

METROPOLITAN UTILITIES DISTRICT OF OMAHA
OMAHA, NEBRASKA

SPECIFICATIONS FOR CONSTRUCTION

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Section 120.1 – General

120.1.1 – Applicable Construction Standards

District Construction Standards apply to the work covered by the Contract and are as listed in the Standard Specifications for Water Main Construction and Section D of the Specifications.

120.1.2 – Equipment

The Contractor shall provide the tools, equipment, and facilities necessary for the safe and proper installation of the main covered under this Contract.

120.1.3 – Protection of Adjacent Property

120.1.3.1 – General

Protect adjacent property and structures from damage by work done under this Contract. The CONTRACTOR shall restore or replace property or structures that are damaged or destroyed at no cost to the District.

120.1.3.2 – Property Pins

Protect existing property pins. At the CONTRACTOR'S expense, a Licensed Land Surveyor shall replace pins that are damaged, disturbed, or removed during construction and furnish the District written confirmation of such replacement.

120.1.3.3 – Removal of Plants and Structures

The CONTRACTOR shall not remove and shall protect plants or structures including trees, shrubbery, fences, and poles unless removal is authorized by the Engineer. Any item removed shall be replaced or restored by the CONTRACTOR per this specification.

120.1.3.4 – Utility Controls

Valve boxes, curb stops, manholes, etc. shall be unobstructed and accessible at all times during construction.

120.1.3.5 – Notifications

The CONTRACTOR shall give 2 working days notice, unless more time is required by the applicable agency, to the State, County, City, Papio-Missouri River Natural Resources District, U.S. Army Corps of Engineers, any railroad, or other governing authority and private property owners before working on their respective rights-of-way or property.

120.1.4 – Easements

Easements (temporary and permanent) will be shown on the contract drawings. Easements may not be secured by the District at the time of bid or award of the contract. The CONTRACTOR shall not be entitled to additional compensation associated with delays in obtaining easements.

The CONTRACTOR shall be responsible in obtaining a copy of easement descriptions from the Engineer and staking easement(s) prior to construction within an easement area. Easements shall be staked by a Licensed Land Surveyor.

120.1.5 – Alignment

The general alignment of the main is shown on the drawings. The CONTRACTOR shall maintain the required line unless the Engineer, during construction, permits deviations. When required by the contract, a Licensed Land Surveyor shall establish the line and grade. Generally mains are located nine feet behind the north or west curb line.

120.1.6 – Grade

120.1.6.1 – Where Grade is Not Shown or Specified on the Drawings.

The main shall follow the general grade of the street or ground. Required deviations are shown on the drawings. The main shall have a definite slope from high to low points.

The distance from the top of pipe to the ground surface shall be five feet (5') or five feet (5') below the top of curb, whichever is greater. Areas where cover exceeds five feet (5') are shown on the drawings. The CONTRACTOR shall install the main with cover in excess of five feet (5') when directed by the Engineer.

120.1.6.2 – Where Grade is Shown or Specified on the Drawings.

The grade of the water main is shown on the drawings.

The main shall have a definite slope from high to low points. When the main must be installed with cover exceeding that shown on the drawings, the CONTRACTOR will be compensated according to the Proposal.

If the CONTRACTOR installs the main with more cover than shown on the drawings where not required to do so, no extra compensation will be provided. Adjustments to bring hydrants to grade are at the CONTRACTOR'S expense.

Section 120.2 – Construction Requirements of Governing Authorities

120.2.1 – General

The CONTRACTOR shall comply with all construction requirements of governing authorities within their respective right-of-way or property.

120.2.2 – Papio-Missouri River Natural Resources District (PMRNRD)

The CONTRACTOR shall maintain and not compromise flood protection at all times during the course of construction through a levee/dike. The CONTRACTOR shall construct an equal elevation ring levee, per PMRNRD specifications, around any excavation through a levee/dike.

On R-613 and R-616 levees and at Union Dike, the CONTRACTOR shall properly stockpile soil and then backfill in pervious and impervious layers, as per the original design of the levee/dike.

The CONTRACTOR shall overbuild (raise height over existing) levee sections that were cut to provide for settlement. The overbuild height shall be one foot at the centerline of the pipe and taper to zero feet at the edge of the excavation (maximum slope shall be 20:1).

The CONTRACTOR shall repair all disturbed trails to equal to or better condition of the existing trail. Trail sections at an overbuilt levee segment shall be warranted for two years against cracking and other failures.

Sewer manholes and valve boxes shall be flush with the ground surface.

Backfill material for a trench within the Papio-Missouri River Natural Resources District right-of way shall be impervious material (clay/silt), placed in 6" lifts and compacted to requirements stated in Construction Standard 1.11.1.

The CONTRACTOR shall coordinate all levee/dike repair work through the PMRNRD and shall comply with their specifications for repair.

Trench side slopes within the Papio-Missouri River Natural Resources District's channel levee right-of-way shall be 3:1 or more gradual.

Seeding within the Papio-Missouri River Natural Resources District channel levee right-of-way shall be planted between April 15 to May 15 or August 15 to September 15 of a given calendar year. Seed drilling shall be the planting method.

120.2.3 – U.S. Army Corps of Engineers (Directional Drilling Requirements on NEDOUG0084 Non-Federal Flood Control Project)

An experienced driller shall perform the work.

Mud flow rates and pressures shall be carefully monitored to minimize the potential for hydrofracturing. Drilling pressures shall not exceed 250 psi.

The annular space between the bore hole and pipe shall be grouted with a cement or bentonite-cement grout mixture. The grout shall expel the semi fluid mixture of bentonite, soil, and water. The grout shall provide a solid barrier against seepage flow along the annulus.

Damage to the levee system shall be repaired in accordance with USACE requirements at no additional cost to the District or USACE. Repairs shall be approved by USACE.

Entry and exit bore pits shall be backfilled and compacted in 8" loose lifts using soils classified as clay (CL or CH) in accordance with ASTM-D 2487. Soil shall be compacted with approved mechanical means to a dry density greater than 95% of ASTM D 698 maximum density within a moisture range of $\pm 3\%$ of optimum moisture content.

An installation plan, which shall be developed by the CONTRACTOR, shall be submitted to the USACE describing the proposed equipment and procedures that will be used to complete the work. The plan shall also document that all USACE requirements will be incorporated in the work.

Section 120.3 – Excavation and Backfill

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120.3.1 – Excavation

120.3.1.1 – General

Excavation machinery is permitted unless it will damage trees, existing structures, etc. above or below ground. In such cases, the excavation shall be hand dug.

120.3.1.2 – Paving Cuts

Paving cuts shall be made only where connections to existing mains are to be made. All cuts shall be sawed along neat, straight lines. The CONTRACTOR shall obtain a permit from the proper authority before making any cuts.

120.3.1.3 – Pipe Trench

The minimum clear width of the trench shall be one foot greater than the outside diameter of the pipe. The maximum clear width of the trench from the bottom to the top of the pipe shall be two feet greater than the outside diameter of the pipe unless shown otherwise on the drawings.

The bottom of the trench shall be flat and at a depth to obtain the proper cover over the pipe. Bell holes shall be dug in the trench bottom to permit the pipe to rest uniformly along its entire length and to permit proper pipe assembly.

The trench bottom shall be firm and free from mud and muck. Where subgrade material will not remain firm and intact under the feet of the workers or will not support the pipe without settling, the trench bottom shall be over excavated to remove unsuitable material. The depth of excavation shall extend into suitable material as determined by the Engineer. After over excavation, ground stabilization fabric, Mirafi-500x or approved equal, shall be placed on the trench floor and extended up the trench walls of the embedment area. The trench shall then be backfilled to within four inches of the desired grade with one or more layers of three-inch crusher run rock. Ground stabilization fabric shall be placed over the rock and the remaining four inches shall be backfilled with granular material conforming to State of Nebraska specifications for fine aggregate for concrete class 47B, and shall be compacted to minimum 70% relative density (ASTM 2049). In no situation shall the pipe rest directly on the crushed rock subgrade.

* 120.3.1.4 – Encountering Possible Contaminated Soil

Whenever soil removed from an excavation has an unusual odor or is discolored from something other than a natural gas leak, the CONTRACTOR and/or Engineer shall notify the Design Engineer.

Engineering shall have an independent licensed environmental services company test the soil and report the nature of the contamination to Engineering and the CONTRACTOR. The Director of Plant Engineering and the CONTRACTOR shall consult with the environmental services company for guidance on how to handle or dispose of the contaminated soil and to determine whether Engineering needs to call the Nebraska Department of Environmental Quality (NDEQ) at the telephone number below to report the contamination. The NDEQ will provide further guidance if other Federal and State agencies need to be contacted.

