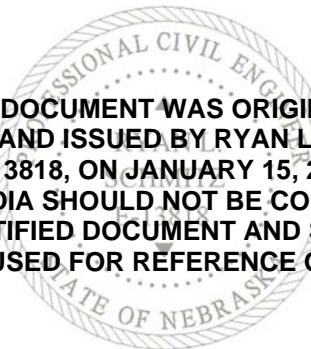


# City of Grand Island, NE

## DIVISION VI

### WATER MAINS

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**DIVISION VI  
WATER MAINS**

**C O N T E N T S**

**REFERENCES AND DEFINITIONS**

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
AWS	American Welding Society
AWWA	American Water Works Association
DIPRA	Ductile Iron Pipe Research Association
EPA	Environmental Protection Agency
NDEQ	Nebraska Department of Environmental Quality
DW-NOI	Dewatering Notice of Intent
NPDES	National Pollution Discharge Elimination System
mg/L	Milligrams per Liter
psi	Pounds per Square Inch
UNS	Unified Numbering System
UHMW	Ultra High Molecular Weight

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## DIVISION VI WATER MAINS

This division is written so that ordinarily the type of construction described is complete, but, where applicable, other divisions are considered a part of this specification.

### SECTION 30 - SCOPE OF WORK

The work covered by this division of the specifications consists of furnishing all labor, plant, equipment, appliances, and materials, and performing all operations necessary to construct and complete water mains and appurtenances in strict accordance with these specifications, the applicable drawings, and subject to the terms and conditions of the contract.

### SECTION 31 - MATERIALS

**31.00 Materials.** Materials shall comply with the requirements of the United States of America Safe Drinking Water Act, other federal regulations for potable water systems, and these specifications as applicable. All materials shall be new and unused, and shall conform to the following specifications.

**31.01 Ductile Iron Pipe.** All pipe shall be ductile iron and shall conform to the AWWA Standard, *DUCTILE-IRON PIPE, CENTRIFUGALLY CAST*, ANSI/AWWA C151/A21.51 and subsequent revisions; and the *THICKNESS DESIGN OF DUCTILE-IRON PIPE*, ANSI/AWWA C150/A21.50 and subsequent revisions or as otherwise shown on the plans.

All pipe three (3) inch diameter to twenty-four (24) inch diameter shall have a nominal length of not less than eighteen (18) feet and be designed for a working pressure of 350 psi with a standard pipe thickness in accordance with Pressure Class 350.

All pipe thirty (30) inch diameter and greater shall have a nominal length of not less than eighteen (18) feet and be designed for a working pressure of 250 psi with a standard pipe thickness in accordance with Pressure Class 250. Mechanical joint pipe, pipe sockets flanges, packing glands, gaskets, and bolts shall conform to the AWWA Standard, *DUCTILE-IRON PRESSURE PIPE AND FITTINGS*, ANSI/AWWA C111/A21.11 and subsequent revisions, and supplied with ductile iron glands as per ASTM A536.

Boltless gasketed joint pipe with the exception of jointing facilities shall conform to the AWWA Standard, *RUBBER-GASKET JOINTS FOR DUCTILE-IRON PRESSURE PIPE AND FITTINGS*, ANSI/AWWA C111/A21.11 and subsequent revisions. Pipe bells shall be grooved or otherwise recessed for gasket sealing and anchorage with reasonably close clearance between pipe bell and adjacent spigot surfaces. The design of the joint shall be such that a deflection of up to three degrees is allowable. All necessary gaskets and gasket lubricants shall be the type recommended and supplied by the pipe manufacturer.

Boltless gasketed joints shall be sealed with a continuous ring gasket manufactured for the use and service and shall seal the joint tight under all operating conditions, including water hammer and pipe movements due to expansion, contraction, and normal settlement. The physical properties and design of the gasket shall be such that they will remain in proper position in the pipe joints under maximum internal pressure and joint deflection conditions. The composition and physical properties of the gaskets shall be submitted to and approved by the Engineer prior to delivery and installation.

**31.02 Fittings.** All pipe fittings three (3) inch diameter to twenty-four (24) inch diameter shall be Pressure Class 350 and all pipe fittings thirty (30) inch diameter and greater shall be Pressure Class 250. All fittings shall be ductile iron, mechanical joint, and shall conform to the AWWA Standard, *DUCTILE-IRON AND GRAY-IRON FITTINGS*, ANSI/AWWA C110/A21.10 and subsequent revisions.

