exhibit F

Project Name: Lucy Lane Improvement Plans – Grand Lake, CO
Project Number: 23-9583
10 Pages

ITEM 11.01 WATER PIPE

1. DESCRIPTION

A. This works consists of furnishing and installing pressure rated pipe for water mains and other appurtenances in accordance with these specifications, the latest revision of the American Water Works Association (AWWA) standard, and American Society for Testing and Materials (ASTM) specification, and in conformity with the details, lines and grades shown on the plans or established.

B. Installation shall consist of excavation, shoring, laying, aligning, and joining pipe, bedding and backfill, flushing, disinfection and testing, and other related work.

C. This work also includes furnishing welded steel pipe used as a casing and not as a carrier pipe and installing it by jacking or other approved methods into place at the location and in conformity with the lines and grades shown on the plans.

2. MATERIALS

A. The Contractor shall install potable water pressure rated pipe of the type, diameter, pressure class, wall thickness and protective coating as shown on the plans and designated in the Bid Schedule. Where applicable, pipe shall be NSF certified for potable water use.

B. Water pipe and fittings shall meet and/or exceed all of the requirements of the latest published standard/specification, at the time of bid for the type of pipe and fittings used:

1. AWWA C151-96 “Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or other Liquids.”

2. AWWA C150, “Thickness Design of Ductile Iron Pipe.” (Pipe diameters 12 inch and smaller shall be pressure class 350).

3. AWWA C104 “Cement Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water.” (All Ductile Iron Pipe supplied shall be cement mortar lined).

4. AWWA C111 “Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings”

5. AWWA C900-89 “Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.”

6. ASTM 2241 “Polyvinyl Chloride Pressure-Rated Pipe (SDR Series).”

7. ASTM 1785 “Polyvinyl Chloride Pipe (Schedule 80).”

8. AWWA M9, “Concrete Pressure Pipe.”

9. AWWA C200-91 “Standard for Steel Water Pipe 6 in. and Larger.”

10. AWWA C205, "Cement Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inches and Larger - Shop Applied.

11. ASTM D 2239PE, "IPS Polyethylene".

12. AWWA C901, "Polyethylene (PE) Pressure Pipe and Tubing, ½ inch through 3 inch of Water Service".

13. AWWA C906, "Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 63 inch for Water Distribution"

14. ASTM D 2683, "Socket-Type Polyethylene (PE) Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

15. ASTM D D3261, "Butt-Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene Plastic Pipe and Tubing".

16. ASTM D 3350, "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials".

C. WELDED STEEL PIPE. Welded steel pipe shall be of the length, diameter and metal thickness shown on the plans and shall conform to the following:

1. Pipe shall conform to the applicable requirements of AWWA Standards C 200, Section 3, manufactured from steel sheets conforming to ASTM A 570/A 570/M, Grade 33 or 36, plates conforming to ASTM A 283/A283M Grade C or D, or ASTM A 572 Grade 290 (42); or it shall be manufactured to meet the requirements of ASTM A 53 Grade B or ASTM A 139 Grade B or C.

2. Surface Preparation and Coating. Inside and outside surfaces shall be blast cleaned with sand, steel grit, steel shot or a combination of steel grit and steel shot to remove mill scale and rust. Structural steel cleaning shall meet the requirements of the Steel Structures Painting Council Surface Preparation Specification No. 6 (SSPC-SP 6, Commercial Blast Cleaning).

3. Welded steel pipe, when used as a casing and not as a carrier pipe, will not require coatings. Sections of the casing shall be welded firmly together on the inside to prevent separation. Certification of the welder/operator will not be required

D. POLYETHYLENE PIPE. Polyethylene pipe shall be of the length, diameter and thickness shown on the plans and shall conform to the following:

1. The same manufacturer shall supply polyethylene pipe and fittings.

2. Polyethylene fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full-service pressure rating of the mating pipe.

3. Flange adapters used with polyethylene pipe shall be made with sufficient through bore length to be clamped in a butt fusion-joining machine without the use of a sub-end holer. The sealing surface of the flange adapter shall be machined with a series of small V-shaped grooves to provide gasketless sealing or to restrain the gasket against blowout.