Nebraska Department of Environmental Quality
1200 "N" Street, Suite 400
P.O. Box 98922
Lincoln, Nebraska 68509
(402) 471-2186

The Director of Plant Engineering shall contact the CONTRACTOR to determine if the work environment is safe to continue work or have work activities stop until the nature of the contamination is determined.

The CONTRACTOR shall place a 20-lb ABC or Purple K fire extinguisher on site and available for use when working with or near contaminated soil. All sources of ignition shall be kept away from the work area unless samples have been tested and determined the contamination is non-flammable.

The CONTRACTOR shall cover and contain the excavated soil on site using filter socks, containment booms or approved equal to the satisfaction of the Engineer until further notified.

120.3.1.5 – Shoring

Excavation in unstable materials shall be braced according to the rules and regulations of the Occupational Health and Safety Administration (OSHA). The width of excavations shall be increased when shoring is employed. Shoring shall remain in place until the pipe and its appurtenances have been installed, joints inspected, any defects and damage repaired, and the backfill compacted to a depth of two feet over the top of the pipe.

If space permits, the sides of any excavation may be sloped back to prevent cave-ins. Such sloping shall start no lower than the top of the pipe and go to the ground surface.

120.3.1.6 – Dewatering

The CONTRACTOR shall remove water that accumulates in an excavation by pumping or other suitable means. Direct all dewatering pump discharge to sewers, drains, or natural drainage channels. The CONTRACTOR shall dewater at no additional cost to the District.

120.3.1.7 – Traffic Precautions

Excavations shall minimize interference with traffic to protect people from injury, and to avoid property damage. Provide, install, and maintain traffic bridges to permit traffic to cross open cuts at intersections and driveways and at location determined by the Engineer. At all times, maintain at least one traffic lane open unless written permission to the contrary has been obtained from the governing authority.

Place and maintain barricades, signs, and lights as required by the governing jurisdiction. When visibility is poor, material, equipment and excavations which may obstruct traffic shall be enclosed by fences or barricades and shall be delineated with appropriate lights. Flagmen shall direct traffic as required by the governing jurisdiction.

120.3.1.8 – Protection of Underground Structures

Various underground structures will be encountered during this Contract.

The CONTRACTOR shall take appropriate measures, at no additional cost to the District, to protect and maintain underground utilities, structures etc.

Where underground structures, are damaged or destroyed, the structure shall be repaired, restored, or replace by the CONTRACTOR at no cost to the District. This work shall meet requirements of the governing authority.

The CONTRACTOR shall obtain information on underground facilities that may be encountered. Accuracy of information on the drawings is not guaranteed and is provided for information only. The CONTRACTOR shall give at least two working days notice to those agencies and companies whose facilities may/will be encountered.

The CONTRACTOR shall be responsible for making all test holes to determine the location of underground structures shown on the drawings or located through the “One Call Utilities Protection Program”, at the CONTRACTOR’S expense. If the proposed water main is in conflict with an obstruction within one-foot clearance of the obstruction, the CONTRACTOR shall notify the Engineer in advance of construction so the line and/or grade of the pipe can be adjusted to avoid the conflict. The Engineer will make the final determination as to how to avoid the conflict. The cost to avoid the conflict shall be paid by the District and shall be established prior to the work being done and in accordance with the contract provisions covering changed work. The CONTRACTOR shall be responsible for all costs to eliminate a conflict should he fail to fully comply with the specifications.

* 120.3.1.9 – Minimum Clearance

The CONTRACTOR shall maintain one-foot minimum vertical and horizontal clearance between underground structures and the new main, unless otherwise directed by the Engineer. Minimum separation between the new main and sewers (sanitary and storm) shall be maintained in accordance with C.S. 1.13.1.

120.3.1.10 – Existing Mains

The CONTRACTOR shall excavate carefully around existing mains to avoid damaging the main or disturbing backing blocks. If through the CONTRACTOR’S work, a backing block fails, a cap, plug, or valve blows off the main, or the main is damaged; the repairs shall be done at the CONTRACTOR’S expense. It is the District’s option whether it or the CONTRACTOR makes the repair.

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120.3.1.11 – Boring

The CONTRACTOR shall bore under paved roads, streets, and railroads. The boring method, diameter, length of bore, and grouting of the annular void shall comply with the requirements of this specification or the requirements of the governing authority, which ever is more restrictive.

Bore holes under State Highways, County Highways, and other roadways under the jurisdiction of the State of Nebraska or Counties of Nebraska shall not exceed 1-1/2" greater than the outside diameter of the pipe barrel on pipes/casings with an inside diameter of 12" or less or, 2" greater than the outside diameter of the pipe barrel on pipes/casings with an inside diameter greater than 12", unless otherwise specified by the governing authority. Voids outside pipe or casings that exceed these limitations shall be pressure grouted.

The CONTRACTOR shall comply with Table 120.3.1 in the event there is not a requirement by the governing authority on permissible bore diameter.

TABLE 120.3.1

<u>Main Size</u>	<u>Maximum Bore Diameter</u>
6"	12"
8"	14"
12"	18"
16"	24"

A larger bore diameter may be used if approved by the Engineer and if the void between the pipe wall and the bore wall is pressure grouted after the pipe is installed. The over sizing of the bore and the grouting shall be at no additional cost to the District.

Bores that are not to be used shall be pressure grouted full.

Pressure grout around piping and casing shall be able to be excavated, after curing, with a backhoe. Grout shall not exceed 200 psi ultimate strength.

Driveways and sidewalks shall not be bored unless indicated in the drawings or as directed by the Engineer.

120.3.1.12 – Casing

The CONTRACTOR shall install casing as shown on the drawings by jacking, tunneling, or dry boring unless the authority having jurisdiction has different requirements. All Casing shall comply with the Nebraska Department of Roads "Policy for Accommodating Utilities on State Highway Right-of Way", or, when applicable, the governing railroad authority. All abandoned or misaligned holes shall be pressure grouted full. Pipe within the casing shall be protected with approved casing spacers and end seals.

120.3.2 – Backfill

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120.3.2.1 – General

The CONTRACTOR shall backfill and compact the trench after laying the pipe according to Construction Standard 1.11.1 and/or according to any special backfill requirements shown on the drawings. The Contractor shall not use the drop tamper while the tamper is on paved surfaces. The drop tamper equipment shall be entirely off of the pavement while compaction is being done.

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No more than 400 feet of the trench may be left open and no more than 1000 feet may be left un-compacted at any one time unless otherwise permitted by the Engineer.

120.3.2.2 – Unacceptable Backfill Material

When the Engineer determines that the proposed backfill material does not meet Construction Standard 1.11.1, the CONTRACTOR shall remove all unacceptable material and procure acceptable material.

Payment for the removal of unacceptable backfill material and for the procurement of acceptable backfill material, when directed by the Engineer, shall be as provided for in the proposal.

120.3.2.3 – Backfill Material Deficiencies

Any deficiency in the amount of backfill material or of material needed to fill depressions caused by settlement shall be furnished by the CONTRACTOR at no cost to the District.

120.3.2.4 – Soil Density Testing

Soil density tests will be conducted by the District to confirm compaction. The frequency of soil density tests will be at the discretion of the Engineer. All costs of initial testing will be paid by the District. If tests indicate materials and work do not meet specifications, the CONTRACTOR shall pay the expense of retesting.

120.3.2.5 – Backfill Warranty

The CONTRACTOR shall warrant the backfill of all excavations for a period of three (3) years after the date the District's Board of Directors approves final payment. During this period, the CONTRACTOR shall be responsible for the furnishing, placement and compaction of additional backfill material, per District specifications, required as a result of settling, erosion, or other occurrences that compromises backfill of excavations. Furthermore, the CONTRACTOR shall be responsible for the furnishing and placement of seed/sod and erosion control devices in order to restore the backfilled site to satisfactory conditions. The CONTRACTOR shall make all necessary backfill replacements and restoration within 30 calendar days after being notified to do so by the District.

Section 120.4 – Horizontal Directional Drilling (HDD)

120.4.1 – General

Horizontal directional drilling (HDD) is an acceptable method of construction for polyethylene pipe (PE). The CONTRACTOR shall comply with all requirements and specifications of the governing authority in regard to HDD activities within their right-of-way or property.

HDD shall be performed using equipment and methods designed for such work, which includes drilling machines, drill rods, drilling fluids, reamers, cutting heads, and expanders. A break-a-way unit, shear pin, or weak link shall be placed between the pipe and the reamer to protect the pipe from over stressing.

120.4.2 – Borehole

For mains less than 10", the borehole diameter shall not exceed 1.5 times the outside diameter of the main. For mains 10" or larger, the bore hole shall not exceed 1.3 times the outside diameter of the main. The radius of curvature shall not exceed that of the pipe manufactures recommendations for the specified pipe size, material, dimension ratio (DR), etc.