Compact ductile-iron, mechanical joint fittings, three (3) inch diameter through twenty-four (24) inch diameter shall conform to the AWWA Standard, *DUCTILE-IRON COMPACT FITTINGS*, ANSI/AWWA C153/A21.53 and subsequent revisions, and designed for a working pressure of 350 psi.

All joint sockets, socket flanges, packing glands, gaskets, and bolts shall conform to the AWWA Standard, *RUBBER-GASKET JOINTS FOR DUCTILE-IRON PRESSURE PIPE AND FITTINGS*, ANSI/AWWA C111/A21.11 and subsequent revisions. Mechanical and push-on joints shall have the same pressure rating as the pipe or fitting of which they are a part. All fittings shall be supplied with ductile iron glands as per ASTM A536 and all required connecting bolts, nuts, glands, gaskets, and accessories.

Unless otherwise specified all bolt holes shall straddle the vertical centerline of all mechanical joint flanges, fittings, valves, and hydrants. (The vertical centerline of a fitting is determined when the fitting is in the position to change the direction of the fluid flowing in a horizontal plane.)

**31.03 Coatings and Linings.** The interior surfaces of all pipe and fittings shall be cement mortar lined in accordance with ASTM C150 and shall conform to the AWWA Standard, *CEMENT-MORTAR LINING FOR DUCTILE-IRON PIPE AND FITTINGS FOR WATER*, ANSI/AWWA C104/A21.4 and subsequent revisions. All cement mortar lining shall be coated with asphaltic seal coat in conformity with the referenced standard specifications.

The exterior of all pipe fittings and interior surface of bells not cement mortar lined, shall be coated with a bituminous pipe coating of a type acceptable to the Engineer. The coating shall dry to a smooth, glossy surface, shall not be brittle when cold or sticky when exposed to the sun, and shall adhere to the pipe at all temperatures. Coating shall be free from blisters and holidays. Coatings and linings shall conform to all subsequent revisions of the cited specifications.

**31.04 Gate Valves.** All valves up to and including twelve (12") inch diameter shall be ductile-iron or cast-iron body, resilient wedge gate valves, and shall conform to the AWWA Standard, *RESILIENT-SEATED GATE VALVES FOR WATER SUPPLY SERVICE*, ANSI/AWWA C509 and subsequent revisions. Valves shall have mechanical joint ends, 2" square operating nut for key operation and "O" ring type stem seals. All valves shall open counterclockwise and be of the non-rising stem type. The valve sealing mechanism shall be a wedge design of ductile-iron or cast-iron, completely encapsulated with a molded resilient covering permanently bonded to the iron wedge to meet ASTM D429 testing. The sealing mechanism shall be designed to provide zero leakage at a minimum of 200 psi operating pressure, with flow in either direction. All valves shall have a full unobstructed waterway, coated with a corrosion resistant material free of cavities or projections conforming to the AWWA Standard, *PROTECTIVE EPOXY INTERIOR COATINGS FOR VALVES AND HYDRANTS*, ANSI/AWWA C550 and subsequent revisions. All valves shall be furnished with all required connecting bolts, nuts, glands, gaskets, and accessories.

Unless otherwise specified, all bolt holes shall straddle the vertical centerline of all mechanical joint flanges, fittings, valves, and hydrants. (The vertical centerline of a fitting is determined when the fitting is in the position to change the direction of the fluid flowing in a horizontal plane.)

Valves shall be manufactured by American®, Clow Valve Co.®, Kennedy Valve®, or Mueller Co.®.

**31.05 Butterfly Valves.** All valves, fourteen (14) inch diameter and larger, shall be rubber seated butterfly valves and shall conform to the AWWA Standard, *RUBBER-SEATED BUTTERFLY VALVES 3" In THROUGH 72 In*, ANSI/AWWA C504 and subsequent revisions, with heavy duty cast iron or ductile-iron bodies. The valves shall be designed for a working pressure of 150 psi. Each valve shall have mechanical joint ends, a suitable heavy reliable operator with more than adequate strength for the torque involved, and a 2" square operating nut for key operation. The operators and shafts shall be fully grease-packed and sealed for life and shall be suitable for direct burial. Valves shall be furnished with standard AWWA nuts and stainless steel shafts or high tensile carbon steel. All valves shall be furnished with all required connecting bolts, nuts, glands, gaskets, and accessories and open counterclockwise.

Valves shall be Henry Pratt® Groundhog butterfly valves or Mueller® Lineseal III butterfly valves.

