threaded outlet of the corporation stop. Service fitting material requirements are identified in Section 702.5.4 'Corporation Stops and Service Fittings.'

(8) After the tap has been made and the corporation stop and bend have been inserted, loop the copper tubing out and then back toward the main, then back away from the main to form the shape of a vertical "S". Ensure that the "S" loop is of sufficient size so that it uses a minimum of 2-feet of copper tubing. Ensure that the highest portion of the loop is not higher than the top of the water main. Wrap any copper service within 3-feet of the main with polyethylene encasement.

(9) Lay the service flat to the property line or otherwise indicated point of termination. Provide a minimum of 6-feet of cover below finished grade.

(10) Place at least 1-foot of approved bedding material around the copper service pipe. The bedding material is considered incidental to the cost of backfilling the service lateral trenches. Protect all laterals and appurtenances from damage when backfilling. Stones 3-inches in diameter or larger are not allowed within 18-inches of the copper service. Backfill containing rocks 3-inches or larger may not be placed around curb boxes.

(11) Restore any disturbed terrace or turf areas associated with the lateral installation work. Any terrace or turf restoration work is considered incidental to any work associated with service laterals.

(12) Coordinate with property owners to allow for flushing service laterals both prior to and immediately after any work impacting a service. Resolve any problems with property owners, including but not limited to problems regarding discolored water or low/no water flow. See Section 703.8 'Water Main Shutoffs' for additional information.

(13) Repair any damage to new or existing service laterals, curb stops or curb boxes resulting from adjacent excavations located within 5-feet of the water lateral at no cost to the City.

703.12.1 Discovery of Lead Service Laterals:

(1) If discovered, replace any active lead service laterals with new copper service laterals. Notify the Engineer immediately upon discovery of any active lead service laterals. Do not proceed with the service replacement work until authorized by the Engineer.

(2) Coordinate the replacement of lead service laterals with the property owner and the property owner's plumber. Assume that the property owner may have delays in making the connection to the new copper service. To the extent practical, either plan for up to 14 calendar days where the excavation at the curb stop may have to remain open while the old service remains in use. Protect and maintain all excavations throughout this delay with attention to public safety. Otherwise, the excavation may be backfilled, but must be re-excavated if the property owner has scheduled for the service replacement to occur within 14 calendar days of the lead service discovery. No additional compensation will be considered due to the impact of this delay or the failure to coordinate with the impacted property owner or plumber.

(3) If authorized by the Engineer, to meet project schedule requirements or weather constraints, the new copper service may be temporarily connected to the existing lead service.

703.13 Disinfection.

(1) Conform disinfection of materials, procedures and requirements to AWWA C651 – Standard for Disinfecting Water Mains - latest revision, except as otherwise required herein.

(2) Prevent dirt, mud, muddy water, or other foreign matter from entering any water pipe or fittings before, during, or upon installation.

(3) Furnish and install a watertight plug for all open ends of pipe and fittings whenever work is temporarily stopped, including during work breaks or overnight. Failure to properly plug and protect the pipe during construction may result in additional costs for all work and materials necessary for cleaning pipes and fittings contaminated during construction.

(4) Deposit the following amounts of Calcium Hypochlorite (HTH or approved equal - 65% available chlorine by weight) in each 20-foot length of pipe:

Pipe Diameter (inches)	Amount of HTH or approved equal required (ounces)
4	1
6	2
8	3-1/2
10	5-1/2
12	7
16	14

(5) Unless otherwise authorized by the Engineer, not more than 20-feet of pipe or fittings may be swabbed cleaned prior to lowering into the trench.

(6) When swabbing is permitted, disinfect the subject material by swabbing or soaking thoroughly all contact surfaces with a concentrated (1 percent available chlorine or greater) chlorine solution. The solution may be prepared by adding 2 oz of Calcium Hypochlorite (HTH or approved equal - 65% available chlorine) or 26 oz household bleach (5 percent available chlorine) to 1 gallon of water.

(7) Applicators (rags, mops, brushes, sprayers) must be clean and cannot be used for other purposes.

(8) Proper personal protection, such as rubber gloves, goggles, and potentially respiratory protection should be worn when performing this work.

703.14 Flushing.

(1) Flush out the highly-chlorinated disinfection water after meeting the required contact time.

(2) The City will furnish up to 300-feet of flushing hose and execute the water main flushing. The Contractor is responsible to furnish any additional lengths of hose for flushes requiring more than 300-feet of hose.

(3) Provide labor to assist the Engineer with valve turning for the duration of the flushing operation.

(4) Flushing segments may not to exceed 1,200-feet in length unless authorized by the Engineer.

(5) Approved flushing devices are either standard 5-¼-inch hydrants or a standard 2-inch diameter flushing/blow-off device, constructed of rigid potable water pipe discharging between 2-feet and 4-feet above the surface in accordance with SDD 7.07 – 2-IN TEMPORARY FLUSHING/BLOW-OFF FOR 8-IN PIPE AND SMALLER.

(6) Prior to the City arriving on-site to execute the flush, prepare the flushing discharge point to ensure a consistent flushing velocity.

(7) Ensure affected stormwater inlets are protected, clear of debris and drain functionally. Flushing activities shall not create flow paths which result in silt, mud, debris or other sediment washing into sewer systems or beyond the disturbance limits of the jobsite.

(8) Discharge to the stormwater sewer system whenever possible. Discharge to the sanitary sewer system may be permitted only when no other option exists.

(9) Discharge to Storm Sewer System:

1. Inform the Engineer, in writing, of the intent and means to flush water main to the storm sewer a minimum of 2-working days prior to the proposed scheduled flush.
2. Note that the Engineer will schedule the next available flushing crew to perform the flush.
3. Note that all discharge to the storm sewer will be de-chlorinated by the Engineer.

(10) Discharge to Sanitary Sewer System:

1. Inform the Engineer, in writing, of the intent and means to discharge flushing water to the sanitary sewer system.
2. Verify with the Engineer that other discharge options are unavailable.
3. With the consent of the Engineer, obtain a permit for approval to discharge flushing water to the sanitary sewer system from the City of Madison Engineering Department.
4. The Engineer will schedule flushing operations no sooner than 2 working days from the time the permit is requested (the timeframe for permit approval is 2 working days).
5. Obtain permit approval in advance of flushing operations.
6. The Water Utility will pay all costs associated with the sanitary sewer discharge permit.

(11) To obtain a sanitary discharge permit, call City Engineering at (608) 267-1995 and provide the following information:

1. Contractor contact information.
2. Requested time and date of discharge.
3. Diameter and length of the water main to be flushed.
4. Estimated discharge volume.
5. Location of the proposed sanitary access structure.

(12) Do not exceed the permit-approved flushing rate.

(13) Do not flush to any location other than the permit-approved sanitary access structure.

(14) Proceed with flushing until the Engineer deems the flushed sections of water main to be adequately de-chlorinated.

(15) In cases where, for example, a downstream lift station is located, the Engineer may require a vac-truck be provided at no additional cost to ensure that the station is not overwhelmed by discharge.

(16) Vac-truck assistance and all other on-site assistance (outside of the standard flushing operations) provided by the Engineer, City of Madison Engineering Department, or Madison Metropolitan Sewer District will be billed on a time and material basis.

(17) In the event that the permit limit on discharge rate to the sanitary sewer is such that using the sanitary sewer would require extensive time, or the flushing operation would be determined to be ineffective, the Engineer may require an alternative flushing plan at no additional cost to the City.

(18) The discharge volume is estimated to be three times the volume of water contained in the section of main to be flushed. Estimates in CCF (100 cubic feet) calculated as:

$$V = 3 * \left[\frac{(3.14) * D^2 * L}{400} \right]$$

Where:

$V = Flush\ Volume\ in\ CCF$

$D = Pipe\ Diameter\ in\ Feet\ (see\ below)$

$L = Pipe\ Length\ in\ Feet$

$D(in)$	$D(ft)$
6	0.50
8	0.67
10	0.83
12	1.00
14	1.16
16	1.33
18	1.50
20	1.67
22	1.83
24	2.00

703.15 Testing.

(1) Newly installed water mains shall undergo water quality testing and hydrostatic pressure testing prior to final acceptance by the City. The mains may also be tested for electrical conductivity through the joints. Repairs or replacement of any defective work is to be done at no additional cost to the City.

703.15.1 Conductivity Testing:

(1) Any damage to asphaltic or epoxy coating materials and/or welded bonding strap connections require at least 2 mils of a corrosion resistant, bituminous, or rubberized undercoating material installed per manufacturer's recommendations.

(2) Complete all backfilling and obtain approval of the hydrostatic pressure tests prior to performing conductivity testing. The Engineer is to be witness and verify all conductivity testing procedures, test section lengths, and results.

(3) Testing of the first section of pipe installed may be required by the Engineer to demonstrate that the pipe is being installed in an acceptable manner.

(4) Furnish approved testing equipment. Perform test while the newly installed main is at normal operating pressure with all air expelled.

(5) Repair or replace any defective areas noted during the conductivity testing to the satisfaction of the Engineer. Any required repairs or replacement shall be done at no cost to the City.

(6) When the connection to the existing system is not made with a valve, test on the existing section of main to the first available valve(s) to determine the condition of the system. Alternatively, provisions may be made to test the work separately (prior to connection to the existing system), with the Engineer's approval.

(7) Make connections for the test at fire hydrants or valves:

(8) Hydrant connection requirements:

1. In the open position with the caps on during the test.
2. Clamp the cable to the hydrant standpipe and flange bolt.
3. Do not use the hydrant-operating nut as a terminal during the test.

(9) Where hydrants or valves are not available, connections will be made to straps welded directly to the pipe.

(10) Use a length of insulated wire that can reach from one connection to the other (the "external circuit"). Testing the external circuit may be conducted three ways.

(11) Method One:

1. Measure the resistance of the external circuit with an ohm-meter and record this number prior to testing the pipe length.
2. Hook the external circuit wire to the new main as previously described and take a new measurement with the same ohmmeter.
3. In an electrically continuous length of main, the total resistance measured should be just slightly more than that of the external circuit – generally no more than 2-3 ohms. Instances of the measured total resistance measured being significantly greater, equate to evidence of defective electrical contact in the pipe.
4. Isolate and correct defective segments, if required. Re-test until the requirements are met.

(12) Method Two:

1. Display conductivity by the reactivity of "tester" devices, such as a low-wattage light bulb with a battery. Any such equipment will be subject to approval of the Engineer.
2. Hook the external circuit wire to the new main as previously described and connect the external circuit to the tester.

3. Instances of non-reactivity in the tester equate to evidence of defective electrical contact in the pipe.

4. Isolate and correct defective segments, if required. Re-test until the requirements are met.

(13) Method Three:

1. Conductivity may be verified through the use of an energized underground utility locating device, which successfully demonstrates all newly installed lines are located correctly and the location signal is continuous along the entire length of the line.

703.15.2 Water Quality Testing:

(1) Perform water quality testing procedures to AWWA C651 – Standard for Disinfecting Water Mains - latest revision, except as otherwise required herein.

(2) Test water main after a section has been installed and the trench is backfilled. Test sections are not to exceed 1,200-feet in length. A separate test is to be performed for each branch of main.

(3) Assist the Engineer in slowly filling the new main from an uncontaminated source by operating the necessary valves. DO NOT operate any valves under any circumstances, except as directly instructed to do so, by and in the presence of the Engineer.

(4) Loosen one nozzle cap per hydrant to allow air pockets to dissipate along the full length of the pipe segment being filled.

(5) Hold the chlorinated water in the newly installed main for a minimum of 48-hours. Upon commencement of the 48-hour period, schedule flushing and sampling activities with the Engineer.

(6) The Engineer will collect and submit samples for bacteriological testing. The newly installed system will not be put into service until the Engineer receives a safe bacteriological sample result from the certified lab.