120.4.3 – Pipe Length

The quantity of pipe indicated on the drawing is an estimated length of pipe that will convey water once in service. The CONTRACTOR, within its bid, shall account for extra pipe

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required for pull back as part of the HDD installation process. The District will not compensate for extra pipe used for pull back beyond the bid price.

Section 120.5 – General Pipe Installation Requirements

120.5.1 – Pipe Handling

Pipe, valves, hydrants and fittings shall be lowered from trucks and into trenches with ropes, wide belt slings, or other suitable tools and equipment that will not damage the material. Dropping or dumping materials from trucks and into the trenches is not permitted. Any item that is dropped or dumped is automatically rejected and shall not be used. The CONTRACTOR shall pay the District the full cost of any District provided item that is dropped or dumped into the trench. In addition, the CONTRACTOR shall return said item to the District's Stores Yard.

120.5.2 – Pipe Cleanliness

All dirt and other foreign material shall be removed from the inside of all pipe and fittings before installation.

Care shall be taken to prevent foreign material (dirt, debris, tools, clothing, animals, etc.) from getting in the pipe before, during, and after installation. The CONTRACTOR shall cover pipe ends if foreign material can't be prevented from entering the pipe until the pipe is installed.

Whenever pipe installation is not in progress, the open ends of the installed pipe shall be closed by a watertight plug or cap. In addition, the open end of the pipe shall be closed by a watertight plug or cap when being pushed through a bore hole or casing.

120.5.3 – Cutting Metal Pipe

Pipe shall be cut at right angles to the axis of the pipe with power cutting tools driven either by hydraulic, electric, or air motors, or by gasoline engines. Tools which can damage the pipe will not be permitted. The use of cutting torches is not permitted, except on steel pipe; in which case the Contractor shall submit cutting materials and procedures to the Engineer for approval.

120.5.4 – Direction of Bells

Pipe shall be laid with bells in the direction of laying (bells ahead).

120.5.5 – Unsuitable Laying Conditions

Pipe shall not be laid in water or when either trench conditions or weather conditions are averse to the laying of pipe unless permitted by the Engineer.

120.5.6 – Pipe Embedment

Unless otherwise shown on the drawings, pipe embedment shall be per Construction Standard 1.11.2.

120.5.7 – General Laying Procedure

After a length of pipe is lowered into the trench, its spigot end shall be centered in the bell of the preceding pipe and brought home. The pipe shall be brought to correct line and grade and secured in place with approved embedment material.

120.5.8 – Joint Lubricant

All spigot ends shall be given a thin film of joint lubricant before the joint is made. The CONTRACTOR shall use only that lubricant furnished by the pipe supplier unless otherwise directed by the Engineer.

120.5.9 – Cleaning Joint Surfaces

The last 12 inches of the internal and external surface of the pipe ends (ex. spigot and/or bell) shall be thoroughly cleaned to remove oil, grit, tar, and all other foreign material. For metal and concrete piping, this shall be done by wire brushing and wiping. For plastic piping, this shall be done with a clean, dry, lint-free cloth to remove dust and light soil. Heavier soil may be washed off with soap and water, followed by a thorough rinse with clean water, and dried with a clean, dry, lint-free cloth. Solvents, other than soap and water, shall not be used to clean joint surfaces.

* 120.5.10 – Sanitary Sewer Crossings

Sanitary sewer crossings shall be done in accordance with the District's Construction Standard 1.13.1.

120.5.11 – Flanged Joint Assembly

The following procedure shall be used for assembling flanged joints:

1. Thoroughly clean the mating surfaces of both flanges. The flanges shall be free of oil, grit, tar, and other foreign material.
2. Coat each mating surface with gasket sealant.
3. Place a full-faced gasket on one flange. Align the bolt holes in the gasket with the bolt holes in the flange.
4. Bring both flanges together and insert the bolts through the bolt holes.
5. Tighten bolts in pairs with each member of the pair on opposite sides of the flange assembly. Each pair shall be drawn up a little at a time until all bolts are uniformly tight.

Section 120.6 – Installation of Ductile Iron (D.I.) Pipe

120.6.1 – Installation of Ductile Iron Push Joint (D.I.P.J.) Pipe

120.6.1.1 – General Joint Assembly

Clean mating surfaces (bell and spigot). Insert a single rubber gasket with the small bulb of the gasket to the outside of the bell [See MUD 119 for gasket material for soil contaminated with organic chemicals (i.e. gasoline)]. Lubricate the spigot, insert spigot in the bell, and push home to complete the joint.

120.6.1.2 – Checking the Gasket

After the joint is assembled, use a feeler gauge to verify the gasket is in its retaining groove. If the gasket is out of the groove, the pipes shall be pulled apart, the gasket removed and disposed of, a new gasket inserted, and the pipes reassembled as directed above. Cut used and rejected gaskets into at least two pieces to prevent reuse.

120.6.1.3 – Preparing Cut Pipe Ends

When cut pipe ends are to be used in place of manufactured spigot ends, the cut end shall be filed or ground to produce a slight bevel of about 30 degrees from the vertical.

CAUTION: *Assure there are no sharp edges that could cut the gasket during assembly.*

120.6.1.4 – Pipe Deflection

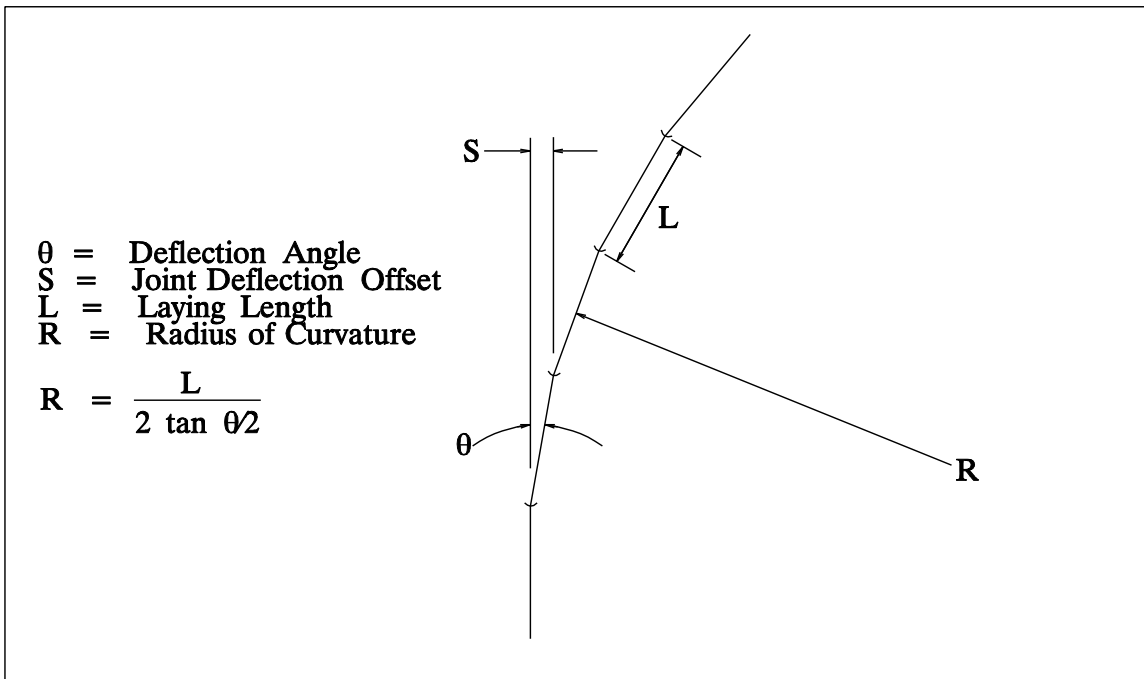
If a deflection is required, the pipe shall be deflected after the pipe spigot is pushed home. At all times, the spigot shall be pushed home with no deflection.

The maximum permissible deflection per length of pipe shall not exceed the recommendations listed in Table 120.6.1.

TABLE 120.6.1. Maximum joint deflection for full length push joint pipe.

Nominal Pipe Size (in.)	*Deflection Angle - θ (degrees)	Maximum Offset - S (in.)		Approx. Radius of Curve - R Produced by Succession of Joints (ft.)	
		Length = 18'	Length = 20'	Length = 18'	Length = 20'
3	5	19	21	205	230
4	5	19	21	205	230
6	5	19	21	205	230
8	5	19	21	205	230
10	5	19	21	205	230
12	5	19	21	205	230
14	3*	11	12	340	380
16	3*	11	12	340	380
18	3*	11	12	340	380
20	3*	11	12	340	380
24	3*	11	12	340	380
30	3*	11	12	340	380
36	3*	11	12	340	380
42	3*	11	12	340	380
48	3*		12		380
54	3*		12		380
60	3*		12		380
64	3*		12		380

* For 14" and larger push joint pipe, maximum deflection angle may be larger than shown above. The Contractor shall consult the pipe manufacturer.