E. Pipe shall be furnished with integral bell gasketed joints. Standard laying lengths shall be used. Random lengths shall only be used where necessary to meet fitting and/or valve locations.

F. Unless otherwise specified, pipe joints shall be push on type.

G. Joints for fittings necessary for junctions, bends, outlets, connections, etc., to be used in the system shall be as specified in ITEM 11.02, Water Main Valves and Fittings

H. Contractor shall be reimbursed at cost for any dewatering required.

3. CONSTRUCTION REQUIREMENTS

A. Installation and testing shall conform to the latest published standard/specification of AWWA and ASTM, at the time of bid that relates to the type of pipe and fittings being installed.

1. ASTM D 2774, "Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping."

2. AWWA M23, "Polyvinyl Chloride (PVC) Pipe Design and Installation."

3. UNI B3, "Recommended Standard for Installation of Polyvinyl Chloride (PVC) Pressure Pipe."

4. AWWA C600-93 "Standard for Installation of Ductile-Iron Water Mains and their Appurtenances.

5. AWWA C605-94, "Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water"

6. AWWA M11, "Steel Pipe Design and Installation"

7. ASTM A139, "Electric-Fusion (ARC) - Welded Steel Pipe (4 Inches and Over)."

8. AWWA C206, "Field Welding of Steel Water Pipe."

B. Before commencing work, the Contractor shall notify the proper representative of the pipe supplier or manufacturer as necessary for on-the-job instruction to the Contractor, his foreman, the Contractor's inspector, and personnel in the proper methods of installation. The Contractor shall assume all responsibility for strictly enforcing these methods unless otherwise specified or directed by the Engineer.

C. ONE INSPECTOR PER PIPE-LAYING CREW

D. ALIGNMENT AND GRADE

1. The Contract Drawings show the proposed line and grade and the location of appurtenances. The Contractor shall not deviate from the alignment unless prior approval is obtained from the Engineer. Any deviation not approved may result in the rejection of the pipeline work by the Engineer and re-installation by the Contractor at no additional cost to the project.

2. Whenever obstructions not shown on the Contract Drawings are encountered during the progress of the work and they interfere to such an extent that an alteration in the Contract Drawings is required, the Engineer shall have the authority to change the Contract Drawings. He may order a deviation from the line and grade or arrange with the owners of the structures for the removal, relocation, or reconstruction of the obstruction.

3. Where a modification in alignment or construction details causes no change in material quantities, additional labor, time or other associated changes, the modification is to be performed by the Contractor at no additional cost to the project.

E. HAULING AND DISTRIBUTION OF PIPE

1. Pipe, fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. All pipe handling, storage and installation shall be in conformance with the manufacture's recommendations.

F. DEWATERING

1. The Contractor shall provide all necessary pumps, dams, drains, ditches, flumes, well points and other means for excluding and removing water from trenches, tunnels, and other parts of the work, and for preventing the slopes from sliding or caving. Dewatering shall not create a hazard or nuisance to the public or result in damage to public or private property. Any discharge to a natural stream may require a Discharge Permit from the Colorado Department of Health. Where necessary the Contractor shall obtain the permit and pay all costs associated with the permit. Contractor shall be reimbursed at cost for any dewatering required.

G. EXCAVATION AND BACKFILL

1. Trenches shall be excavated and backfilled in accordance with Item 2.06 "Excavation and Backfill for Structures." Trench width shall be sufficient to allow for proper jointing of the pipe and thorough compaction of the bedding and backfill material under and around the pipe.

H. LOWERING OF WATER MAIN MATERIAL INTO TRENCH

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1. Proper implements, tools, and facilities acceptable to the Engineer shall be provided and used by the Contractor for the safe and convenient performance of the work. All pipe materials shall be carefully lowered into the trench piece by piece by means of ropes, or other suitable tools or equipment, in such a manner as to prevent damage to water main materials, joints and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped in the trench.