(7) If a sample receives an unsafe test result, schedule with the Engineer to have the main flushed and sampled two additional times, occurring at least 24-hours apart.

(8) If either of the two follow-up samples collected do not pass the test, disinfect the main again per AWWA C651 and the chlorinated water again held in the pipe for a minimum of 48-hours.

(9) Following the 48-hour holding period, assist the Engineer with flushing the line again and re-sampling.

(10) Repeat this process, at no additional cost to the City, until a safe sample is received from the City's designated testing lab. Cover all costs incurred by the Engineer, including any labor and material.

703.15.3 Hydrostatic Pressure Testing.

(1) Hydrostatically pressure test all new water main, including hydrants, in accordance with the AWWA Standard for Installation of Ductile Iron Water Main (AWWA C600 - latest revision).

(2) Hydrostatic pressure testing can be done through a newly installed hydrant, a temporary hydrant, a temporary flushing/blow-off assembly per SDD 7.07, or a newly installed permanent service

lateral connection. Regardless of method selected to perform the pressure test, provide an above-grade connection location for the Water Utility Inspector's pressure gauge during the test.

(3) After the main has been declared bacteriologically safe by the designated testing lab, and following the installation of service laterals on new private development work, or as soon thereafter convenient for the Engineer, conduct a hydrostatic pressure test. On street reconstruction projects, pressure test mains prior to making any water service lateral connections. All pressure tests shall be witnessed and verified by the Engineer.

(4) Expel all air from the pipe prior to the engineer's arrival to witness the start of the pressure test. If hydrants or blow-offs are not available at high points, make the necessary taps at high points to expel the air and insert plugs after the air is expelled.

(5) Hydrostatic Pressure Test Requirements:

1. Maximum test segment length of 1,200-feet.
2. 150 psi test pressure (minimum).
3. Minimum duration of 2-hours.
4. Test pressure may not drop below 125 psi at any point during the pressure test.

(6) The Engineer reserves the right to install a locking mechanism at the test gage or install direct-connect pressure recorders for the test.

(7) Higher pressures and shorter durations may be considered upon request.

(8) Longer test segment lengths may be considered upon request.

(9) Use only clean, disinfected containers and equipment to add make-up water at the end of the pressure testing. to return to the original starting pressure of the test. Refill measurements are to be done with a graduated container, measured in ounces.

(10) The Engineer reserves the right to require make-up water be added at any point during the pressure test if the test pressure drops more than 5 psi during the test, which restarts the 2-hour testing duration. Furnish all equipment, labor, and supplies necessary to apply pressure to the pipeline in a manner satisfactory to the Engineer.

(11) The testing allowance (allowable makeup water) shall be no greater than as calculated in the formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

L = Gallons per hour

S = Length of test main in feet

D = Diameter of pipe in inches

P = Average pressure in pounds per square inch during testing

(12) When testing against closed metal-seated valves, an additional testing allowance per closed valve of 0.0078 gph per inch of nominal valve size is permitted.

(13) If the pipe line fails the pressure test, locate the leak and repair it to like-new condition. The proposed repair method is to be reviewed by the Engineer and result in an end product that is equal to, or better than new construction.

(14) Following location and repair of the leak, repeat the pressure test until a satisfactory result is obtained. All costs associated with retesting the pipe line is considered to be incidental.

703.16 Finishing Work and Maintenance.

(1) Repair any structures or other features damaged during construction, including but not limited to:

1. Concrete, asphalt, and gravel pavements.
2. Stone flagging or paving.
3. Sidewalks, curbs and gutters.
4. Culverts.
5. Fences.

(2) Rebuild or re-lay all surfaces properly to the original line and grade in accordance these Specifications, or in the absence of applicable specifications, to original condition.

(3) Prior to final acceptance by the Engineer, clean and grade the project area. Final payment will be withheld until such work is completed in a manner satisfactory to the Engineer

(4) Maintain all repaired, restored, or replaced surfaces until final acceptance of the project by the City.

(5) Repair, restore or replace all failures occurring during the guarantee period at no cost to the City.

703.17 Final Inspection.

(1) Final inspection will not be scheduled until:

1. Repair, replace or adjust valve boxes, valve box adaptors, curb boxes and hydrants.
2. Repair or replace any other features disturbed or damaged by construction activities.
3. All applicable finish work and maintenance is complete.
4. All water system testing is satisfactorily completed.

(2) When satisfied that all work is complete, notify the Engineer and schedule a final inspection at least two working-days ahead of paving.

(3) Complete the final inspection with the Engineer, reviewing all project records and paperwork for completeness and, if necessary, establish a punchlist of any remaining final repairs or adjustments required prior to Madison Water Utility's acceptance of the installed water system improvements.

(4) Make the necessary repairs or corrections of any noted deficiencies and schedule a final confirmation inspection, before final payment is made and installations are accepted by Madison Water Utility.

(5) If noted deficiencies have not been adequately resolved at the time of the final confirmation inspection, subsequent inspections will be required until satisfactory resolution of the noted deficiencies have been completed. Any subsequent inspections required after the final confirmation inspection are subject to charges of costs incurred related to any additional inspections.

703.18 Water Utility Construction Services.

(1) Supplemental construction services provided by the Engineer include:

1. Water main filling.
2. Flushing.
3. Testing.
4. Live-tap installations.

(2) Schedule services as follows:

1. Between the hours of 7:00 AM and 3:00 PM.
2. Monday through Friday.

(3) Requests for supplemental construction services occurring outside of the approved hours will be subject to any associated overtime charges being billed.

(4) Do not schedule live-tap installations to occur outside of the approved hours.

(5) The Engineer reserves the right to decline any supplemental construction services which are requested to occur outside of the approved hours.

(6) Upon request, the Engineer may authorize the Contractor to fill water mains. Do not proceed with filling water mains unless authorization by the Engineer has been obtained in writing.

(6) Madison Water Utility owns and maintains the municipal water system consisting of all public water mains and service laterals from the main to the curb stop or shut-off valve, or otherwise to a distance of eight (8) feet within the public right-of-way. Beyond these limits, water service laterals are privately owned and maintained and the Utility cannot provide utility locating services.

ARTICLE 704 – BID ITEMS, MEASUREMENT AND PAYMENT

704.1 General.

(1) Visit the site prior to bidding and become familiar with the existing conditions. It will be the responsibility of the Contractor to work with the utilities located in the right of way to resolve conflicts during the construction process.

(2) Prices for the various items include all means to complete the work as specified, such as (but not limited to):

1. Equipment.
2. Tools.
3. Materials.
4. Labor.
5. Related incidentals.

(3) The Water Utility will furnish tapping valves, tapping sleeves, and one valve box for all pressurized taps 4-inches or larger. With this one exception, the Water Utility will not furnish any materials to the Contractor unless specifically stated in the Contract documents.

(4) Only work that is completed and accepted in accordance with the terms of these Specifications and the Contract Documents will be measured for payment.

704.2 Bid Items.

(1) Note that all requirements of Articles 701-704 and these Specifications, Standard Detail Drawings, and Contract Documents are applicable to all bid items as described or otherwise considered incidental. Include the costs of all required work in the unit prices that were bid in the Contract Documents, unless specifically noted otherwise.

(2) This includes any sections of a bid item listed as "(Vacant)".

(3) In the event of conflicting information within these Specifications, the bid items govern.

704.3 Furnish & Install Pipe & Fittings.

4-Inch, Bid Item 70001; 6-Inch, Bid Item 70002; 8-Inch, Bid Item 70003; 10-Inch, Bid Item 70004; 12-Inch, Bid Item 70005; 16-Inch, Bid Item 70006; 20-Inch, Bid Item 70007; 24-Inch, Bid Item 70008.

704.3.1 Description:

(1) Furnish, install and test new water main and fittings. Work for this item also includes:

1. Thrust restraints.
2. Temporary flushing devices (blow-offs and/or temporary hydrants).
3. Polyethylene encasement.
4. Temporarily raising or lowering existing water services.
5. Exposing existing water main to verify location and depth.
6. Placing imported select fill in trench excavations.
7. Disposal of excess excavated material.
8. Concrete and asphalt pavement removal.
9. Restoring the site.

704.3.2 Materials:

(1) Refer to Article 702 and this section.

(2) All materials necessary to perform the work, including:

1. Pipe and accessories.
2. Fittings and accessories.
3. Sleeves, clamps, tie rods, plugs.
4. Thrust blocking and/or restrained-joint gaskets.
5. Polyethylene encasement.
6. Bedding material to cover the pipe.

(3) Temporary blow-off devices:

1. Temporary 2-inch diameter flushing/blow-off devices will be permitted on 8-inch or smaller mains provided they are assembled in accordance with SDD 7.07 – 2-IN TEMPORARY FLUSHING / BLOW-OFF FOR 8-IN PIPE AND SMALLER.
2. Plastic tubing or other flexible tubing materials are not permitted.
3. Terminate blow-off device at least 2-4-feet above ground with a ball valve and a 2 ½ -inch brass NST fire-hose connection.

704.3.3 Construction:

(1) Refer to Article 703 and this section.

(2) Pipe Laying and Bedding:

1. Lay pipes with a minimum of 6-feet and a maximum of 7-feet of cover from final grade, unless otherwise depicted on the Construction Drawings or required by the Engineer.
2. For line or grade adjustments of 24-inches or less, use offsets in lieu of bend fittings.
3. Inspect all pipe and fittings for damage and cleanliness prior to lowering into the trench. Any costs due to the repair of damaged valves and hydrants caused by sand or silt in the pipe will be assessed.
4. Never roll or push the pipe into the trench from the bank. Always lower the pipe into the trench using mechanical equipment.
5. Do not place chlorine in a pipe during installation that will not be filled and flushed within 45 days of installation.
6. Restore any disturbed turf areas associated with any water main or service lateral installation located in roadway terraces. The restoration is considered incidental to the service lateral work.

(3) Slip Joints:

1. A slip joint is made by compressing a rubber gasket between a bell cast in the end of one pipe and the plain end of the pipe to be joined.
2. Assemble in accordance with AWWA C600 - latest revision, including:
3. Thoroughly clean the groove and the bell socket of the pipe or fitting, and the plain end of the mating pipe.
4. Using a clean gasket of the proper design for the joint to be assembled, make a small loop in the gasket and insert it in the socket, making sure the gasket faces the correct direction and that it is properly seated.
5. Apply lubricant to the gasket and plain end of the pipe in accordance with ANSI/AWWA C111/A21.11 - latest revision. Only use lubricant supplied by the pipe manufacturer.
6. Be sure that the plain end of the pipe is beveled, as square or sharp edges may damage or dislodge the gasket and cause a leak.
7. Push the plain end into the bell of the pipe, keeping the joint straight while pushing.
8. Deflect the pipe as required only after the joint is assembled.
9. Establish conductivity across the joint in accordance with methods permitted in Section 702.1.2 (2) – ‘Ductile Iron Pipe – Pipe Requirements.’

704.3.4 Method of Measurement:

(1) Measured by length, in feet, to the nearest half foot for each size (diameter) of pipe installed.

(2) Measured along the centerline of the pipe, from center to center of valves and fittings.

(3) No deductions from the measured lengths for fitting installations.

704.3.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70001	FURNISH AND INSTALL 4 INCH PIPE & FITTINGS	L.F.
70002	FURNISH AND INSTALL 6 INCH PIPE & FITTINGS	L.F.
70003	FURNISH AND INSTALL 8 INCH PIPE & FITTINGS	L.F.
70004	FURNISH AND INSTALL 10 INCH PIPE & FITTINGS	L.F.
70005	FURNISH AND INSTALL 12 INCH PIPE & FITTINGS	L.F.
70006	FURNISH AND INSTALL 16 INCH PIPE & FITTINGS	L.F.
70007	FURNISH AND INSTALL 20 INCH PIPE & FITTINGS	L.F.
70008	FURNISH AND INSTALL 24 INCH PIPE & FITTINGS	L.F.