Pipeline Curve Geometry

* Denotes Change

** Section Renumbered

120.6.2 – Installation of Ductile Iron Mechanical Joint (D.I.M.J.) Pipe

120.6.2.1 – General Joint Assembly

Mechanical joints shall be assembled as follows:

1. Clean the bell and spigot.
2. Lightly coat both the bell and spigot with joint lubricant.
3. Slip the cast iron/ductile iron gland over the spigot. The lip extension of the gland shall extend toward the end of the spigot.
4. Slip a rubber gasket over the spigot with the thick edge of the gasket toward the gland. [See MUD 119 for gasket material for soil contaminated with organic chemicals (i.e. gasoline).]
5. Insert the spigot into the bell.
6. Press the gasket into place into the bell. Installed properly, the gasket will be evenly located around the entire joint.
7. Slide the gland into position for bolting. Align the bolt holes in the gland and the bell.
8. Insert the bolts and screw on the nuts finger tight.
9. Tighten bolts in pairs with each member of the pair on opposite sides of the pipe. This will draw the gland into the joint. Tighten the bolts with a torque limiting wrench to the values listed in Table 120.6.2.

TABLE 120.6.2
Permissible Bolt Torque

Bolt Diameter (inches)	Torque (foot-pounds)
5/8	45-60
3/4	75-90
1	85-100
1 1/4	105-120

120.6.2.2 – Retainer Glands

Retainer glands for use with mechanical joint pipe shall be used and installed in accordance with Construction Standard 5.5.3. **All mechanical joint pipe to be retained shall use wedge action retainer glands. Set screw retainer glands shall not be used except for retaining plain end fittings. Do not use wedge action retainer glands on plain end fittings.**

120.6.2.3 – Preparing Cut Pipe Ends

When cut pipe ends are to be used in place of manufactured spigot ends, the cut end shall be filed or ground to produce a slight bevel of about 30 degrees from the vertical. **CAUTION:** *Assure there are no sharp edges that could cut the gasket during assembly.*

120.6.2.4 – Pipe Deflection

If a deflection is required, the pipe shall be deflected after step 8 and before step 9 of the assembly procedure. The maximum permissible deflection per length of pipe shall not exceed the recommendations listed in Table 120.6.3.

* Denotes Change

** Section Renumbered

TABLE 120.6.3. Maximum joint deflection for full-length M.J. pipe without retainer glands.

Nominal Pipe Size (in.)	Deflection Angle - θ (degrees & minutes)	Maximum Offset - S (in.)		Approx. Radius of Curve - R Produced by Succession of Joints (ft.)	
		Length = 18'	Length = 20'	Length = 18'	Length = 20'
3	8-18	31	35	125	140
4	8-18	31	35	125	140
6	7-07	27	30	145	160
8	5-21	20	22	195	220
10	5-21	20	22	195	220
12	5-21	20	22	195	220
14	3-35	13.5	15	285	320
16	3-35	13.5	15	285	320
18	3-00	11	12	340	380
20	3-00	11	12	340	380
24	2-23	9	10	450	500

Joint deflection with retainer glands shall not exceed the above table or the gland manufacturer's specifications.

120.6.3 – Installation of Ductile Iron Restrained Joint (D.I.R.J.) Pipe

120.6.3.1 – General Joint Assembly

Restrained joint pipe is unique between manufacturers. The CONTRACTOR shall be responsible in knowing the manufacturer's assembly procedure for the restrained joint pipe that is being installed. The CONTRACTOR shall be responsible for installing the pipe per the pipe manufacturer's instructions. The following is a general assembly procedure for ductile iron restrained joint pipe.

1. Clean the mating bell and spigot.
2. Clean and insert the rubber gasket into the appropriate seat in the pipe bell. [See MUD 119 for gasket material for soil contaminated with organic chemicals (i.e. gasoline).]
3. Lubricate the gasket and the companion spigot end.
4. Insert the spigot end into the companion bell.
5. Install the restraint mechanism.
6. Pull the leading pipe (pipe just installed) axially to engage the restraint mechanism. **CAUTION:** *Pulling more than required to engage the restraint mechanism may separate adjoining non-restrained joints (push or mechanical joints).*

120.6.3.2 – Pipe Deflection

If a deflection is required, the pipe shall be deflected after the joint has been completely assembled. The maximum permissible deflection per length of pipe shall not exceed the recommendations listed in Table 120.6.4.

* Denotes Change

** Section Renumbered

TABLE 120.6.4. Maximum joint deflection for full-length R.J. pipe.

Nominal Pipe Size (in.)	Deflection Angle – θ (degrees-minutes)	Maximum Offset – S (20' Pipe Length) (in.)	Approx. Radius of Curve – R Produced by Succession of Joints (20' Pipe Length) (ft.)
4	5-0	21	230
6	4-0	17	285
8	4-0	17	285
10	4-0	17	285
12	4-0	17	285
14	3-0	12	380
16	3-0	12	380
18	3-0	12	380
20	2-30	10	460
24	2-15	9	510
30	1-45	7	655
36	1-30	6	765
42	0-30	2	2295
48	0-30	2	2295
54	0-30	2	2295

Section 120.7 – Installation of Polyvinyl Chloride (PVC) Pipe

PVC pipe shall not be installed in soils contaminated with organic chemicals (gasoline, diesel, oil, etc.). If organic chemicals are encountered in the soil during construction, the Contractor shall immediately cease construction activities and notify the Engineer. The Contractor shall not continue construction of the pipeline in the contaminated area until notified, in writing, by the Engineer.

120.7.1 – Assembling Push-On Pipe Joint

Only pipes with factory installed gaskets shall be used. **CAUTION:** *Do not remove the gasket from the pipe bell end as this may damage the pipe.*

Clean the joint surfaces. Apply lubricant per the manufacturer’s specifications. **CAUTION:** *Do not use any other lubricant than that supplied by the pipe manufacturer.*

Brace the bell so that it doesn’t move during the joint assembly process. Insert the spigot into the mating bell assuring straight alignment. Once the spigot evenly contacts the gasket, apply firm pressure either by hand or bar and block assembly. Larger pipe may require the use of mechanical assistance. Push the pipe until the “reference mark” on the spigot end is flush and visible with the lip of the mating bell. **CAUTION:** *Do not over insert the spigot and do not use excessive force which may over insert previously assembled pipe joints.*

120.7.2 – Assembling Pipe to Valves, Fittings and other Mechanical Joint Appurtenances

Mechanical-joint ductile iron fittings shall be used in PVC water main construction.

Pipe ends that will be inserted into a mechanical joint fitting or valve shall have all but ¼” of the factory bevel removed. A cut pipe end shall have a ¼” bevel constructed on the end of the pipe. The angle and depth of the bevel shall match that of the first ¼” of bevel, closest to the bell end, on a factory beveled pipe end. The end may be beveled using a wood rasp, a pipe beveling tool, sander or abrasive disk. All burrs and sharp edges shall be removed prior to joint construction.

* Denotes Change

** Section Renumbered

The PVC pipe end shall be pushed fully home (bottomed out) within the mechanical-joint bell. The joint shall be assembled per Section 120.6.2.1 within this specification.

120.7.3 – Preparing Cut Pipe Ends

Pipe shall be cut perpendicular to the pipe axis using a steel bladed hand or power saw or a power saw with an abrasive blade.

Cut pipe ends that will be inserted into a PVC bell shall be beveled to match a factory beveled spigot end and an insertion reference mark shall be drawn around the circumference of the pipe an appropriate distance back from the cut end. A factory beveled spigot end shall be used as a guide for proper bevel angle and depth; furthermore, the end shall be used to determine the distance of the insertion reference mark from the end of the pipe. The end may be beveled using a wood rasp, a pipe beveling tool, sander or abrasive disk. All burrs and sharp edges shall be removed to avoid cutting the gasket during joint construction.

* 120.7.4 – Pipe Joint Deflection and Pipe Bending

WARNING: Under no circumstances shall it be permitted to bend pipe to achieve a change in horizontal and/or vertical alignment. Each pipe segment shall be straight from pipe end to pipe end. Bending PVC pipe can induce stresses within the pipe that may cause pipeline failure during tapping operations.

Pipe joints may be deflected to achieve **minor changes** in alignment. Pipe joints shall not be deflected more than 4" (1") per 20' length of PVC pipe manufactured by Diamond Plastics Corporation or as recommended by the pipe manufacturer. If a required change in alignment exceeds that of joint deflection, fittings (bends) shall be used.

120.7.5 – Pipe Surface Damage

Pipe segments that have scratches, gouges, cuts, etc. that are 10% or greater of the pipe wall thickness shall not be used in the construction of the pipeline.