2. If damage occurs to any pipe or water main accessories in handling, the damage shall be immediately brought to the Engineer's attention. The Engineer shall prescribe corrective repairs or rejection of the damaged items. Damaged materials shall be promptly removed from the job site.

I. INSPECTION BEFORE INSTALLATION

1. All pipe barrel, bells, spigots and connections shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation in final position. Gasket materials shall be inspected for proper installation and lubrication.

2. In the event that a portion of a length of pipe is damaged, the damaged portion shall be cut off in an approved manner and discarded. Remaining sound portions may be used in cast iron fittings, or in the main with couplings. The Contractor shall be responsible for any and all damage to material and incur the expense of repairing or replacing same. All rubber gaskets shall be stored in as cool a place as practicable, preferably at 21°C (70°F) or less. Rubber gaskets shall not be exposed to the direct sun for more than 72 hours. The Engineer shall make the final determination of pipe materials quality.

3. Any pipe, coupling, sleeve or rubber rings found to be defective in workmanship or material or so damaged beyond repair shall be subject to rejection by the Engineer and shall be promptly removed from the job site.

J. CLEANING OF PIPE JOINTS

1. The outside of the spigot and the inside of the bell shall be wiped clean and dry before the joint lubricant is applied, and the pipe is laid. All dirt and debris shall be kept clear of the pipe joint during installation of the pipe. The Contractor shall cover the ends of the pipe during construction and at the end of each workday to protect the pipe joints and intrusion of dirt, debris, insects, and vermin.

K. PIPE INSTALLATION

1. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the trench. If the pipe laying crew cannot install the pipe in place without intrusion of foreign material, the Engineer may require that a tightly woven canvas bag of suitable size be placed over each end until the connection is made to the adjacent pipe. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.
2. As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. Cut pipe shall be made

smooth with a suitable file. The pipe shall be secured in place with approved backfill material stamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space.

3. Where ground water is present and at times when pipe laying is not in progress, the open ends of pipe shall be kept plugged and watertight with rubber and metal pipe stoppers, or other means approved by the Engineer. The Contractor shall have two of each size required on the job. If water is in the trench, the seal shall remain in place until the trench is completely dry.

4. Where the new main is to be connected into an existing main, the Contractor shall make said connections. All connections shall be made with fittings, tools, and equipment suitable for the size and pipe material to be connected. All cutting, plugging and disconnection of water mains or other similar work shall be done by the Contractor at the Contractor's expense, unless otherwise specified.

5. Prior to the connection into an existing main, the Contractor shall coordinate the isolation of the water main section with the Owner to minimize disruption of service. The Contractor shall dig observation pits at all such connections to determine exact size, location, and condition of the existing main.

6. All service or testing taps into the main shall be made by the Contractor. A tapping saddle shall be installed at each tap and is to be compatible to the pipe material or as otherwise specified.

L. CUTTING OF PIPE

1. The cutting of pipe for inserting valves, fittings, or closure pieces shall be done to avoid damage to the pipe and in accordance with the pipe manufacturer recommendations utilizing the proper tools and equipment.

M. BELL ENDS TO FACE DIRECTION OF LAYING

1. Pipe shall be laid with bell ends facing in the direction of laying, unless otherwise directed by the Engineer. Where pipe is laid on a grade of 10 percent or greater, the laying shall start at the bottom and shall proceed upward with the bell ends of the pipe upgrade.

N. PERMISSIBLE DEFLECTION AT JOINTS

1. Wherever it is necessary to deflect the pipe alignment from a straight line in either the vertical or horizontal plane, the amount of deflection allowed shall not exceed the recommended limits for the type of joint and pipe size. Any deflection not specified on the plans, shall be approved by the Engineer. Maximum deflections shall not exceed the pipe manufacturer's recommendations for the type of joint used. The pipe barrel shall not be bent to achieve a deflection in the alignment.

O. PIPE JOINING

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1. PUSH-ON JOINT. The inside wall of the bell and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, and other foreign matter. A thin film of gasket lubricant as supplied by the pipe manufacturer shall be applied according to the pipe manufacturer's recommendations. The gasket material shall be properly installed and inspected prior to joining the pipe sections.