(2) Payment for temporary flushing hydrants and/or blow-offs will be considered only if subsequently required as a result of plan revisions issued by the Engineer:

1. A payment of $1,500.00 will be made for any authorized temporary flushing hydrant.
2. Any hydrant used for temporary flushing purposes may not become a permanent fixture anywhere in the system.
3. A payment of $500.00 will be made for any authorized 2-inch or larger blow-off device.
4. Temporary hydrants or blow-offs resulting from a plan revision must be reviewed by the Engineer for payment considerations.

(3) Additional Fittings, where authorized, are to be paid or credited as follows:

DESCRIPTION	UNIT	PRICE
4-INCH FITTING	EACH	$575.00
6-INCH FITTING	EACH	$705.00
8-INCH FITTING	EACH	$950.00
10-INCH FITTING	EACH	$1,075.00
12-INCH FITTING	EACH	$1,200.00
16-INCH FITTING	EACH	$2,150.00
20-INCH FITTING	EACH	$2,685.00

(4) Total fitting quantity to be balanced out by any fittings identified on the plan set to be furnished and installed, but that were not furnished and installed.

1. Additional bend fittings: Paid as diameter value, credited as 1 fitting.
2. Additional reducer fittings: Paid as average value between the two diameters, credited as 1 fitting.

3. Additional tee fittings: Paid as run diameter value plus half of the branch diameter value. Credited as 1-1/2 fittings.

4. Additional cross fittings: Paid as diameter 1 value plus diameter 2 value, credited as 2 fittings.

5. Additional offset fittings: Paid as 1 1/2 times diameter value, credited as 1 1/2 fittings.

6. Additional solid sleeve, cap or plug fittings: Paid as 1/4 diameter value, credited as 1/4 fittings.

(5) If unanticipated contaminated soil is encountered and nitrile or fluorocarbon water main gaskets are subsequently required by the Engineer, provide an invoice for the required gaskets which will be paid or credited at the Contractor's cost. Additionally, clay trench plugs, if required by the Engineer, are to be paid or credited as follows:

DESCRIPTION	**UNIT**	**PRICE**
CLAY TRENCH PLUG PER SDD 7.23	EACH	$600.00

704.4 Horizontal Directional Drill Pipe.

8-Inch, Bid Item 70010; 10-Inch, Bid Item 70011; 12-Inch, Bid Item 70012; 16-Inch, Bid Item 70013; 20-Inch, Bid Item 70014; 24-Inch, Bid Item 70015.

704.4.1 Description:

(1) Furnish, assemble, install and test horizontal directional-drilled water pipe and fittings. Work for this item also includes:

1. Excavating boring pits and other trenches. Backfilling and compacting said excavations.
2. Exposing existing water mains to verify location and depth.
3. Installing tracer wire, joint adapters, bracing, plugs and other accessories.
4. Hard-rock drilling.
5. Disposing of surplus material.
6. Restoring the work area.

704.4.2 Materials:

(1) Refer to Article 702 and this section.

(2) High-Density Polyethylene (HDPE), as described herein, is the approved standard pipe material for Horizontal Directional-Drilling pipe installations.

1. If proposing to use pipe material other than HDPE for horizontal directional-drilling, submit full material specifications to the Engineer for review per Article 703 – 'Repairs and Alterations.'
2. Any proposed alternative material needs to have been used on a minimum of five similarly sized horizontal directional-drilling projects within the last three years to be considered.

(3) HDPE Pipe Requirements:

1. In compliance with AWWA C906 – latest edition, ASTM F714 – latest edition.
2. 200 psi pressure rating.
3. DR-11 dimension ratio.
4. Match inside diameter as closely as practical to the inside diameter of the connection pipe.
5. Outside diameters shall be Ductile Iron Outside Diameter (DIOD).
6. Comply with the requirements of the Safe Drinking Water Act and certified as suitable for drinking water by ANSI/NSF Standard 61.
7. Identified as water with either a factory installed co-extruding longitudinal blue stripe in the pipe or blue underground warning tape with "Caution Buried Water Line Below" imprinted on it, placed 2-feet above the new pipe.

8. Cuts or gouges in the HDPE pipe, per ASTM F585 are acceptable up to 10% of the wall thickness. Cut out and remove any pipe sections where cuts or gouges are greater than 10% of the wall thickness and butt fuse the ends.

(4) Joining HDPE pipe to HDPE pipe *or* HDPE fittings:

1. Thermal butt fusion.

2. Thermal butt fusion is to be executed in accordance with the requirements of the pipe and/or fitting manufacturer. Equipment used to execute the thermal butt fusion joints shall be furnished or approved by the pipe and/or fitting manufacturer.

(5) Mechanical Joint Adapters:

1. Join HDPE pipe to mechanical joint bells in accordance with the requirements of ANSI/AWWA C111/A21.11.

2. Mechanical joint adapters shall be certified to meet the requirements of ANSI/AWWA C901 and C906 requirements (latest revisions).

3. Thermal butt fusion is required at joints between mechanical joint adapters and HDPE pipe.

(6) Tracer Wire:

1. Galvanized or stainless steel.

2. ¼-inch diameter braided cable.

3. 2,000-lb minimum breaking strength.

4. Protective PVC coating (to resist corrosion and damage during installation).

5. Includes valve box at each end of tracer wire installation.

704.4.3 Construction:

(1) Refer to Article 703 and this section.

(2) Prior to bidding, become familiar with anticipated subsurface and existing field conditions that will affect the location of the bore pits and the lengths and depths of the pipe installation, as well as any equipment, tools and materials required to keep the necessary installation within the limits identified on the drawings.

(3) The Contract Documents represent the best information available with regard to anticipated field conditions; however, any provisions necessary for encountering hard-rock drilling are to be included and are considered incidental to the installation.

(4) Exposing existing water mains to verify location is considered incidental to the installation.

(5) Submit a horizontal directional-drilling plan, sequence of work, and drilling schedule to the Engineer for review prior to commencing work. At a minimum, include:

1. Detailed site plan drawing which depicts location and size of boring pits and staging areas.

2. Proposed sequence and schedule of HDD operations.

3. Method of controlling and monitoring and recording the bore location, accuracy, and depth.
4. Drilling mud storage, handling and contingency plan.
5. Any other applicable details regarding how the work will progress and be controlled.

(6) The Engineer will review the precision of the installed pipe. For gross misalignment, the Engineer reserves the right to require that the pipe be reinstalled at no cost to the City. Maintain liability for all costs associated with modifying to easements due to HDPE installation alignment errors. Pipe installation accuracy requirements:

1. Horizontal accuracy of +/- 3-feet.
2. Vertical accuracy of plus 6-inches and minus 3-feet.

(7) Perform pipe joining with personnel trained by the thermal fusion equipment manufacturer in the use of the equipment for thermal butt fusion/electro-fusion of HDPE pipe.

(8) Do not proceed with installation of the pipe until mechanical end seals are securely installed.

(9) The Plastics Pipe Institute does not recommend pneumatic pressure testing of pipe prior to installation. If warranted, or elected to be performed by the Contractor, any pre-installation testing shall be conducted hydrostatically. Hydrostatic testing is preferred because less energy is released if the test section fails catastrophically. Post-installation pressure tests are still required in all cases.

(10) Do not make ductile iron connections to the fused HDPE adaptors on the same day the HDPE pipe was installed. Allow 24-hours for initial contraction of the HPDE pipe upon removal of the installation pull force loads.

(11) Install tracer wire along the full length of the pipe. Bring the tracer wire up to finish grade at each end of the bore inside a valve box to allow access for future use. Securely clamp or weld the tracer wire to the valve box. Provide accessible connection point to allow for extension of grounding wire from a locating device. Center the valve box over the mechanical joint transition fitting.

704.4.4 Method of Measurement:

(1) Measured by length in feet, to the nearest half-foot for each size (diameter) of pipe installed.

(2) Measured along the centerline of the pipe from center-to-center of valves and fittings.

(3) No deductions will be taken from the measured lengths for fitting installations. No additions to the length of the pipe will be given due to misalignment of the bore.

704.4.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70010	HORIZONTAL DIRECTIONAL DRILL 8 INCH PIPE	L.F.
70011	HORIZONTAL DIRECTIONAL DRILL 10 INCH PIPE	L.F.
70012	HORIZONTAL DIRECTIONAL DRILL 12 INCH PIPE	L.F.
70013	HORIZONTAL DIRECTIONAL DRILL 16 INCH PIPE	L.F.
70014	HORIZONTAL DIRECTIONAL DRILL 20 INCH PIPE	L.F.
70015	HORIZONTAL DIRECTIONAL DRILL 24 INCH PIPE	L.F.

(2) Valve boxes required for tracer wire endpoints are considered to be incidental to this bid item.

704.5 Furnish & Install Casing.

18-Inch, Bid Item 70020; 20-Inch, Bid Item 70021; 24-Inch, Bid Item 70022; 30-Inch, Bid Item 70023.

704.5.1 Description:

(1) Install steel or reinforced concrete casing pipes for water mains.

704.5.2 Materials:

(1) Refer to Article 702 and this section.

(2) Steel Casing Pipe:

1. Minimum yield strength of 35,000 psi.
2. Minimum wall thickness:

Pipe Diameter (inches)	Wall Thickness (inches)
18	0.31250
20	0.34375
24	0.37500
30	0.46875

(3) Reinforced Concrete Pipe:

1. Class V minimum.

(4) Carrier Pipe:

1. US Pipe TR-Flex, or equivalent.

(5) Casing fill:

1. Silica sand or pea gravel.

(6) Casing Spacers – Hardwood Timber:

1. 4-inch by 4-inch hardwood timbers, per Standard Detail Drawing 7.21 – 'Casing Spacers.'
2. Hardwood timber casing spacers may be used with water mains up to 12-inches in diameter, and within casings not exceeding 60-feet in length.

(7) Casing Spacers – Manufactured:

1. Manufactured casing spacers shall include stainless steel risers, nuts, bolts and bands, minimum 8-inch width, and polymer runners. Acceptable products include:
2. BWM Company Stainless Steel Casing Spacers, model: BWM-SS 8-inch width.
3. CCI Pipeline Systems Stainless Steel Band Casing Spacer, model: CSS8.
4. Advance Products & Systems Stainless Steel Band Spacers, model: SSI, 8-inch width.

704.5.3 Construction:

(1) Prior to installation of the pipe casing, perform required ULOs to verify the location of surrounding utilities and structures. Provide utility location information to the Engineer for review and approval of any adjustments in casing installation line or grade, in writing.

(2) Install per the approved drawings to an accuracy of +/- 1% or +/- 2-feet, whichever is less.

(3) Install the pipe casing by traditional open trench construction wherever applicable.

(4) For untrenched installation of the pipe casing, install by dry auger boring and jacking methods.

(5) Requirements:

1. Borehole diameter to be essentially the same as the outside diameter of the casing.
2. Auger is to remain inside the casing at all times.
3. Pressure-grout the annular space around the casing if the auger is pushed ahead of the casing.
4. Pressure grout voids as they develop.
5. Pressure-grout any spaces greater than approximately 1-inch from the outside of the casing.
6. Provide a steerable front section of casing to allow vertical grade adjustments.
7. Provide a water level or other means to monitor the grade elevation of the auger casing.
8. Water jacking for excavation of the soil is not permitted.

(6) Provide a boring and jacking plan to the Engineer for review and approval prior to commencing work.

(7) Connect adjacent lengths of steel pipe by continuous, circumferential, field butt-welding in accordance with AWWA C206.

(8) Install carrier pipe on line and grade through the casing pipe.

(9) Install approved casing spacers at the required distances per Standard Detail Drawing 7.21 – 'Casing Spacers,' and in accordance with the manufacturer's installation requirements.