Section 120.8 – Installation of Polyethylene (P.E.) Pipe

PE pipe shall not be installed in soils contaminated with organic chemicals (gasoline, diesel, oil, etc.). If organic chemicals are encountered in the soil during construction, the Contractor shall immediately cease construction activities and notify the Engineer. The Contractor shall not continue construction of the pipeline in the contaminated area until notified, in writing, by the Engineer.

120.8.1 – Installation Method

Unless otherwise specified in the contract documents, polyethylene pipe shall be installed by horizontal directional drilling.

120.8.2 – Joints

Unless otherwise specified in the contract documents, all polyethylene joints shall be thermally butt fused per pipe manufacturers published recommendations and procedures. The manufacturer shall provide a listing of recommended fusion parameters and documentation that appropriate testing has validated these parameters.

Fusions on nominal pipe diameters 12" and larger shall be performed by a Certified Fusion Technician. The Technician shall be certified to perform fusions on HDPE pipe by the manufacturer of the fusion equipment used in the construction of the pipeline. Proof of certification shall be submitted at time of bid and provided at the request of the Engineer.

General Joining Procedure:

1. Clean: Each pipe end shall be clean and dry.

2. Secure: Each pipe end that is to be fused together shall be held in a position using the clamps on the butt fusion machine to prevent lateral movement. Axial movement will occur as part of the fusion process.
3. Face: Pipe ends shall be faced to establish clean, parallel mating surfaces. This shall be done using machines specifically designed for this purpose. If properly faced, there will not be any gap between pipe ends when brought together.
4. Align: Pipe shall be aligned so that the outside diameters of both pipe ends are even along the whole circumference of the pipe.
5. Melt: The pipe ends shall be heated per the pipe manufacturer's recommended temperature, interface pressure, and time duration. Pipe ends shall be heated with equipment specifically designed for this purpose.
6. Join: The pipe ends shall be joined together by bringing both heated ends together to form a properly mixed homogeneous joint. Pipe manufacturer's recommended joining procedure shall be followed. The pipe manufacturer shall either specify an interface pressure or bead size of molten material as a guide for a proper joint.
7. Hold: The molten joint shall be held immobile under pressure until adequately cooled. Cooling times shall comply with the pipe manufacturer's recommendations.

120.8.3 – Cutting Pipe

Pipe shall be cut perpendicular to the axis of the pipe using a guillotine cutter, run-around cutter, coarse-tooth handsaw, or chain saw. Typically handsaws and chainsaws will be used on larger diameter pipe. Only chainsaws that will be designated solely for the use of cutting polyethylene water pipe shall be used. If a chainsaw is used to cut other material (ex. wood), it shall not be used to cut polyethylene water pipe. Chainsaws shall be used without chain lubricant to prevent contamination of the water main. Saw chips/dust shall be completely removed from the water pipe.

120.8.4 – Bead Removal

Melt beads shall not be removed from the inside or outside of the butt fused joint.

120.8.5 – Pipe Surface Damage

Damage (scratches, gouges, cuts, etc.) that exceed 10% of the pipe wall thickness and butt fusion misalignments shall be cut out from the pipeline. The two cut ends shall be butt fused together.

Section 120.9 – Installation of Prestressed Concrete Cylinder Pipe (P.C.C.P.)

120.9.1 – General Joint Assembly

The following procedure shall be used to assemble joints:

1. Clean the bell and spigot rings.
2. Check the bell and spigot rings for any nicks or burrs. Any nicks or burrs which are discovered shall be carefully filed smooth.
3. Coat the gasket with lubricant and install it on the spigot.
4. Exercise the gasket by inserting a smooth round rod between the gasket and the spigot and running the rod around the spigot for a complete turn in one direction and then for a complete turn in the opposite direction.
5. Lubricate the bell.
6. Insert the spigot in the bell and push the pipe home.
7. Check the position of the gasket in the joint with steel feeler gauges before the pipe reaches final position.

120.9.2 – Joint Grouting

120.9.2.1 – Inside Joint Recess

Fill the inside joint recess with a mortar consisting of one part Portland cement and three part sand and having a consistency such that it will stay in the recess without sagging,

slumping, or falling out. Clean and saturate the recess with clean water before applying the mortar. Trowel the surface of the mortar flush with the adjacent pipe surfaces.

120.9.2.2 – Outside Joint Recess

Enclose the outside joint recess using a diaper furnished by the pipe manufacturer, which acts as a form for the grout. Mix the grout to a pouring consistency, which shall consist of one part Portland cement and three parts sand. Pour the grout into the space formed by the diaper and the pipe, allow the grout to run to the bottom of the pipe, and rod until the joint is completely filled.

The grouting of the joints shall comply with the pipe manufacturer's recommendations and procedures.

120.9.3 – Joint Harnesses

Joint harnesses shall be installed as shown on the Drawings. Grout all harness joints as described above.

120.9.4 – Temporary Supports

The Contractor may be required to provide temporary support for previously laid pipe to maintain the correct grade where pipe is being installed in concave transitions between grades. No additional compensation will be provided for this work.

120.9.5 – Pipe Deflection

Joint deflections for straight concrete pipe or joint breaks with bevels shall not exceed the pipe manufacturer's published recommendations.

120.10 – Installation of Steel Pipe

At all times during construction and installation of the pipeline, the CONTRACTOR shall use every precaution to prevent damage to the protective coating on the pipe. No metal tools or heavy objects shall be permitted to come into contact unnecessarily with the finished coating. Workers will be permitted to walk upon the coating only when necessary, in which case they shall wear shoes with rubber or composition soles and heels. Any damage to the pipe or the protective coating from any cause during the installation of the pipeline and before final acceptance by the District shall be repaired as directed by the Engineer and at the expense of the CONTRACTOR. During welding the coating shall be protected by draping any 18" wide strip of heat resistant material over the top half of the pipe on each side of the coating holdback to avoid damage to the coating by hot weld spatter. No welding ground shall be made on the coated part of the pipe.

Pipe shall be handled with wide belt slings. Chains, cables and other equipment likely to cause damage to the pipe or coating shall not be used.

Field joints shall be wrapped in accordance with AWWA C209, Cold Applied Tape Coatings for Special Sections, Connections and Fittings for Steel Water Pipelines. The joints shall be cleaned, primed and wrapped with two wraps of tape with a 35 mil thickness each. All material used on field wrapped joints shall be in accordance with AWWA C209.

120.11 – Corrosion Protection of Pipelines and Appurtenances

120.11.1 – Polyethylene Encasement of Ductile Iron

All buried ductile iron pipe and fittings shall be encased in polyethylene in accordance with Construction Standard 1.12.1.

120.11.2 – Wrapping of Couplings on Ductile Iron Mains

All mechanical couplings shall be wrapped in polyethylene in accordance with Construction Standard 1.12.1.

120.11.3 – Coating of Couplings on Concrete Mains

Buried steel couplings installed on concrete pipe and any adjacent bare steel shall be fully encased in 2" to 6" of cement mortar coating.

120.11.4 – Material in Vaults

Uncoated gate valves (other than bronze), steel piping, mechanical couplings, mechanical joints, flanges including bolts, nuts and washers and any other uncoated ferrous material in vaults shall be wrapped per Construction Standard 8.5.1.

120.11.5 – Protection of Buried Steel

All steel flanged outlets, steel mechanical couplings and any other uncoated steel appurtenances which are buried and not located in vaults shall be primed and double wrapped with cold applied pipe wrap conforming to AWWA C209 and Construction Standard 8.5.1.

120.11.6 – Insulated Flange Sets

All flanges specified as insulated flanges shall be assembled with double insulating flange sets, which shall be installed per Construction Standard 8.2.2.

* 120.11.7 – Cathodi Clamps and Anode Installation

All Cathodi Clamps and Anodes shall be installed per Construction Standard 8.3.3.

Section 120.12 – Installation of Appurtenances

* 120.12.1 – Trace Wire

Trace wire shall be installed on all proposed mains in accordance with Construction Standard 1.14.1.

Trace wire, to be installed as part of the project, shall be connected to existing trace wire at all connection points between new and existing water mains.

Prior to final payment, the Engineer will verify that the trace wire is continuous and allows for the proper tracing of the water main. If the Engineer identifies locations where the trace wire is not continuous, to include all connection points between new and existing mains, the CONTRACTOR, at no additional cost to the District, shall make necessary repairs/corrections. Final payment will not be issued until this work is complete.