   The spigot end of the pipe shall be entered into the socket with care used to keep the joint from contacting the ground. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack-type tool or other device approved by the Engineer. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint.

   The Contractor shall protect the end of the pipe where force is applied during installation. Wood blocking or other suitable material shall be utilized as approved by the Engineer. Any pipe damaged during installation shall be subject to rejection by the Engineer.

   Field cut pipe lengths shall be filed or ground to resemble the spigot end of the pipe as manufactured. Complete assembly instructions are available from the pipe manufacturer.

2. POLYETHYLENE PIPE *Heat Fusion Joining*. Joints between plain end pipes and fittings shall be made by butt heat fusion, and joints between the main and saddle branch fittings shall be made using saddle fusion using only procedures that are recommended by the pipe and fitting Manufacturer. The Contractor shall ensure that persons making the heat fusion joints have received training in the Manufacturers recommended procedure. The Contractor shall maintain records of trained personnel and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall not be removed.

   Heat Fusion Training Services. Upon request, the Manufacturer shall provide training in the Manufacturer's recommended butt fusion and saddle fusion procedures to the Contractor's installation personnel and to inspectors representing the Project Manager.

   Butt Fusion of Unlike Wall Thickness. Butt fusion shall be performed between pipe ends, or pipe ends and fittings outlets of like outside diameter and wall thickness (SDR or DR). Butt fusion joining between like diameter but unlike wall thickness shall not be permitted. Transitions between unlike wall thicknesses shall be made with a transition nipple (anchor length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means.

3. POLYETHYLENE PIPE *Mechanical Joining.* If permission is obtained from the Engineer on an individual connection basis, polyethylene pipe and fittings may be joined together or to other materials by means of flanged connections (flange adapters and back-up rings) or mechanical couplings designed for joining polyethylene pipe to polyethylene pipe or to another material. Mechanical couplings shall be fully pressure rated and fully thrust restrained such that when installed in accordance with Manufacturer's recommendations, a longitudinal load applied to the mechanical coupling will cause the

pipe to yield before the mechanical coupling disjoins. External joint restraints shall not be used in lieu of fully restrained mechanical couplings.

4. POLYETHYLENE PIPE BRANCH CONNECTIONS

Branch connections to the main shall be made with suitable tees.

P. THRUST BLOCKS AND ANCHORS

1. At all locations along the pipeline subject to reactive forces while the pipeline is pressurized, poured in place concrete thrust blocks, formed with plywood and anchors shall be installed as detailed on the plans. These locations include but are not limited to bends, plugs, and caps, tees, reducers, valves, and hydrants. Concrete thrust blocks and anchors shall be of the minimum size and installed as detailed on the plans. Also reference ITEM 11.02 "Water Main Valves and Fittings" for construction requirements.

Q. JACKED PIPE

1. The term "jacking" as used herein shall mean jacking, directional boring, or other approved construction methods. Method of installing pipe other than jacking may be used only with written approval from the Engineer. Trenching, jetting, or any other method that may cause damage to the embankment, foundations, roadway area, or be hazardous to the traveling public will not be permitted. When jacking is specified, the pipe must be jacked without disrupting roadway traffic.

2. The sides of the jacking pit shall be supported in such a manner as to prevent any movement or slippage of the earth during the jacking operations.

3. A jacking frame shall be constructed of guide timbers or rails to the exact line and grade of the casing and shall be capable of maintaining the desired alignment and gradient throughout the jacking operation.

4. Depending upon the soil conditions, the excavation operation inside the pipe shall proceed approximately 1 foot ahead of the lead pipe. The excavation around the pipe shall be cut accurately to line and grade and as reasonably close to the outside diameter of the pipe as possible.

5. Each section of pipe in its final position shall be straight and true in alignment and grade. Deviation in alignment and grade from beginning to end of the jacked pipe shall not exceed plus or minus 0.3 foot per 100 feet of length.