(10) Fill the annular space between the casing and carrier pipe with specified sand or gravel material.

(11) Take care to ensure that developed thrust pressures do not disturb existing utilities in or around the bore pit area.

(12) Properly dispose of excess material off-site.

704.5.4 Method of Measurement:

(1) Measured by length in feet, to the nearest half foot for each size (diameter) of casing installed.

(2) Measured along the centerline, from end to end of the casing.

704.5.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70020	FURNISH AND INSTALL 18 INCH CASING	L.F.
70021	FURNISH AND INSTALL 20 INCH CASING	L.F.
70022	FURNISH AND INSTALL 24 INCH CASING	L.F.
70023	FURNISH AND INSTALL 30 INCH CASING	L.F.

704.6 Furnish & Install Water Valve.

4-Inch, Bid Item 70030; 6-Inch, Bid Item 70031; 8-Inch, Bid Item 70032; 10-Inch, Bid Item 70033; 12-Inch, Bid Item 70034; 16-Inch, Bid Item 70035; 20-Inch, Bid Item 70036.

704.6.1 Description:

(1) Furnish and install water main valves and associated accessories. Work for this item also includes, but is not limited to:

1. Mechanical joint restraint:
2. Valve boxes and box extensions.
3. Valve box adjustments.
4. Establishing electrical conductivity across the valve.

704.6.2 Materials:

(1) Refer to Article 702 and this section.

(2) Valves 12-inches and smaller - Requirements:

1. Resilient Wedge Gate Valves.
2. Meet requirements of AWWA C509 or AWWA C515 - latest revision.
3. Supplied with mechanical joints.
4. Open to the left.
5. Non-rising stem.
6. O-ring packing.
7. 2-inch square operating nut.
8. Acceptable models include:

Brand	Model
Kennedy	KS-FW 8571, KS-RW 7571 or equal
Mueller	A2360, A2361 or equal
Clow	F-6100 Model 2638, 2639, 2640 or equal
American Flow Control	Series 2500 or equal
American Flow Control	Series 2500 with Alpha Ends (restrained) or equal

(3) Valves 14-inches and larger - Requirements:

1. Rubber Seated Butterfly Valves.
2. Meets the requirements of AWWA C504 - latest revision.
3. Supplied with mechanical joints.

4. Open to the left.
5. Acceptable models include:

Brand	Model
Kennedy	B4500 or equal
Mueller	B3211-20 or equal

(4) Valve boxes:

1. Bingham and Taylor cast-iron.
2. Three piece screw type.
3. No. 6 round base.
4. 5-1/4-inch shaft.
5. With stay-put covers marked “WATER.”.
6. Valve box covers/lids shall be smooth, round, standard drop in lids without grooves or ridges (Bingham and Taylor L1-5 model, or equal).

(5) Paving Adapters

1. Bingham and Taylor 6030 fully-threaded, screw type Rite Hite Adaptor.

(6) Valve Box Alignment Devices:

1. All valves shall be supplied with a Gate Valve Adaptor as manufactured by Adaptor Inc., or equal.
2. Metal frame
3. Supplied with ¾-inch rubber gasket.
4. Sized to fit the brand of valve being supplied.

(7) Valve Box Extensions:

1. Tyler, or equal
2. Screw type
3. 5-1/4-IN shaft
4. No. 58 - 12-IN long,
5. No. 59 - 18-IN long,
6. No. 60 - 26-IN long.

704.6.3 Construction:

(1) Refer to Article 703 and this section.

(2) Prior to installation, inspect all valves and associated accessories for:

1. Cracks or other handling damages.
2. Verification of bolt tightness.
3. Opening direction and number of turns to open.
4. Freedom of operation.
5. Cleanliness of valve ports, especially seating surfaces.

(3) Set and join valves and associated accessories to the pipe with mechanical joints per Article 703.

(4) Always install valves in the closed position to prevent foreign material from causing damage.

(5) Adjust valves following installation so they operate easily and properly.

(6) Establish conductivity across valves by means of mechanical or field-welded bonding straps and any associated coating repairs per Section 702.3.1 (5) – 'Electrical Conductivity.' Bonding straps shall be minimum 2 gauge copper wire capable of transmission of at least 500 amps, or Engineer approved equivalent.

(7) A valve box is required at every valve installation. Valve box installation requirements:

1. Ensure that the valve box does not transmit shock or stress to the valve.
2. Center the valve box over the valve operating nut using the valve box alignment device in accordance with Standard Detail Drawing 7.06 – Water Valve Box Alignment.
3. Verify valve box alignment with a plumb bob centered on the operating nut. The box must be centered over the nut within the allowable tolerance of ½-inch, which ensures a minimum ¾ inch clearance between the box and the operating nut – See Standard Detail Drawing 7.06 – Water Valve Box Alignment for more details.
4. Valve boxes located on sloped surfaces of 3% or greater may not allow for alignment verification as described above and shall be visually assessed with the operation of a centered, unrestricted valve key.
5. Valve boxes located on mains installed at depths requiring valve box extensions shall incorporate a temporary PVC riser tube, or similar method, to ensure straight vertical alignment through the extended valve box.
6. Compaction around valve boxes should be in accordance with Article 703 "Backfilling and Compaction" and this section.
7. Set the box cover at or below finished base course elevation depending on thickness of the asphalt binder course and finished asphalt surface to allow for the installation of a Rite-Hite Adapter.
8. Rite-Hite Adaptors, or approved equivalent valve box adaptors shall be fully threaded, screw-type adaptors. The use of "cheaters," "non-threaded risers," or "drop-in" extensions is prohibited.

9. Install Rite-Hite Adapter and verify that there is adequate adjustment in both directions in the valve box to reach proper finished asphalt grade. See Standard Detail Drawing 7.08 – 'Typical Valve & Box Installation' for more details.

10. Modifying the valve box or adapter in any way is prohibited, unless specifically authorized by the Engineer.

11. Prior to paving binder course or finished asphalt surface, the adapter should be removed, and then reinstalled after paving, prior to rolling the asphalt.

12. Reset any valve boxes that have shifted so they are plumb and centered over the valve at any time throughout construction, and until formal acceptance of the project by the Engineer.

704.6.4 Method of Measurement:

(1) Measured by each completed unit.

704.6.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70030	FURNISH AND INSTALL 4-INCH WATER VALVE	EACH
70031	FURNISH AND INSTALL 6-INCH WATER VALVE	EACH
70032	FURNISH AND INSTALL 8-INCH WATER VALVE	EACH
70033	FURNISH AND INSTALL 10-INCH WATER VALVE	EACH
70034	FURNISH AND INSTALL 12-INCH WATER VALVE	EACH
70035	FURNISH AND INSTALL 16-INCH WATER VALVE	EACH
70036	FURNISH AND INSTALL 20-INCH WATER VALVE	EACH

704.7 Furnish and Install Hydrant / Salvage Existing Hydrants.

Bid Item 70040.

704.7.1 Description:

(1) Furnish and install fire hydrants and associated thrust restraints. Adjust hydrant as necessary.

(2) Prepare a proper drain field for the hydrant.

(3) Establish electrical conductivity between the hydrant assembly and the distribution system mains.

(4) Decommission and salvage existing fire hydrants as designated on the plans.

(5) Restore all disturbed terrace or turf areas.

704.7.2 Materials:

(1) Refer to Article 702 and this section.

(2) Hydrant requirements:

1. Hydrants are required to have “breakaway” capability
2. Acceptable models include:

Brand	Model
AFC Waterous	Pacer WB-67
Mueller	Super Centurion A423

(3) Nozzle requirements:

1. Side nozzles: Two at 2½-inch diameter.
2. Pumper nozzle: One at 4½-inch diameter.
3. National Standard threads.
4. Chains attaching the caps to the hydrant.
5. Embossed with the word OPEN and an arrow showing that the hydrant opens left.
6. Valve opening: 5¼-inch with National Standard operating nut shape.
7. Painted red with blue nozzle caps – Waterous color M4152 (Houston Blue), or equal.
8. 360-degree top rotation.
9. “Dry top” operating threads to be sealed when open.
10. 6-inch mechanical joint bottom connection with conductive mechanical joint (no lead) gasket and necessary accessories.

(4) Upper valve plate requirements:

1. Brass with a brass-to-brass foot valve.

(5) Drain valve facing requirements:

1. Furnish hydrant with plastic drain valve facing (otherwise, drain tube/drain valve assembly).

(6) Operating nut requirements:

1. One-piece operating nut.

(7) Reflective locating device:

1. "Hydra-Finder" manufactured by RoDon Corp.

(8) Extensions: Per manufacturer's recommendations.

704.7.3 Construction:

(1) Refer to Article 703 and this section.

(2) Ensure that the Engineer is present whenever:

1. A hydrant is to be set.
2. A hydrant has been set, prior to backfilling.
3. A hydrant extension is to be installed.
4. A hydrant is to be disassembled for adjustment or maintenance.

(3) Be responsible for the proper operation of all hydrants on the project until the City formally accepts the water mains, and the warranty period has expired.

(4) Unless directed otherwise, set all hydrants so the back of the hydrant is 8-feet from the associated property line.

(5) Ensure that the hydrant is set so the bury-line is not below finished grade and not more than 3-inches above finished grade.

(6) The base of the hydrant barrel may not exceed a depth of 9-feet below finished grade.

(7) Hydrant extensions:

1. Extensions may be necessary to bring the bury-line to finish grade.
2. Notify the Engineer at least 2 working days prior to installing an extension.
3. Coordinate with the Engineer to have the extension furnished.
4. When an extension becomes necessary as a result of Engineer-ordered grade adjustments during construction or plan revisions issued by the Engineer, the City will furnish the extension and the installation labor.
5. When an extension is necessary as a result of negligence, or when the planned depth is greater than the available hydrant length, supply an approved extension. Do not install the extension until the Engineer is present.
6. No more than 1 hydrant extension will be permitted per hydrant installation.

7. Note that any subsequent adjustments to the hydrant elevation, including any extra fittings needed to meet these requirements, are considered incidental to the hydrant installation.

(8) Restrain the full length of hydrants lead from the tee on the water main to the hydrant, including the hydrant valve and any associated fittings, with mechanical joint restraints. Push-on pipe joints are not permitted along the hydrant lead unless there is a continuous pipe dimension on the lead longer than the full-length of a new pipe. Under that condition, an approved joint-restraint locking gasket is required at the joint.

(9) Install a full-size, unbroken 4-inch x 8-inch x 16-inch solid concrete masonry block, laid flat, in the excavation to provide a firm base for the hydrant. If a hydrant lead valve is designated on the plans, also install a full-size, unbroken 4-inch x 8-inch x 16-inch solid concrete masonry block, laid flat, in the excavation to provide a firm base for the valve.

(10) Install solid concrete or poured concrete thrust blocking against undisturbed soil behind the base of the hydrant in accordance with Article 703 of these Standard Specifications.

(11) Set the hydrant in a truly vertical position and securely brace it until backfilling is complete.

(12) Rotate the hydrant so that the small nozzles are parallel to the curb line.

(13) Establish conductivity to the hydrant barrel by means of mechanical or field-welded bonding straps and any associated coating repairs per Section 702.3.1 (5) – 'Electrical Conductivity.' Bonding straps shall be minimum 2 gauge copper wire capable of transmission of at least 500 amps, or Engineer approved equivalent.

(14) Use 1-inch washed stone as backfill around the lower portion of the hydrant. Take special care to keep the weep holes/drain holes in the hydrant elbow open to allow drainage.

(15) Cover the stone backfill with 6-mil polyethylene, or suitable geotextile fabric, to prevent loose dirt from filling in the voids in the stones.

(16) Backfill the remainder of the excavation with approved material and compact evenly in lifts not exceeding 12-inches. Ensure that the pressure of the backfill on the stem is evenly distributed.