120.12.2 – Mechanical Couplings

120.12.2.1 – General Installation Procedure

The following procedure shall be used to install mechanical couplings:

1. Clean eight inches of each pipe end to remove all oil, grit, tar, rust, loose scale, and other foreign material.
2. Slip the follower rings over each pipe end past the cleaned portion of the pipe.
3. Clean the gaskets and slip them over the pipe ends past the cleaned area.
4. Measure the length of the middle ring.
5. Place a mark on each pipe a distance equal to one-half the middle ring measurement from the end.
6. Clean the middle ring and slip it over one pipe end to the measurement mark.
7. Insert the other pipe end into the middle ring.

8. Slide the gaskets into place and make sure the gaskets are evenly seated between the pipe middle ring.
9. Slide the follower rings into place.
10. Insert the bolts making sure that adjacent bolts face opposite directions and attach nuts with the rounded edge facing toward the follower ring.
11. Tighten the bolts uniformly with a torque limiting wrench. The torque applied to the bolts shall not exceed the following:
 - 5/8" bolts – 75 foot-pounds[#]
 - 3/4" bolts – 90 foot-pounds[#]

[#]Unless otherwise directed by manufacturer

Bolts shall be tightened in pairs with each member of the pair on opposite side of the coupling. Each pair shall be drawn up a little at a time until all bolts are uniformly tight.

120.12.2.2 – Permissible Gaps

For pipelines 16" and smaller, if there isn't a reducer or valve within 160 feet of the coupling, the gap between pipe ends shall not exceed one inch. The maximum gap shall be a ¼ inch when a reducer or valve is within 160 feet of the coupling. When called for in the contract documents, the CONTRACTOR shall be required to fill the gap between pipe ends. The method for filling the gap will be described in the contract documents. Exceptions to these limits will be in unusual cases only and with permission of the Engineer.

120.12.2.3 – Permissible Deflection

Pipeline deflection at a coupling shall not exceed the maximum deflection published by the coupling manufacturer.

120.12.3 – Valves

The approximate locations of valves are shown on the drawings. In general, valves shall be set at or near property lines. The Engineer will determine the exact locations in the field.

Valves shall be set and installed with the pipe in accordance with the requirements for installing pipe. In addition, each valve shall be installed with an adjustable valve box or precast vault for valve operation.

120.12.4 – Fire Hydrants

Fire hydrants shall be installed in accordance to Construction Standard 3.0.1.

120.12.5 – Backing Blocks

120.12.5.1 – General

Concrete backing blocks shall be installed to resist the pressure in the water main at all bends, tees, caps and plugs unless otherwise directed by the Engineer.

The backing blocks are designed for 180 psi main pressure. Required dimensions are shown in Construction Standard 1.8.11.

Poor soil conditions may require larger backing areas. If such conditions are encountered, the size of the backing blocks shall be increased as directed by the Engineer.

120.12.5.2 – Installation

Backing blocks shall be cast-in-place concrete. Pre-cast concrete blocks shall not be used as part of any backing block. Backing blocks shall bear on undisturbed soil.

Backing blocks shall be placed to resist the resultant force at a fitting. Prevent concrete from flowing over and around joints and bolts.

The “depth” of the backing block is determined by the distance from the main to undisturbed soil, but will usually not exceed three feet six inches.

120.12.5.3 – Temporary Backing

Backing of temporary caps and plugs at connections shall be easily removeable after pressure testing is complete and the connection is to be made.

120.12.5.4 – Immediate Support Backing Blocks

When water service must be immediately restored, immediate support backing blocks are required. Immediate support backing blocks shall be installed where indicated on the drawings or directed by the Engineer and shall be in accordance to Construction Standard 1.8.12.

120.12.6 – Vaults and Adjustable Valve Boxes

Application of precast concrete vaults and adjustable valve boxes (CC boxes) shall be per Table 120.12.1.

Vaults and valve boxes shall be installed so District personnel can easily engage the valve operating nut with a valve key from ground level. Tops of valve boxes and round iron frames and covers of vaults shall be installed flush with ground level or pavement.

Vaults or valve boxes installed in unpaved roads or shoulders and rural areas shall have a concrete collar constructed around the round iron frame of the vault or top section of the valve box per Construction Standard 1.8.5.

TABLE 120.12.1
Use of Vaults and Adjustable Valve Boxes (CC Boxes)

Application	Depth [#]	Precast 48” Vaults	60” Vaults	Adjustable Valve Box (CC Box)	Construction Standard
4” to 14” Gate Valve	< 7'			x	1.8.4
4” to 14” Gate Valve	≥ 7'	x			1.8.1
4” or Larger Check Valve	Any	x			1.8.1
16” or Larger Gate Valve	Any	x			1.8.1
18” to 48” Butterfly Valve	Any		x		1.8.1
4” or Larger Pressure Control Valve	Any		x		1.8.1
Air Tap	Any	x			1.6.1
Air Tap w/4” to 14” Valve	Any	x			1.6.1
Air Tap with 16” Valve	Any		x		1.6.1
Gate Valve with 2 Air Taps	Any	x			1.6.1

Note: Install 30” vault in lieu of 48” vault, only when directed by the Engineer.

Measured from the top of the main.

* Denotes Change

** Section Renumbered

120.12.7 – Air Taps

Air taps shall be installed where air may become trapped in the main. This includes high points in the pipeline, valves that become high points when closed and temporary caps and plugs installed for hydrostatic pressure testing.

The CONTRACTOR shall furnish and install air taps per Construction Standard 1.6.1.

Air taps shall be installed at locations shown on the drawings. Air taps shall be located on property lines unless otherwise directed by the Engineer.

The CONTRACTOR shall install additional air taps as directed by the Engineer.

- * 120.12.8 – Sample Taps and 1" Air Taps & Automatic Air Release Valves used as Sample Taps
Sample taps will be used by the District to collect samples to confirm disinfection of the water mains. In some cases air taps may be used for this purpose and will be indicated as such on the project drawings.

The CONTRACTOR shall furnish and install sample taps as shown on the project drawings or as directed by the Engineer per Construction Standard 1.6.2. Sample taps shall remain accessible until bacteria test samples have been cleared by the District's Chemical Laboratory. The CONTRACTOR shall fence sample tap excavations, in a manner acceptable to the Engineer. The CONTRACTOR shall maintain fencing until the excavation is ready to be backfilled. Fencing shall occur at no additional cost to the District. Sample taps shall be closed and left on the main when the excavation is backfilled.

The CONTRACTOR shall furnish and install 1" Air Taps (including automatic air release valves) as sample points where specifically indicated on the project drawings or as directed by the Engineer per Construction Standard 1.6.1. The 1" corporation associated with air taps, per Fig. 1 of Construction Standard 1.6.1, shall be installed during pipeline construction. The 1" automatic air release valve shall be installed after bacteria tests pass. Air taps, per Fig. 2 of Construction Standard 1.6.1, shall be installed in its entirety during the construction of the pipeline. In all cases, vault bottom sections and barrel sections shall be installed during the construction of the pipeline. Vault cone sections and top sections shall be installed after bacteria tests pass.

When excavations are left open and temperatures are expected to drop below 32°F, the CONTRACTOR shall insulate exposed pipe and fittings, including sample taps and air taps/air release valves used as sample points containing water to prevent freezing. Any damage to the pipeline and appurtenances caused by freezing shall be repaired by the CONTRACTOR at no additional cost to the District.

120.13 – Connections to Existing Mains

120.13.1 – General

The CONTRACTOR shall connect the new to the existing mains as shown on the project drawings.

120.13.2 – Connections by Tapping Live Mains

The District will make all taps into live mains. The CONTRACTOR shall provide an excavation conforming to Construction Standard 1.10.1 and OSHA requirements to permit District access for tapping live mains. The District will furnish and install the tapping sleeve and valve and will perform the tapping operations. The CONTRACTOR shall furnish and

install the backing block and the vault with frame and cover or valve box. The CONTRACTOR shall backfill and compact the excavation per Construction Standard 1.11.1.

120.13.3 – Other Connections

The CONTRACTOR shall make all connections other than those requiring the tapping of live mains. If necessary, the District will take the existing main out of service only for the time required to make the connection. In such a situation, the CONTRACTOR shall give the District two working days notice to schedule personnel and equipment. If the CONTRACTOR fails to give proper notice, or if proper notice is given, but the main can not be shut down due to operational reasons, the CONTRACTOR is not entitled to compensation for delays.

If the CONTRACTOR is laying the main into a connection and a chlorine tube is not to be installed, terminate the main and seal the end with a cap, plug or dead end hydrant as directed by the Engineer. The termination of the main shall be backed unless otherwise directed by the Engineer.

120.14 – Pressure Testing and Disinfection of Mains

120.14.1 – Chlorine Tubes

Chlorine tubes are used to disinfect and pressure test the main. The CONTRACTOR shall install chlorine tubes as shown on the project drawings. Mechanical couplings generally facilitate installation and removal of the tubes.