R. PRESSURE AND LEAK TESTING

1. The Contractor shall fill and flush the pipeline prior to pressure and leakage testing and disinfection of the water system. The lines shall be filled by the Owner's representative or by the Contractor under the supervision of the Owner's representative.

2. The lines shall be filled slowly to prevent entrapping air. The lines shall then be flushed at blowoffs or at hydrants. Valves shall be opened and closed slowly to prevent excess surges while maintaining positive pressure in the system at all times. Disposal of the water flushed from the pipeline shall not cause erosion, a nuisance or disrupt traffic.

3. The Contractor will be required to perform a pressure and leakage test of the water mains, valves, and fittings in the system constructed (not service lines 2 inches in diameter or less). Where any section of main is provided with concrete thrust blocks, the test shall not be made until at least 5 days have elapsed after the concrete was placed. If high-early strength cement is used in the concrete thrust blocks, the test shall be made after 48 hours.

4. The Contractor shall utilize fire hydrants where available on the pipeline to conduct the tests. When necessary, additional taps into the pipeline may be required to perform the testing. The Contractor shall supply all required materials and equipment required for testing and additional tapping of the pipeline. The tests shall be conducted in the presence of the Engineer.

5. The pipeline segment to be tested (**NOT TO EXCEED 1000 FEET IN LENGTH)** shall be isolated and approved by the Engineer. The pipeline or segment shall be filled with water and subjected to a pressure and leakage test with water as set forth in AWWA Standard C605. Each separate lateral shall be tested. Any excessive leakage, as determined by the Engineer, shall be located and repairs made. Should the pipeline or segments tested exceed permissible leakage limits, the Contractor shall excavate and locate the source of leakage and make repairs. After the Contractor has notified the Engineer that repairs have been made, the test shall be repeated, at the Contractors expense, until the pipeline or segment test results are within the specified limits.

S. DISINFECTION

1. All mains, valves, hydrants, hydrant connections and other appurtenances installed under this Contract shall, upon completion of all water supply related construction, be disinfected in accordance with AWWA Standard C651 and any additional requirements of the Owner or Engineer. The water main shall be isolated from any existing in-service line to prevent any cross connections with the existing line.

2. The Contractor, under the supervision of the Engineer or Owner, shall take water samples and have the samples tested by an approved laboratory. The samples shall be prepared, taken, stored in containers, and handled by the methods required by the testing laboratory standards. If initial testing is unsatisfactory with the health department standards or as determined by the Engineer, the Contractor shall disinfect and retest the water main. This procedure shall be repeated until satisfactory results are obtained at the Contractor's expense. **NO PORTION OF THE WATER MAIN SHALL BE TAPPED FOR SERVICE UNTIL THE LINE HAS BEEN INSPECTED, DISINFECTED AND ACCEPTED**.

3. The Owner will furnish water to the Contractor at no cost for flushing, testing, and disinfecting the pipeline, if hydrants or other connections are convenient to the work. Otherwise, the Contractor shall be responsible for securing a water supply acceptable to

the Engineer at no additional cost to the Owner. The wasteful use of furnished water will not be allowed.

4. Mains shall be drained through hydrants, blowoffs, and air vents.

5. Hydrants or blowoffs shall not be connected to any sewer, submerged in any stream, or be installed in any other manner that will permit back siphonage into the distribution system. The discharge and disposal of water used for disinfection shall comply with all state and federal requirements.

4. METHOD OF MEASUREMENT

A. Water lines of the various types and sizes will be measured by the linear foot installed, and accepted in place, as measured along its centerline without deduction for valves, fittings, and special castings.

B. The quantity of encasement and jacked pipe will be measured by the linear foot complete in place and accepted.

5 BASIS OF PAYMENT

A. Water pipe and welded steel pipe used for encasements will be paid for at the contract unit price per linear foot installed and accepted for the size and type that appear in the Bid Schedule.

B. Excavation, shoring, backfill, bedding, compaction, dewatering, flushing, pressure testing, disinfect ion and water will not be paid for separately, but shall be included in the work.

C. All work incidental to installing encasement and jacked pipe will not be measured and paid for separately but shall be included in the work.