(17) Restore all disturbed turf areas associated with the hydrant installation.

(18) Install ½-inch expansion joint around hydrant barrel when hydrant installation is located in concrete pavement. Install expansion joint filler material in accordance to Section 303.2(d) of these Specifications.

(19) Salvaging existing hydrants (incidental when designated on plans):

1. Do not proceed with hydrant abandonments until the existing water main has been abandoned.

2. For screw type hydrants:

    (i) Unscrew the hydrant with chain tongs (or like), and remove the high stock, and salvage for the Engineer.

    (ii) Remove the frost case and salvage for the Engineer.

3. For non-screw type hydrants:

(i) Excavate to the bottom of the hydrant and disassemble/disconnect it from the hydrant lead.

(ii) Remove the hydrant and salvage for the Engineer.

4. Backfill the remaining opening/excavation with existing material and compact.
5. Use select fill material if there is not enough approved existing backfill material.
6. Restore all disturbed turf areas associated with the hydrant abandonment.
7. Hydrants that are damaged due to negligence will not be paid.
8. Hydrants damaged during this work will be billed $635.00 by the Engineer.

704.7.4 Method of Measurement:

(1) Measured by each completed unit.

704.7.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70040	FURNISH, INSTALL AND SALVAGE HYDRANT	EACH

704.8 Relocate Hydrant.

Bid Item 70041.

704.8.1 Description:

(1) Remove and relocate existing fire hydrants.

704.8.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant)

704.8.3 Construction:

(1) Refer to Article 703 and this section.

(2) If the hydrant lead valve is adequately restrained to the water main tee:

1. Shut off the hydrant lead valve and excavate as necessary along the hydrant lead.
2. Add or remove fittings, extending or shortening the hydrant lead as shown on the drawings or as ordered by the Engineer, to properly install the hydrant in accordance with Article 704 – 'Furnish & Install Hydrant'.

(3) If the hydrant does not have a valve, or if the valve is not adequately restrained to the main:

1. Shut off the water main after coordinating with the Engineer.
2. Excavate along the hydrant lead and cut the lead.
3. Install valve per Article 704 and securely restrain the new valve back to the water main tee.
4. Return the water main to service as soon as practical and safe.
5. Add or remove fittings, extending or shortening the hydrant lead as shown on the drawings or as ordered by the Engineer to properly install the hydrant in accordance with Article 704 – 'Furnish & Install Hydrant'.

(4) Backfill and compact the excavation to an elevation 6-inches below the finished grade of the street terrace in accordance with Article 704 – 'Furnish & Install Hydrant'.

(5) Restore all disturbed turf areas associated with the hydrant relocation/installation.

704.8.4 Method of Measurement:

(1) Measured by each completed unit.

704.8.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70041	RELOCATE HYDRANT	EACH

704.9 Furnish & Install Water Service Laterals.

1-Inch, Bid Item 70050; 1½-Inch, Bid Item 70051; 2-Inch, Bid Item 70052.

704.9.1 Description:

(1) Install new copper service laterals and related accessories. Work for this item also includes:

1. Tapping the water main and installing or repairing polyethylene water main encasement.
2. Installing the associated service lateral fittings and curb box.
3. Adjusting the new curb box relative to finished grade.
4. Removing any existing curb stops/curb boxes inside the excavated service ditch.
5. Placing imported select fill in trench excavations.
6. Disposal of excess excavated material.
7. Restoration of disturbed terrace or turf areas.

704.9.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant)

704.9.3 Construction:

(1) Refer to Article 703 and this section.

(2) New service lateral installations require one singular continuous copper tubing segment to be installed between the corporation stop/bend fitting connection and the curb stop connection. Confirm proposed curb stop location prior to installation to prevent relocation after installation.

(3) Adequately wrap the corporation stop with polyethylene wrap to prevent debris from entering or impacting the operability of the corporation stop. Extend polyethylene wrap from the corporation stop at least 3-feet along the copper lateral.

(4) Whenever possible, install the curb stop on the service at a point 8-feet from the property line.

(5) Install a full-size, unbroken 4-inch x 8-inch x 8-inch solid concrete masonry block, laid flat, in the excavation to provide a firm base for the curb stop.

(6) Install the curb box vertically over the curb stop so that after the service is backfilled to final grade, a key may be placed on the rod of the curb stop and it may be operated easily.

(7) Securely wrap the curb box with polyethylene wrap in order to prevent debris from settling near the curb stop.

(8) Top of curb rod must terminate within 3-feet of finished box height. Any required rod extensions are considered to be incidental to the installation.

(9) Set curb boxes 1-inch below the finished ground elevation when located in unpaved areas.

(10) Set curb boxes ¼-inch below finished grade when located in paved areas.

(11) Unless directed by the Engineer or as otherwise indicated on the approved plans, do not locate curb boxes in curb, sidewalk, driveways, or within 5-feet of the base of trees.

(12) Install ½-inch expansion joint around curb boxes located in concrete pavement. Install expansion joint filler material in accordance to Section 303.2(d) of these Specifications.

(13) When backfilling new service lateral trenches place a 2-inch x 4-inch board next to each curb or valve box in the terraces. Ensure that the board is at least 4-feet long, with at least 2-feet buried and 2-feet exposed.

(14) Following installation, open the corporation stop and the curb stop, and flush out the service lateral. Once flushed, securely install a plug or copper end cap to keep rocks and dirt out of the lateral.

(15) Leave the corporation stop open.

(16) Install 2-inch rigid insulation at all storm sewer crossings and areas with less than 5-feet of cover.

(17) Flexible tubular insulation, with equivalent R-value, is acceptable in areas where tunneling or other existing utilities restrict the use of rigid insulation boards. See Section 704.17 – Furnish and Install Insulation for material requirements.

(18) Installation of insulation is considered for payment separately under Bid Item 70101 – Furnish and Install Insulation.

704.9.4 Method of Measurement:

(1) Measured by each completed unit.

704.9.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70050	FURNISH AND INSTALL 1 INCH SERVICE LATERALS	EACH
70051	FURNISH AND INSTALL 1½ INCH SERVICE LATERALS	EACH
70052	FURNISH AND INSTALL 2 INCH SERVICE LATERALS	EACH

704.10 Replace Service Lateral.

1-Inch, Bid Item 70053; 1½-Inch, Bid Item 70054; 2-Inch, Bid Item 70055.

704.10.1 Description:

(1) Abandon existing service lateral and replace it with a new service lateral. Typically a result of:

1. Tree ordinance restrictions (see Article 107).
2. Utility conflicts, or driveway approach/pavement conflicts.
3. Broken curb stops or damage to the existing copper tubing on the existing lateral.
4. The request of the Engineer.

704.10.2 Materials:

(1) Refer to Article 702 and this section.

704.10.3 Construction:

(1) Refer to Article 703, 704.9 and this section.

(2) Allow for any services designated for replacement on the plans to first be reexamined by the Engineer in order to determine the necessity for replacement and evaluate alternatives.

(3) Alternatives to the indicated total replacement may include a combination of:

1. Extending/reconnecting a service lateral per Article 704.
2. Disconnecting/reconnecting a service lateral per Article 704.
3. Replacing a curb stop/box per Article 704.

(4) If the Engineer determines the existing service lateral shall be replaced, abandon the existing service lateral and install a new service lateral in accordance to Article 704 – 'Furnish & Install Water Service Lateral'.

(5) If the existing main is proposed to remain in service after the new main installation, the existing service connection shall be abandoned at the corporation stop prior to backfilling the service coupling connection. Close the existing corporation stop, remove the existing bend fitting, insert a compatible brass corporation stop plug, and re-tighten the collar to abandon the existing service.

704.10.4 Method of Measurement:

(1) Measured by each completed unit.

704.10.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70053	REPLACE 1-INCH COPPER SERVICE LATERAL	EACH
70054	REPLACE 1½-INCH COPPER SERVICE LATERAL	EACH
70055	REPLACE 2-INCH COPPER SERVICE LATERAL	EACH

704.11 Reconnect Service Lateral.

1-Inch, Bid Item 70056; 1½-Inch, Bid Item 70057; 2-Inch, Bid Item 70058.

704.11.1 Description:

(1) Connect-to and extend existing water service laterals otherwise cut off and shorten, existing copper water service laterals and connect the lateral to the new water main. Restore any disturbed terrace areas, as necessary.

704.11.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant)

704.11.3 Construction:

(1) Refer to Article 703, 704.9 and this section.

(2) Extend and reconnect lateral:

1. Excavate to expose the existing water main at the existing service connection.
2. Cut-off the service pipe at the exposed location.
3. Couple the disconnected end of the service with a new service of the designated size.
4. Extend the new copper lateral to the new water main and connect the new service tubing to the corporation stop on the new water main.

(3) Disconnect and reconnect lateral:

1. Excavate to expose the existing service lateral at the location of the new water main crossing.
2. Cut-off the service tubing at the exposed crossing location.
3. Couple the disconnected end of the service tubing with a new service of the designated size.
4. Reconnect the modified service length to the corporation stop on the new water main.

704.11.4 Method of Measurement:

(1) Measured by each completed unit.

704.11.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70056	RECONNECT 1-INCH SERVICE LATERAL	EACH
70057	RECONNECT 1½-INCH SERVICE LATERAL	EACH
70058	RECONNECT 2-INCH SERVICE LATERAL	EACH

704.12 Cut-In or Connect-To Existing Water System.

Bid Item 70080.

704.12.1 Description:

(1) Cut-In or Connect To Existing Water System consists of all means and methods, equipment, tools, labor, and incidentals necessary for making a plug-removal connection or a cut-in connection to existing water mains, including thrust restrain against and water-tight capping of existing water mains associated with the work.

704.12.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.12.3 Construction:

(1) Refer to Article 703 and this section.

(2) Excavate and expose the existing water main to a point 18-inches below the bottom of the pipe at the proposed location of the plug-removal connection or cut-in connection.

(3) Shut off all valves required to isolate the exposed pipe segment. Be responsible and properly equipped for valve-turning at all times while doing such work.

(4) Place a water pump at the bottom of the excavation for dewatering, as needed. When cutting out sections of pipe proceed slowly and ensure dewatering efforts prevent the water level within the excavation from rising above the invert elevation of the exposed pipe.

(5) Before placing new pipe and fittings on the exposed end of the existing fitting or the cut-off end of the existing pipe, disinfect the new fitting or valve by swabbing or soaking thoroughly in accordance with Section 703 of the Standard Specifications.

(6) Fasten new fittings to existing fittings or ductile iron pipes as described in Article 703. For connections to existing cast iron or other existing pipe materials, secure the new pipe or fitting with threaded rods or approved repair clamps in accordance with the Standard Detail Drawings.

(7) Any required fittings, pipe, solid sleeves or repair clamps required along the run of existing water main to perform the cut in connection, up to a distance of 10-feet, is considered incidental to making the cut in connection.

1. Payment for pipe and fittings along the run of existing water main will only be considered when the plans require existing main replacement along the run of existing main exceeding 10-feet in length, or if directed by the Engineer to replace additional existing main during construction.

2. Valve connections remain eligible for separate valve installation payment under 704.6.

(8) All cut-in connections and tee branch connections require concrete thrust restraint in addition to mechanical joint restraint. See Article 703 and the Standard Detail Drawings for concrete thrust restraint requirements.

(9) For cut-in connections or as otherwise necessary, secure the disconnected end of the existing pipe with either a pipe plug or a cap fitting, as approved by the Engineer. Place standard thrust blocking between the end of the existing pipe and the new fitting, unless specified otherwise in the Contract Documents or as directed by the Engineer.

(10) Install a high potential galvanic anode per Section 704.31 – 'Furnish and Install Anode' at all water main connections consisting of new ductile iron water main connecting to a dissimilar existing water main material, including unwrapped ductile iron pipe, or as otherwise directed by the Engineer.