Chlorine tubes shall remain in the main and accessible until bacteria test samples have been cleared by the District's Chemical Laboratory. The Engineer may require the CONTRACTOR to remove chlorine tube(s) after pressure testing, but prior to samples clearing. When samples clear, the CONTRACTOR shall remove remaining chlorine tubes, replace them with pipe, and backfill excavations.

The CONTRACTOR shall fence chlorine tube excavations, in a manner acceptable to the Engineer. The CONTRACTOR shall maintain fencing until the excavation is ready to be backfilled. Fencing shall occur at no additional cost to the District.

When excavations are left open and temperatures are expected to drop below 32°F, the CONTRACTOR shall insulate exposed pipe and fittings, including chlorine tubes, containing water to prevent freezing. Any damage to the pipeline and appurtenances, including chlorine tubes, caused by freezing shall be repaired by the CONTRACTOR at no additional cost to the District.

120.14.2 – Pressure and Leakage Testing of Non-Polyethylene Mains

120.14.2.1 – General

Mains will be subjected to a combined pressure and leakage test. For ease of testing, the main may be divided into sections as shown on the drawings.

Successful pressure and leakage testing does not relieve the CONTRACTOR of any responsibility during the warranty period.

120.14.2.2 – Pressure and Leakage Test Procedure

District personnel will conduct the test per Construction Standard 1.4.0. The CONTRACTOR, at his/her discretion, may witness the test.

120.14.2.3 – Test Failure

If the test section fails to meet the test requirements set forth, the CONTRACTOR shall locate and repair, at his own expense, all defective joints, breaks, and leaks. All

assistance to the CONTRACTOR, from District personnel, for locating and isolating leaks will be deducted from final payment with the cost computed on a time and material basis.

The CONTRACTOR may conduct his own pressure and leakage test to locate leaks or to check system integrity. Such a test will not be accepted as a substitute for any tests conducted by District personnel. The equipment and methods, which the CONTRACTOR desires to use for such a test, shall be approved by the Engineer prior to use.

If the CONTRACTOR performs such a test by "jumping" the chlorine tube, "jump" piping shall incorporate a hydrant meter assembly with backflow protection. The hydrant meter assembly shall be rented from the District. All fees, deposits and licensing pertaining to the hydrant meter assembly shall be per the District's Billing Price Book. Fees and deposits for the hydrant meter assembly shall be paid by the CONTRACTOR and will not be deducted from final payment.

120.14.2.4 – Retesting after Failure

After all repairs have been completed, the test section will be subjected to another pressure and leakage test. If the test section passes the second test, the cost of retesting will not be deducted from the CONTRACTOR'S final payment.

120.14.2.5 – Repair of Obvious Leaks

All discovered, obvious, or visible leaks shall be repaired by the CONTRACTOR at his/her expense even if the test section meets allowable leakage requirements.

120.14.3 – Pressure and Leakage Testing of Polyethylene Mains

120.14.3.1 – General

The District will conduct a combined hydrostatic pressure test (leakage test) and chlorination of the newly installed HDPE water main. Successful pressure (leakage) testing does not relieve the CONTRACTOR of any responsibility during the warranty period.

120.14.3.2 – Pressure and Leakage Test Procedure

District personnel will conduct the test per Construction Standard 1.4.0. The CONTRACTOR, at his/her discretion, may witness the test.

120.14.3.3 – Test Failure

If the test section fails the test requirements above, the CONTRACTOR shall locate and repair, at his own expense, all defective joints, breaks, and leak locations. All assistance rendered to the CONTRACTOR by the District for locating and isolating leaks will be deducted from final payment with the cost computed on a time and material basis.

The CONTRACTOR may conduct his own pressure and leakage test to locate leaks or check system integrity. Such testing is not a substitute for the District pressure and leakage test. The equipment and methods used by the CONTRACTOR for such a test shall be reviewed with the Engineer. The CONTRACTOR shall not commence with such a test without approval from the Engineer.

120.14.3.4 – Retesting after Failure

After all repairs are completed, the test section will be subjected to another pressure and leakage test. If the test section passes the second test, the cost of re-testing will not be deducted from the CONTRACTOR'S final payment. Costs of all additional tests conducted as a result of failure of the second test will be deducted from the CONTRACTOR'S final payment with the cost computed on a time and material basis.

120.14.3.5 – Repair of Obvious Leaks

All discovered, obvious, or visible leaks shall be repaired by the CONTRACTOR at his/her own expense even if the test section meets allowable make-up requirements.

120.14.4 – Chlorination of Mains

120.14.4.1 – General

The District will chlorinate the main after installation. The main may be divided into sections to facilitate chlorination. After chlorination and passing of bacteria test(s), the main or section of main may be put into service. The placing of any section of main into service does not construe acceptance of work not completed.

120.14.4.2 – Chlorination Procedure

Chlorination of the mains will be conducted by District personnel per Construction Standard 1.4.3.

During the disinfecting process, the CONTRACTOR shall remove selective chlorine tubes at the direction of the Engineer and replace them with lengths of pipe which have been disinfected per this specification. When directed by the Engineer, the CONTRACTOR shall remove the remaining chlorine tubes and replace them with lengths of pipe which have been disinfected per this specification. The District will then reflush and sample the main per Construction Standard 1.4.4. When the District's Chemical Laboratory has tested and passed the samples, the Engineer will direct the CONTRACTOR to backfill all remaining excavations.

120.14.4.3 – Failure of Test

If samples fail the bacteriological tests, the main will be flushed, and rechlorinated as necessary by the District. The cost of flushing and rechlorination will be deducted from the final payment due the CONTRACTOR. Flushing and rechlorination costs will be computed on a time and material basis. Final payment will not be made until the main has met all disinfection requirements.

120.14.4.4 – Disinfection of Pipe and Fittings Installed After Chlorination

The CONTRACTOR shall disinfect all pipe and fittings which will be installed in the main after the main has been chlorinated or installed at connections to existing mains, which will not be subjected to the chlorination procedure described above. The following procedure shall be used:

1. The ends of existing pipe shall be thoroughly cleaned both inside and outside before any new parts are installed.
2. The ends of the existing pipe shall be sprayed with a concentrated chlorine solution, which will be provided by the District, both inside and outside. The inside of the pipe shall be sprayed as far back into the main as possible.
3. All inside surfaces of any new material that will have contact with potable water shall be cleaned and sprayed with a concentrated chlorine solution furnished by the District in a plastic container. This includes middle rings and gaskets for mechanical couplings, push joints, mechanical joints, and split sleeves. This solution contains approximately 100 parts per million of chlorine. After use, this solution should be removed from the container as soon as possible to avoid degradation of the container.

120.15 – Erosion and Sediment Control

The CONTRACTOR shall implement erosion and sediment control measures per Construction Standard 0.2.1. Other methods of erosion and sediment control not specified in Construction Standard 0.2.1 maybe used with the approval of the Engineer. The CONTRACTOR shall maintain all erosion and sediment controls as specified in Construction Standard 0.2.1. In the case of CONTRACTOR proposed and approved controls, these controls shall be maintained to maintain the intent of the control. Furthermore, these controls shall be maintained until the site is stabilized. Stabilized shall be defined as an established stand of perennial vegetation with a density of 80%. The CONTRACTOR shall install and maintain any erosion and sediment controls requested by the Engineer.

The CONTRACTOR shall conduct his/her work in compliance with all stipulations of a construction site's Storm Water Pollution Prevention Plan (SWPPP). When conducting work on a third party's construction site (i.e. subdivision) where a SWPPP has been implemented, the CONTRACTOR may find it necessary to remove existing erosion and sediment controls to facilitate water main installation. The CONTRACTOR shall only remove what is necessary to construct the water main. The removal of erosion and sediment controls shall occur at no additional cost to the District. The CONTRACTOR will not be responsible for reinstalling the erosion and sediment controls unless specifically requested by the Engineer. The CONTRACTOR will receive additional compensation for reinstalling erosion and sediment controls per the Proposal.

120.16 – Restoration of Disturbed Areas

120.16.1 – General

Restoration of disturbed areas and all other clean-up shall follow backfilling as soon as possible and be completed within 14 calendar days following backfilling unless more time is allowed, in writing, by the District.

120.16.2 – Clean-Up Requirements

All dirt, rubbish, excess excavated material and other debris shall be legally disposed of by the CONTRACTOR during the course of the project. The site shall be left clean upon the completion of the project to the Engineer's satisfaction. The CONTRACTOR shall be responsible for the cost of all clean-up requirements.

* 120.16.3 – Pavement Repair

All streets, sidewalks, driveways and curb (handicap) ramps that are removed shall be replaced. Replacement shall conform to the requirements of the governing authority.

Sidewalk and driveway replacements shall be, at a minimum, the same thickness as the existing sections. Repairs shall be carried to the first existing joint beyond the edge of the excavation. All work shall satisfy the property owner.