1. Anode installations are not required at locations where new ductile iron pipe connects to service lateral piping, including large-diameter service lateral piping, unless otherwise specified on the plans or required by the Engineer.

704.12.4 Method of Measurement:

(1) Measured by each completed unit.

704.12.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70080	CUT-IN OR CONNECT TO EXISTING WATER SYSTEM	EACH

704.13 Furnish Excavation and Ditch for Live Tap.

Bid Item 70081.

704.13.1 Description:

(1) Excavate and prepare the ditch for the City to perform a live-tap connection on an existing water main. Upon completion of tap, cut-off and cap the existing water main.

704.13.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.13.3 Construction:

(1) Refer to Article 703 and this section.

(2) Prepare a suitable work area in the ditch for the Engineer to perform the live-tap:

(3) Expose the water main across the full width of the ditch.

(4) Provide at least 1-foot of clear space around the circumference of the exposed water main.

(5) Locate and identify the proposed tap location in the ditch and adjust as necessary to maintain a distance of at least 18-inches from the nearest joint.

(6) Provide at least a 4-foot-wide clear working area, extending at least 6-feet perpendicular from the main at the location of the live-tap.

(7) Upon completion of the live-tap by the City, cut-off and cap the existing water main in accordance to Article 704 - 'Cut Off Existing Water Main'. The cut-off and cap work associated with the live-tap is incidental to the work and will not be paid separately.

(8) Upon completion of the live-tap by the City, install concrete thrust restraint opposite the tap in addition to the mechanical joint restraint required at the tap connection. See Article 703 and the Standard Detail Drawings for concrete thrust restraint requirements.

704.13.4 Method of Measurement:

(1) Measured by each completed unit.

704.13.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70081	FURNISH EXCAVATION AND DITCH FOR LIVE TAP	EACH

704.14 Cut Off Existing Water Main.

Bid Item 70082.

704.14.1 Description:

(1) Abandon and plug a segment of existing water main by "cutting it off" from the active water system. The work also includes securely capping or plugging the cut end of the active main.

704.14.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.14.3 Construction:

(1) Refer to Article 703 and this section.

(2) Prior to proceeding with the cut-off, perform the required water main shut-off notifications.

(3) When authorized to proceed, isolate and shut off the existing water main.

(4) Cut off the water main at the location designated for abandonment.

(5) Install a concrete pipe plug in the end of the existing main which is to be abandoned.

(6) On the end of the water main which is to remain in service:

1. Install a restrained mechanical joint cap over the cut end of the existing water main, or within 2-feet of a fitting or live-tap.

2. Otherwise, install a restrained mechanical joint plug fitting into a new or existing fitting located at the end of the main.

(7) If the water main cut-off work is intended to remove and replace an existing fitting, valve, or segment of pipe, cut off as designated, remove the existing material and replace it with the new fittings and/or the lengths of pipe and solid sleeves necessary to reconnect to the existing main.

(8) Disinfect any associated materials by swabbing methods in accordance to Article 703.

704.14.4 Method of Measurement:

(1) Measured by each completed unit.

704.14.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70082	CUT OFF EXISTING WATER MAIN	EACH

704.15 Abandon Water Valve Box.

Bid Item 70090.

704.15.1 Description:

(1) Abandon valve boxes within the project limits that are set upon valves no longer in service.

(2) Place the abandoned valve in the closed position prior to abandoning the box.

(3) Completely remove the valve box whenever possible.

704.15.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.15.3 Construction:

(1) Refer to Article 703 and this section.

(2) Proceed with work only after the existing water main has been abandoned.

(3) Remove the top casting of the valve box to a point at least 3-feet below the final elevation, and then backfill the opening.

704.15.4 Method of Measurement:

(1) Measured by each completed unit.

704.15.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70090	ABANDON WATER VALVE BOX	EACH

704.16 Abandon Water Valve Access Structure.

Bid Item 70092.

704.16.1 Description:

(1) Abandon all designated water valve access structures or manholes within the project limits.

(2) If the valve is to remain active, install a valve box.

704.16.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.16.3 Construction:

(1) Refer to Article 703 and this section.

(2) Remove the existing casting and the structure walls.

(3) If concrete is in contact with a main and/or valve that is to remain in service, and removal of the structure may damage the existing piping system, the Engineer may instead require that the structure walls be removed to a depth of 3-feet below finished grade.

(4) If the existing valve is to remain in use, remove and replace the water valve access structure with a valve box per Article 704.

(5) Use select fill as additional backfill material if there is not enough approved existing material.

704.16.4 Method of Measurement:

(1) Measured by each completed unit.

704.16.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70092	ABANDON WATER VALVE ACCESS STRUCTURE	EACH

704.17 Furnish and Install Insulation.

Bid Item 70101.

704.17.1 Description:

(1) Install rigid board or tubular insulation to insulate water mains and/or water service laterals.

(2) Styrofoam insulation is required when:

1. The top of water main or service lateral has 5-feet of cover or less.
2. The water main or service lateral crosses below storm sewer.
3. When otherwise specified on the drawings or as directed by the Engineer.

704.17.2 Materials:

(1) Refer to Article 702 and this section.

(2) Rigid Board insulation requirements:

1. Thickness: 2-inch (minimum).
2. R-Value: 5 per inch of thickness (minimum).
3. Minimum strength: 25 psi.
4. High-density polystyrene board as manufactured by Dow Chemical Co., or equal.
5. 4-foot by 8-foot sheets.

(3) Tubular Insulation for Service Laterals:

1. Tubular elastomeric cellular insulation, per ASTM C-534, Type 1, Grade 1
2. Tubular polyethylene/polyolefin cellular insulation, per ASTM C-1427, Type 1
3. R-Value shall be comparable to rigid board insulation.
4. Match the interior diameter of preformed insulation tube to the diameter of the service lateral.
5. Wrap tape around the insulation tube at 3-foot intervals to secure the insulation prior to installation.

704.17.3 Construction:

(1) Refer to Article 703 and this section.

(2) After pipe installation, place bedding material and compact to a level 6-inches above the top of pipe. Place insulation board in the trench centered over the pipe on a level surface in order to provide proper support for the insulation.

(3) Following installation of the insulation, place and compact the remaining bedding/cover material to the top of the pipe zone, at least 12-inches above the top of pipe, and then backfill and compact the remainder of the trench.

(4) Tubular insulation may be used in certain circumstances, such as tunneling laterals, which restrict the placement of rigid board insulation. See Section 704.9 - Furnish & Install Water Service Laterals for additional information.

704.17.4 Method of Measurement:

(1) Measured per each 4-FT by 8-FT sheet of insulation effectively installed, or per 8-FT length unit of tubular service insulation effectively installed.

704.17.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70101	FURNISH AND INSTALL INSULATION	EACH

704.18 Landscape Restoration for Water Main.

Bid Item 70102.

704.18.1 Description:

(1) Restore turf areas disturbed from water main installation, including all incidentals necessary to restore the terrace or turf area to grade, such as topsoil and seeding, are included herein.

704.18.2 Materials:

(1) Refer to Article 702 and this section.

(2) Topsoil: See Article 202 of these Specifications.

(3) Seeding: See Article 207 of these Specifications.

704.18.3 Construction:

(1) Refer to Article 703 and this section.

(2) Do not begin placing topsoil until all disturbed areas have been graded to match the original surface grades or to the otherwise specified lines and grades, considering the topsoil depth.

(3) Place and spread topsoil uniformly to a depth of at least 6-inches, unless specified otherwise.

(4) Clean topsoil off of sidewalks, paths, curbs, and roadways prior to the end of each working day.

(5) Protect adjacent stormwater structures during placement of topsoil. The Engineer reserves the right to order the installation of curb and field inlet sediment barriers to be constructed in accordance with Article 210 of these Specifications.

(6) Water the restoration areas immediately after seeding. Keep the areas moist by watering or sprinkling until the perennial grass seed covering the entire disturbed terrace area has germinated and grown to a minimum height of 2-inches. Reseed any bare patches.

(7) Place mulch on all seeded areas within 3 days of completing the seeding. Do not mulch during high wind conditions. Maintain the mulched areas and repair any areas damaged by wind, erosion, traffic, or other causes until the turf is firmly established.

(8) When ordered by the Engineer, dust-proof the patch by sprinkling it with a water and calcium chloride mixture in accordance with Article 107 of these Specifications.

704.18.4 Method of Measurement:

(1) Measured by length in feet, to the nearest half foot, along the trench centerline at the surface.

704.18.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70102	TERRACE RESTORATION FOR WATER MAIN	T.F.

(2) Additional compensation will be at the rate stated in Article 107 for providing any dust proofing.

704.19 Water Valve Access Structure.

Bid Item 70103.

704.19.1 Description:

(1) Furnish and install a 6-foot (inside diameter) water valve access structure with steps and casting. The work also includes preparing the foundation for the structure and tapping the water main.

704.19.2 Materials:

(1) Refer to Article 702 and this section.

(2) Adjustment rings and castings: Conform to Articles 503 and 507.

(3) The water valve access structure has a flat top with an offset opening and a standard access structure frame and non-rocking cover.

(4) See Standard Detail Drawing 7.05 for additional material details.

704.19.3 Construction:

(1) Construction of concrete valve access structures is to be done in accordance to the requirements Standard Detail Drawings 7.05 and Article 507 of these Specifications.

(2) Center the water valve access structure over the valve.

(3) Place clear gravel and stones up to 3-inches as a base for the structure.

(4) Place an 8-inch or larger concrete block under the valve to provide support.

(5) Provide appropriate openings in the structure and the support ring so that the structure is not resting on the water main.

(6) Install a 1-inch tap on each side of the valve.

704.19.4 Method of Measurement:

(1) Measured by each completed unit.

704.19.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70103	WATER VALVE ACCESS STRUCTURE	EACH

704.20 Adjust Water Valve Box Sections.

Bid Item 70104.

704.20.1 Description:

Work under this item may include a combination of the following:

(1) Adjust existing water valve boxes to ½-inch below finished grade.

(2) In addition to the work described in (1), furnish and install a new water valve box top casting and lid where the Engineer determines existing valve box top section is damaged or non-functioning.

(3) In addition to the work described in (1) and (2), furnish and install a new lower valve box section(s) where the Engineer determines existing lower valve box sections to be damaged or non-functioning.

(4) If full replacement of existing valve box is required, perform the replacement installation in accordance with Section 704.6 – 'Furnish & Install Water Valve.'

704.20.2 Materials:

(1) Refer to Article 702 and this section.

(2) Refer to Article 704 – 'Furnish & Install Water Valve' and this section.

704.20.3 Construction:

(1) Refer to Article 703 and this section.

(2) Refer to Article 704 'Furnish & Install Water Valve' and this section.

(3) If the Engineer determines that an existing valve box is in acceptable overall condition and alignment, adjust the existing valve box to a depth at finished grade within appropriate tolerances.

(4) If the Engineer determines that an existing valve box is improperly aligned or otherwise damaged and unacceptable, excavate and expose the existing water valve box to the depth needed to install a new top casting with a new lid, center the valve box over the operating nut and adjust the valve boxes to finished grade.

(5) If the Engineer determines that the entire existing valve box is unacceptable, excavate, remove and replace the bottom section of the valve box in addition to the work described above.

(6) Extensions or replacement valve box materials may be required and will be paid as listed below.

(7) Ensure that all adjusted valve boxes are centered over the valve operating nut and free of dirt and debris when complete.

(8) Compaction around valve boxes shall be in accordance with Article 703 "Backfilling and Compaction" and this section.

704.20.4 Method of Measurement:

(1) Measured per completed unit, at every valve, by each adjusted or replaced section:

(2) Adjustment of existing water valve box only is measured as one completed unit per valve.

(3) Adjustment of existing water valve box and replacement of new top casting and lid is measured as two completed units per valve.

(4) Adjustment of existing water valve box, replacement of new top casting and lid, and replacement of existing lower valve box section is measured as three completed units per valve.

704.20.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70104	ADJUST WATER VALVE BOX SECTION	EACH

(2) Adjustment of new valve boxes is incidental to valve box installations and will not be paid.

704.21 Pipe Plug for Water Main Installation.

Bid Item 70105.

704.21.1 Description:

(1) Furnish and install a concrete mix on each end of abandoned pipes that were removed due to an existing grade conflict during the installation of new water facilities.

(2) This bid item applies only to pipes which are 10-inches in diameter or larger. Pipe plugs applied to pipes less than 10-inches in diameter are considered incidental to the related work, and will not be compensated in this bid item.

704.21.2 Materials:

(1) Refer to Article 702 and this section.

(2) Concrete mix can be either:

1. A pre-approved bag mix.
2. Pre-mix from a concrete supplier.

704.21.3 Construction:

(1) Refer to Article 703 and this section.

(2) Excavate and expose the conflicting abandoned pipe.

(3) Cut out a segment of the pipe that is large enough for clearance of the concrete mix on the open ends, and for the new water main to pass through.

(4) Using a concrete mix on the open ends of the abandoned pipe, form a tight seal so as not to allow dirt or water to enter the pipe.

704.21.4 Method of Measurement:

(1) Measured as a completed unit for each pipe end plugged.

704.21.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70105	PIPE PLUG FOR WATER MAIN INSTALLATION	EACH

704.22 Rock Excavation.

Bid Item 70106.

704.22.1 Description:

(1) Rock excavation applies to the removal of hard solid rock in ledges, bedded deposits, un-stratified masses, conglomerate deposits or any other material so firmly cemented as to present characteristics of solid rock.

(2) If determined by the Engineer that such material is so hard or so firmly cemented that it is not practical to excavate and remove such material with a power shovel, it shall be thoroughly and continuously drilled and blasted prior to removal.

(3) Power shovels, as referred to above:

1. A modern track mounted power shovel or backhoe.
2. Not less than ¾-cubic yard manufacturer's rated capacity.
3. Have adequate power and good running condition.
4. Used by an experienced operator.

(4) Rock excavation also applies to all stone/rock necessary to be removed having a volume of 2 cubic yards or more. Removal of plain or asphalt-bound bases or surface courses of macadam, gravel, or broken stone are not considered rock excavation.

704.22.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.22.3 Construction:

(1) Refer to Article 703 and this section.

(2) Remove enough rock to provide clearance below and on each side of all pipe, valves and fittings. Clearance requirements:

1. At least 6-inches for nominal pipe sizes 24-inches or smaller
2. At least 9-inches for nominal pipe sizes 30-inches or larger.

(3) The width of rock excavation is limited to the outside diameter of the pipe plus 2-feet.

(4) Upon completion of the rock excavation, refill that portion of the trench with select fill and mechanically compact the fill material prior to laying the pipe. The pipe is required to have uniform bearing along its entire length and never shall be laid directly on rock.

704.22.4 Method of Measurement:

(1) Field-measure and compute the rock excavation volume in cubic yards (neat-line volumes).

(2) The vertical measurement extends from the surface of the rock to an elevation of 6-inches below the bottom invert of the water main.

(3) The vertical measurement for valve access structures extends from the surface of the rock to an elevation of 8-inches below the bottom invert of the valve access structure (up to ten 10-feet deep). The measurement extends 12-inches below the bottom invert of the valve access structure if it is over 10-feet deep.

(4) Horizontal measurements are limited to the outside diameter of the pipe or outside width of the structure, plus two 2-feet.

(5) Boulders measuring up to ½-cubic yard are considered incidental to excavation removal. Boulders up to 2-cubic yards in volume may be considered for payment under the Boulder Removal bid item, if authorized by the Engineer. Boulders measuring 2-cubic yards or more in volume are considered for payment under the Rock Removal bid item and. These boulders are to be measured individually. The volume of each boulder computed from average dimensions taken in three directions.

(6) No measurement of excessive excavation.

704.22.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70106	ROCK EXCAVATION	C.Y.

704.23 Removal of Excess Amounts of Boulders.

Bid Item 70107.

704.23.1 Description:

(1) Boulders are considered to be naturally occurring rocks that have a dimension greater than 12-inches in one or more faces.

(2) Remove any and all boulders encountered regardless of number.

(3) Removal of boulders up to ½-cubic yard in volume is considered incidental regardless of the quantity encountered.

(4) When deemed by the Engineer that the amount of boulders encountered on a project is excessive, additional payment will be covered under this item.

704.23.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.23.3 Construction:

(1) Refer to Article 703 and this section.

(2) (Vacant).

704.23.4 Method of Measurement:

(1) Payment for this item must be authorized by the Engineer.

(2) Boulders under 1-cubic yard in volume are to be measured by truck volume.

(3) Boulders over 1-cubic yard in volume are to be measured individually. Measure by taking the average dimensions in three directions.

704.23.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70107	REMOVAL OF EXCESS AMOUNTS OF BOULDERS	C.Y.

(2) In the absence of a bid item, a payment of $20.00 per cubic yard of small boulders (up to 1-cubic yard in volume) hauled from the project may be added to the Contract Documents, when authorized by the Engineer.

(3) Additionally, a payment of $50.00 per cubic yard of large boulders (between 1-cubic yard and 2-cubic yards in volume) hauled from the project may be added to the Contract Documents, when authorized by the Engineer.

(4) Excessively large boulders (over 2-cubic yards in volume) are considered to be, and paid under, the Rock Excavation Bid Item.

704.24 Additional Excavation.

Bid Item 70108.

704.24.1 Description:

(1) Refer to Article 703.4 and this section.

(2) Additional excavation applies to:

1. Additional excavation areas specifically depicted on the Construction Drawings and/or described in the Contract Documents.
2. Additional excavation extending beyond the allowable 2-foot allowance as a result of grade adjustments and/or adjusted excavation requirements ordered by the Engineer.
3. No compensation will be considered for over-excavation done for convenience.
4. Note that additional excavation extending beyond the allowable 1-foot allowance as a result of artificial foundation construction in poor soils ordered by the Engineer is considered to be undercut and shall be paid for under the "Undercut" bid item.

704.24.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.24.3 Construction:

(1) Refer to Article 703 and this section.

(2) (Vacant).

704.24.4 Method of Measurement:

(1) Field-measure and compute the authorized additional excavation volume in cubic yards (neat-line volumes).

(2) Maximum allowed measured width:

(3) The outside diameter of the pipe/structure, plus 2-feet, plus the amount necessary for sheeting and bracing.

704.24.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70108	ADDITIONAL EXCAVATION	C.Y.

(2) No payments for over-excavation done for convenience or without the Engineer's consent.

704.25 Undercut.

Bid Item 70109.

704.25.1 Description:

(1) Undercut is defined as any work involved in removing unsuitable materials and forming a satisfactory foundation at depths greater than 12-inches below the water main where identified on the drawings and/or specifications, and other areas where the Engineer approves the undercut in writing.

(2) All work associated with forming a stable and satisfactory foundation at depths of twelve 12-inches or less below the bottom of the pipe is considered incidental and will not be considered as undercut.

704.25.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.25.3 Construction:

(1) Refer to Article 703 and this section.

(2) (Vacant).

704.25.4 Method of Measurement:

(1) Field-measure and compute the undercut volume in cubic yards (neat-line volumes).

(2) Maximum measured width: The outside diameter of the pipe or outside dimension of the bottom of the structure, plus 2-feet, plus the amount necessary for sheeting and bracing.

704.25.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70109	UNDERCUT	C.Y.

704.26 Adjust Water Service Box.

(No Bid Item).

704.26.1 Description:

(1) Adjust existing water service boxes within the project limits to match the finished grade as shown on the plans or directed by the Engineer.

704.26.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.26.3 Construction:

(1) Refer to Article 703 and this section.

(2) Excavate and expose the existing water service boxes to the depth needed to adjust the valve boxes to finished grade.

(3) Apply extensions as required.

(4) Leave all service boxes centered over the curb stop and free of dirt and debris.

704.26.4 Method of Measurement:

(1) Measured by each completed unit.

704.26.5 Basis of Payment:

(1) Paid as follows:

AMOUNT PAID	DESCRIPTION	UNIT
$150.00	ADJUST WATER SERVICE BOX	EACH

(2) Measured per completed unit, at every curb box, by each adjusted or replaced section.

(3) Adjustment of existing curb box only measured as one completed unit.

(4) Adjustment of existing curb box and replacement of new top casting, new lid and/or new extension is measured as two completed units per curb box.

(5) Adjustments to new service boxes are incidental to their installation, and will not be paid under this item.

704.27 Furnish and Install Curb Box.

(No Bid Item).

704.27.1 Description:

(1) Provide all labor and materials necessary to install new curb boxes where existing curb boxes are damaged, or otherwise in need of replacement as authorized in writing by the Engineer.

704.27.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.27.3 Construction:

(1) Refer to Article 703 and this section.

(2) Install the curb box vertically over the curb stop so that after the service is backfilled to final grade, a key may be placed on the rod of the curb stop and it may be operated easily.

(3) Securely wrap the curb box with polyethylene wrap in order to prevent debris from settling near the curb stop.

(4) Top of curb rod must terminate within 3-feet of finished box height. Any required rod extensions are considered to be incidental to the installation.

(5) Set curb boxes 1-inch below flush with the finished ground elevation when located in unpaved areas.

(6) Set curb boxes between ¼-inch below finished grade and flush with the finished when located in paved areas.

704.27.4 Method of Measurement:

(1) Measured by each completed unit.

704.27.5 Basis of Payment:

(1) Paid as follows:

AMOUNT PAID	DESCRIPTION	UNIT
$350.00	FURNISH AND INSTALL CURB BOX	EACH

704.28 Furnish and Install Curb Stop.

(No Bid Item).

704.28.1 Description:

(1) Provide all labor and material necessary to install new curb stops where existing curb stops are damaged, or otherwise in need of replacement as authorized in writing by the Engineer. Installations of curb boxes are not included in the scope of this pay item.

704.28.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.28.3 Construction:

(1) Refer to Article 703 and this section.

(2) Install curb stops on the designated service lateral at a point 8-feet from the property line, unless specified otherwise or ordered by the Engineer.

(3) Install a full-size, unbroken 4-inch x 8-inch x 8-inch solid concrete masonry block, laid flat, in the excavation to provide a firm base for the curb stop.

(4) Adequately wrap the curb stop with polyethylene wrap to prevent debris from entering or impacting the operability of the curb stop.

(5) Do not locate curb stops in curb, sidewalk, driveways, or within 5-feet of the bases of trees.

704.28.4 Method of Measurement:

(1) Measured by each completed unit.

704.28.5 Basis of Payment:

(1) Paid as follows:

AMOUNT PAID	DESCRIPTION	UNIT
$500.00	FURNISH AND INSTALL 1-IN CURB STOP	EACH
$750.00	FURNISH AND INSTALL 1.5-IN OR 2-IN CURB STOP	EACH

(2) If a required curb stop replacement is located within paved surfaces, the associated pavement removal and replacement will be compensated separately with established Contract bid items, when available.

704.29 Abandon Existing Curb Box.

(No Bid Item).

704.29.1 Description:

(1) Abandon all water service curb boxes within the project limits that are connected to laterals no longer in service, as shown on the plans or directed by the Engineer.

704.29.2 Materials:

(1) Refer to Article 702 and this section.

(2) (Vacant).

704.29.3 Construction:

(1) Refer to Article 703 and this section.

(2) Proceed with the work only after the existing water service lateral has been abandoned.

(3) Remove the top casting to a point 2-feet below the final elevation.

(4) Restore the terrace area as necessary.

704.29.4 Method of Measurement:

(1) Measured by each completed unit.