120.16.4 – Unpaved Roadways

Unpaved roads shall be restored as required by the governing authority.
All work shall satisfy the property owner.

120.16.5 – Established Grassy Areas

Established lawns that have been damaged shall be resodded to match the existing lawn unless otherwise directed by the Engineer.

All other areas shall be seeded. See MUD 119 for seed requirements.

The CONTRACTOR shall comply with all seeding and soil restoration requirements of any permit issued for the given project by the U.S. Army Corps of Engineers at no additional cost to the District.

All reseeded and resodded areas shall be watered and maintained by the CONTRACTOR for 28 days from the time the sod is placed and the seeding is completed. At the end of this maintenance period, the Engineer will inspect the resodded or reseeded areas. If any sod or grass growing from seed is determined by the Engineer to be dead or otherwise unacceptable, the CONTRACTOR shall replace the sod or grass at no additional cost to the District. The CONTRACTOR shall then water and maintain these areas for an additional 28 days continuing the process until acceptable to the Engineer.

Final payment shall not be made until the reseeded and/or resodded areas are accepted by the District Engineer.

If this section conflicts with language in the project's Storm Water Pollution Protection Plan (SWPPP), the stricter of the two shall govern.

120.16.6 – Shoulders and Ditches

When installing mains along roads or streets with shoulders, the grading of shoulders and ditches shall be done by the CONTRACTOR according to the requirements of the governing authority.

120.16.7 – Miscellaneous

All other disturbed or damaged items, such as fences, poles, shrubbery, and trees shall be either repaired or replaced. All repairs shall be to the satisfaction of the property owner or the governing authority. Any replacements shall be of equal quality to those items which they replace. In addition, all replacements shall be made to the satisfaction of the property owner or governing authority.

120.17 – Measurement and Payment

120.17.1 – General

The District will make payment for each item listed in the Proposal on the basis of the unit prices set by the CONTRACTOR and the quantities installed. Payment for extra work will be made as provided in the Proposal. No additional payment will be made for those items not listed as bid items or as extra work items in the Proposal. Such items are considered subsidiary to those items for which payment is provided.

120.17.2 – Payment Conditions

120.17.2.1 – Augering/Boring

Payment for augering will be based on the minimum length, in lineal feet, required to accomplish the crossing as determined by the Engineer. No extra payment will be made for abandoned, misaligned, or oversized holes.

120.17.2.2 – Casing

Payment for furnishing all material, augering for the casing, and installing the casing will be based on the minimum length, in lineal feet, of casing to be installed as required by the authority having jurisdiction. No extra payment will be made for abandoned or misaligned holes.

120.17.2.3 – Valves

Payment for installing the valve and furnishing and installing other materials as required in the particular bid listing will be based on the number of each size and type of valve installed. No extra payment will be made for valves which are part of a hydrant branch.

120.17.2.4 – Fire Hydrants

Payment for installing the hydrant and hydrant branch valve and for furnishing and installing the hydrant tee and other materials required for a complete installation will be based on the number of each type of hydrant installed.

120.17.2.5 – Backing Blocks

No extra payment will be made for installing backing blocks of the sizes and shapes required on the drawings. If it is necessary to install larger backing blocks than originally designed, extra payment for the extra excavation, backfill, and concrete required will be made as provided in the Proposal.

120.17.2.6 – Air Taps

No extra payment will be made if an air tap is included as part of a valve installation. When air taps are independent of valve installations, payment for furnishing and installing air tap materials and vault will be made on the basis of the number of air taps installed.

120.17.2.7 – Chlorine Tubes

Payment for installing chlorine tubes and mechanical couplings and replacing tubes with pipe after testing and chlorination will be based on the number of chlorine tubes installed and removed.

120.17.2.8 – Connections

Payment for making each connection as listed in the Proposal will be based on the number of each connection made.

120.17.2.9 – Restoration of Disturbed Areas

Payment will be made for the particular items of restoration as listed in the Proposal at the unit prices set down by the CONTRACTOR. Those items not listed in the Proposal are considered subsidiary to the other bid items for which payment is provided and no extra payment will be made.

120.17.2.10 – Precast Concrete Manholes, Rings, and Covers, and Adjustable Valve Boxes

Separate payment for these items will not be made. These items are considered as integral parts of the valve and air relief installations listed in the Proposal. The costs of these items shall be included in the unit prices for those items. However, additional payment will be made as provided in the Proposal if depth restrictions make it necessary to substitute a 48 inch vault for a 30 inch vault or adjustable valve box.

120.17.2.11 – Pipe and Fittings

Payment for excavating the trench, installing pipe, fittings, and backing blocks; backfilling the trench; and compacting the trench will be based on the length in lineal feet, of each size of pipe installed in the trench, including the length of the fittings and excluding the pipe and tees required for hydrants, as measured along the centerline of the pipe and the number of each size and type of fitting.

120.17.2.12 – Additional Cover

Extra compensation will not be paid as provided in the Proposal for installing mains with cover in excess five feet when proposed depth of cover is indicated on drawings.

Extra compensation will be paid as provided for in the Proposal for installing mains with cover in excess of that shown on the drawings when required by the Engineer.

No extra compensation will be made if the CONTRACTOR chooses to lay the main with a cover greater than that required by the drawings or by the Engineer. In addition, the

CONTRACTOR shall bear the cost of adjustments required to bring hydrants to the proper grades.

Also, no extra compensation for additional cover will be made for augering at covers greater than five feet or for installing pipe in such auger holes.

120.17.2.13 – Crushed Rock and Sand-Gravel for Trench Subgrade

Payment for furnishing and placing crushed rock and sand-gravel as part of the trench subgrade will be based on the tonnage placed and the prices contained in the Proposal.

120.17.2.14 – Disposal of Unacceptable Backfill

Payment for disposing of unacceptable backfill material will be based on the number of loose cubic yards disposed and the price contained in the Proposal.

120.17.2.15 – Furnishing and Placing Acceptable Backfill

Payment for furnishing acceptable backfill material will be based on the number of cubic yards furnished and the price contained in the Proposal. No additional payment will be made for placing acceptable backfill material.

* 120.17.2.16 – Removing and Replacing Sidewalks, Paved Driveways & Curb (Handicap) Ramps

Payment for removing and replacing sidewalks, paved driveways and curb (handicap) ramps will be based on the area removed and replaced at the price and units contained in the Proposal. In addition, payment will be made only when such removal and replacement has been authorized by the Engineer or noted on the drawings. The work to be paid under this item does not include removing and replacing pavement.

If the project is located in a Government entity's jurisdiction that requires special stipulations causing the Contractor to incur additional costs, the Contractor may submit the invoices to the District's Engineer for approval for additional payment.

* 120.17.2.17 – Removing and Replacing Pavement

Payment for removing and replacing pavement will be based on the area removed and replaced at the price and units contained in the Proposal. In addition, payment will be made only when such removal and replacement has been authorized by the Engineer or noted on the drawings. The work to be paid under this item does not include removing and replacing sidewalks, paved driveways or curb (handicap) ramps.

If the project is located in a Government entity's jurisdiction that requires special stipulations causing the Contractor to incur additional costs, the Contractor may submit the invoices to the District's Engineer for approval for additional payment.

** 120.17.2.18 – Furnishing and Placing Crushed Rock or Gravel for Roadway Surfacing

Payment for furnishing and placing either crushed rock or gravel to resurface unpaved roadways will be based on the amount, in tons, placed of crushed rock, gravel, or both and the respective price contained in the Proposal.

** 120.17.2.19 – Seeding and Sodding

Payment for seeding or sodding will be based on the area seeded or sodded, or both at the respective prices and units contained in the Proposal. The CONTRACTOR shall not receive payment for seeding or sodding until the 28-day maintenance period has been satisfied and accepted by the District Engineer.

In addition, payment will be made only for those areas specifically authorized by the Engineer or specifically delineated on the drawings. All seeding and sodding required

outside those areas due to damage caused by the CONTRACTOR'S operation shall be at his/her expense.

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120.17.2.20 – Erosion and Sediment Controls

Payment for furnishing, installing, maintaining, and removing silt fencing will be based on lineal footage at the price contained in the proposal. Payment for furnishing, installing, maintaining, and removing curb inlet filters will be per curb inlet at the price contained in the proposal. Payment for furnishing, installing, maintaining, and removing area inlet protection will be per area inlet at the price contained in the proposal. Payment for furnishing, installing, and maintaining erosion control blankets/matting will be based on square yardage at the price contained in the proposal. Payment for CONTRACTOR proposed erosion and sediment controls will not exceed those similar in nature and intent as those defined in Construction Standard 0.2.1. The CONTRACTOR shall not receive payment for erosion control measures until the site has been stabilized (as defined in this specification) and applicable erosion and sediment control measures have been removed.