704.29.5 Basis of Payment:

(1) Paid as follows:

AMOUNT PAID	DESCRIPTION	UNIT
$100.00	ABANDON EXISTING CURB BOX	EACH

(2) Note that only curb boxes that fall outside of new service excavations will be paid.

704.30 Temporary Water Supply System.

Bid Item 70110.

704.30.1 Description:

(1) Furnish, install, disinfect and maintain temporary water supply system, as approved by the Engineer, including any associated water quality testing, ramping or burying at pedestrian or vehicle crossings, preparation and distribution of customer notices, and restoration work.

704.30.2 Materials:

(1) Refer to Article 702 and this section.

(2) All materials furnished for use as temporary water system pipe, service hose, connections and related appurtenances that come into contact with drinking water are to be certified for compliance with ANSI/NSF Standard 61 by an ANSI approved third-party certification program or laboratory.

(3) All materials shall be fully adequate to withstand the required water pressure and all other conditions of use, and shall provide adequate water tightness before being put into service.

(4) All previously used materials may only have been used in potable water applications.

(5) All materials for use as main temporary bypass lines, service lines, connections and related appurtenances shall have a minimum working pressure rating of 200 psi and be made of materials that will not have an adverse effect on the taste or odor of the water.

(6) The main temporary bypass supply pipe must be at least 2-inch diameter and have at least two supply connections from either direct bulkhead connections to existing water main or hydrant connections equipped with a reduced-pressure zone valves.

(7) Individual lateral check valves are not permitted.

704.30.3 Construction:

(1) Refer to Article 703 and this section.

(2) General requirements for providing temporary water service:

1. Submit a proposed Temporary Water Service plan depicting the proposed components, configuration/locations, protection measures, proposed disinfection methods, and contact information for the Contractor's representative(s) responsible for routine maintenance and emergency response. The Temporary Water Service Plan must be approved by the Engineer and Madison Fire Department before installing any section of the temporary water system.

2. The temporary bypass system shall maintain a continuous supply of water to all affected customers for the duration of time that the existing main is out-of-service for rehabilitation. The temporary bypass system shall be maintained in a safe and operative condition at all times. For protection of the work and the public, flashers and barricades shall be installed at apt locations and as directed by the Engineer. The flashers and barricades shall be in proper operating condition.

3. Temporary water piping shall be protected from freezing weather at all times.

4. The work is to be in conformance with the requirements of the Standard Specifications, and AWWA C602 Cement Mortar Lining of Water Pipelines in Place – 4 In. and Larger, Section 4.6 Temporary Bypass to Customers.

(3) Notification Requirements for Service Interruptions:

1. In addition to customer notice requirements of Article 703, the notice to affected temporary system customers shall include the delivery of a door-hanger or similar pamphlet which indicates the date and time of the planned service interruption and, as applicable, the proposed location of temporary service connection and the proposed route of the temporary service line & main bypass line. Include contact information for the Contractor's field representative and the Engineer.

2. Whenever possible, make connections to the customer's water service line on a day and at a time that is convenient to the customer. Make satisfactory arrangements with the customer so that stop and waste valves shall be accessible at all times. Immediately prior to individual service work, attempt to notify the customer again to verify that all water use has been stopped. Do not interrupt any customer's service until certain that all labor, material and equipment necessary to perform the work are present at the work site. Bear all responsibility for any loss or damage arising out of the failure of any such customer to receive the specified notice of a planned interruption of service.

(4) Emergency Shutdowns and Notifications:

1. In the event of a break on a water main, service, bypass pipe, temporary service or other failure of a Madison Water Utility facility, whether the result of Contractor's activities or other unrelated matters, act in accordance with the following procedure:

   (i) Immediately notify Madison Water Utility's Construction Supervisor and the Utility's 24-hour Operator at (608) 266-4667 and inform them of the situation, the affected area, estimated duration, and if there is a need for an immediate water main shutdown.

   (ii) The Contractor is NOT to operate any valves unless directly authorized to do so by a Madison Water Utility representative.

   (iii) Notify all residents affected by the emergency service interruption.

(5) Temporary Bypass Water System Set-Up:

1. Install and securely restrain compatible tee, tapped sleeves or bulkheads (temporary line caps) on the existing water main to keep the section of the existing water main pressurized and capable of supplying a continuous flow of water. The supply connection shall be fitted with a compatible outlet fitting to supply the temporary system. Secure and restrain all piping extending from the existing main to the above-ground supply piping. Installation of these connections is considered to be incidental to temporary supply system.

2. For hydrant fed systems, disinfect the hydrant standpipe prior to connecting the bypass pipe to the hydrant by pouring 1 quart of commercially available bleach (solution containing approximately 5% sodium hypochlorite) into the hydrant. The hydrant shall be filled with clean water and let stand for a minimum of 20 minutes. The hydrant shall then be flushed and the bypass pipe connected to it. All hydrant nozzles shall be capped when not in use.

3. All temporary water supply connections off existing hydrants shall be made in such a manner that if it becomes necessary, they can be easily removed so that the hydrant can be used for firefighting purposes, with minimum effort.

4. Provide smooth bore sample taps where designated on approved Temporary Bypass Plan.

5. Temporary valves and, if required, temporary hydrants shall be installed on the temporary bypass pipe at all appropriate locations, as designated on an approved Temporary Bypass Service Plan.

6. Install bypass pipe on the house-side of a sidewalk and in ditches or along City-owned greenways whenever possible to minimize or avoid crossing traffic or pedestrian routes. Where not possible, install bypass pipe to minimize crossing traffic or pedestrian routes. When crossing these routes, provide a ramping system to protect the bypass pipe at each location where pipe crosses roads or driveways. ADA compliance shall be provided at sidewalk or sidewalk ramp crossings per Article 107 of the Standard Specifications.

7. Any unconnected threaded main taps must be capped prior to disinfecting the temporary system and remain capped for the duration of time the temporary system is in place.

8. Under no circumstances is any portion of the temporary water system to lie in a gutter, ditch or any other line of surface water flow.

9. If previously used material is employed for use in the temporary bypass water system, clean and/or pressure wash the piping such that it inspires confidence in the system.

10. Water from the temporary bypass pipes will NOT be allowed for any purpose other than to supply the bypass system. Water for filling water tanks, or any other purpose other than supplying water to bypass pipes must be obtained from a hydrant with a Madison Water Utility approved reduced pressure zone valve (RPZ) installed per Section 107.11 of the Standard Specifications and these Special Provisions.

11. Water Utility temporary bulk water supply service fees for installation of any required RPZ valves, volume charges, temporary meters and related items will be waived. Contact the Water Utility Engineering Section at (608) 266-4646 to coordinate the installation of the RPZ valves. Adequately protect and support City RPZ valves at all times; any RPZ valve damage resulting from negligence or freezing must be repaired or replaced at the Contractor's expense.

(6) Bypass System Disinfection:

1. All bypass pipes shall be properly disinfected and yield a safe-water sample prior to connecting any customers to the temporary bypass system.

2. Install a bulk chlorine disinfection station or stations for the disinfection of temporary service laterals. Stations shall consist of a large drum or container filled with disinfectant solution with an attached spigot. Disinfect and flush each lateral adequately before entering into service

3. As part of the Temporary Water Service plan described in these Special Provisions, include the proposed disinfection, flushing, and applicable customer notification procedures required for the proposed temporary bypass system. These procedures shall be in accordance with AWWA C651 – Disinfecting Water Mains.

4. Properly dispose of any highly-chlorinated water in accordance with Article 703 of the Standard Specifications.

(7) Temporary Customer Service Lines:

1. After completing the temporary bypass disinfection per these Special Provisions, thoroughly flush piping to be used for temporary services with potable water immediately prior to connection to consumer's service. Notify consumers prior to shutting off the service and transfer services to the bypass. Do not transfer services to the bypass earlier than necessary.

2. Match the diameter of the temporary service lines with the existing service lateral diameter for all services 1½-inch diameter and smaller. Use hoses or piping that is hydraulically equivalent to the service size for all services 2 inch in diameter and larger.

3. Contractor is responsible for protecting all temporary service lines, including the connection to the private plumbing system, from damage. Any internal private plumbing issues resulting from the temporary supply shall be promptly addressed by the Contractor at their cost.

(8) Return Service Line to New Water Main:

1. After completion of the water main rehabilitation, clear the water service lines by back flushing with potable water or as otherwise approved in the disinfection and flushing plan. Disconnect the service bypass pipe, restore the water service line back to normal conditions, and restore water flow. All areas used while providing temporary service shall be properly restored to pre-construction status, or as noted.

2. After flushing is completed and service lines have been restored to the permanent laterals, remove bypass and all associated materials used for maintenance and ramping. Complete restoration of all areas damaged by temporary bypass pipe and service connections.

(9) 24-Hour Maintenance:

1. Be responsible for maintenance and repair of the temporary bypass system and all associated protective equipment (barricades, flashers, ramps etc.) at all times. Be equipped to make all repairs necessary, at the project site, for the duration of the project.

2. Designate a permanent company employee to maintain the bypass and services. Supply Madison Water Utility with applicable emergency and after hours phone numbers as part of the proposed Temporary Water Service Plan submittal required in these Special Provisions.

704.30.4 Method of Measurement:

(1) Measured as a Lump Sum to include all materials and work described in these Special Provisions.

704.30.5 Basis of Payment:

(1) Temporary Water Supply System shall be paid for at a Lump Sum unit price. Payment of 80% will be authorized after the bypass system has received safe water quality samples and all affected properties have been connected to the system. The remaining 20% will be authorized for payment after the system has been removed and all properties are served from the municipal water mains:

ITEM NUMBER	DESCRIPTION	UNIT
70110	TEMPORARY WATER SUPPLY SYSTEM	L.S.

704.31 Furnish and Install Anode.

Bid Item 70111.

704.31.1 Description:

(1) Furnish and install galvanic anodes for added corrosion protection where new water mains connect to dissimilar existing main materials. The Contractor shall install galvanic anodes in accordance with these specifications, or as otherwise directed by the Engineer.

704.31.2 Materials:

(1) Anodes.

1. Anodes utilized for typical galvanic anode system installation shall be prepackaged magnesium style high potential anodes weighing at least seventeen (17) pounds.

2. Anodes shall be packaged in a cotton bag prepacked with low resistive backfill consisting of seventy-five percent (75%) gypsum, twenty percent (20%) bentonite, and five percent (5%) sodium sulfate.

(2) Pipe Connection Lead Wire.

1. Anodes shall be provided with at least 10-feet of #12 AWG copper, single-conductor lead wire. Lead wire cable shall be designed for direct burial applications.

(3) Thermite Welding Equipment.

1. Connect the lead wire to the new water main pipe with field-welded CADWELD thermite weld caps, or approved equal.

(4) (Vacant).

704.31.3 Construction:

(1) Refer to Article 703 and this section.

(2) Anode Installation.

1. Anodes are required at all locations where new ductile iron water main is attaching to existing, dissimilar water main material, including existing unwrapped ductile iron. Anode placement at connections to wrapped ductile iron water main will be required when required by the Engineer or are specified on the plans.

2. Anodes are not required at service lateral connections, including large-diameter services.

3. Anodes shall be installed between one and three feet from the side wall of the pipe, to a centerline depth in-line with the approximate horizontal plane of the pipe.

(3) Connect the copper lead wire to the new ductile iron pipe within one-foot of the water main connection with field-welded CADWELD bond. Protect and repair bond connection and any associated coating repairs per Section 702.3.1 (5) – 'Electrical Conductivity.'

(4) Extreme care shall be taken not to damage the anodes or direct buried lead wires during backfill operations.

(5) (Vacant).

704.31.4 Method of Measurement:

(1) Measured by each completed unit.

704.31.5 Basis of Payment:

(1) Paid at the contract unit prices under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
70111	FURNISH AND INSTALL ANODE	EACH