**31.06 Tapping Sleeves and Tapping Valves.** All tapping sleeves shall be either ductile-iron body, mechanical joint, or 304 stainless steel body, full circumferential seal with carbon steel flange or ductile iron flange. All tapping sleeves shall be furnished with all required connecting bolts, nuts, glands, gaskets, and accessories.

Ductile iron body tapping sleeves shall be: American® Series 2800-C tapping sleeve; Kennedy Valve® tapping sleeve, or Mueller Co.® H-615 tapping sleeve.

Stainless steel body tapping sleeves shall be manufactured in compliance with AWWA Standard C223; and shall be: Ford Meter Box Co.® "Fast" with carbon steel flange; Romac Industries, Inc® "SST" with ductile flange; Mueller Co.® "H-304" with carbon steel or ductile flange; or Smith Blair ® 662 with carbon steel flange.

All tapping valves shall conform to the AWWA Standard, *RESILIENT-SEATED GATE VALVES FOR WATER SUPPLY SERVICE*, ANSI/AWWA C509 and subsequent revisions. Valves shall have a 2" square operating nut for key operation and "O" ring type stem seals. All valves shall open counterclockwise and be of the non-rising stem type. The valve sealing mechanism shall be a wedge design of ductile-iron or cast-iron, completely encapsulated with a molded resilient covering permanently boned to the iron wedge to meet ASTM D429 testing. The sealing mechanism shall be designed to provide zero leakage at a minimum of 200 psi operating pressure, with flow in either direction. All valves shall have a full unobstructed waterway, coated with a corrosion resistant material free of cavities or projections conforming to the AWWA Standard, *PROTECTIVE INTERIOR COATINGS FOR VALVES AND HYDRANTS*, ANSI/AWWA C550 and subsequent revisions.

Unless otherwise specified, all bolt holes shall straddle the vertical centerline of all mechanical joint flanges, fittings, valves, and hydrants. (The vertical centerline of a fitting is determined when the fitting is in the position to change the direction of the fluid flowing in a horizontal plane.)

Tapping valves shall be: American® Series 2500 tapping valve; Kennedy Valve® tapping valve, or Mueller Co.® T- 2362 tapping valve.

**31.07 Water Main Valve Boxes.** All buried valves installed in lines larger than 2" dia., shall be provided with cast iron, "Buffalo" type, valve boxes. Valve boxes shall have a two-piece screw-type extension sleeve and be intended for the size of valve on which it is to be used and for the depth of cover as required. The box's lid shall have the word "WATER" cast thereon. Valve boxes shall be size 664-S: "Tyler Union – series 6850, SIP Industries – series 6013; or Star Pipe Products – series VB-0001.

Valve box extensions shall be cast iron, screw-type: Tyler Union – series 6850 boxes; SIP Industries – series 6118; or Star Pipe Products – series VBES24S.



**31.08 Not Used**

**31.09 Sleeve Couplings.** Sleeve couplings shall conform to the AWWA Standard, *BOLTED, SLEEVE-TYPE COUPLINGS FOR PLAIN-END PIPE*, ANSI/AWWA C219 and subsequent revisions, and have an inside diameter suitable for connecting ductile iron pipe to ductile iron pipe or cast iron pipe to cast iron pipe. The center sleeve shall be ductile iron ASTM A-536, grade 65-45-12. Ends shall have a smooth inside taper for uniform gasket seating. End rings shall be ductile iron ASTM A-536, grade 65-45-12. Couplings shall be furnished complete with gaskets, bolts, and nuts conforming to the AWWA Standard, *RUBBER-GASKET JOINTS FOR DUCTILE-IRON PRESSURE PIPE AND FITTINGS*, ANSI/AWWA C111/A21.11 and subsequent revisions, and without pipe stops. All materials shall be designed for 250 psi working pressure with the resulting seal flexible and bottle-tight.

Sleeve couplings shall be: Romac Industries, Inc® 501, Smith Blair ® 442, Hymax® 2 Wide-Range, or Romac Alpha, The center sleeve shall have a minimum Length as determined by the table below:

	<b>Pipe Diameter</b>	<b>Minimum Sleeve Length Required</b>
<b>Romac 501</b>	3" to 12"	7"
<b>Romac 501</b>	> 12"	14"
<b>Smith Blair 442</b>	4" to 8"	7"
<b>Smith Blair 442</b>	> 8"	14"
<b>Hymax 2</b>	4" to 12"	7"
<b>Romac Alpha</b>	4" to 12"	7"

**31.10 Fire Hydrants.** Fire hydrants shall conform to the AWWA Standard, *DRY-BARREL FIRE HYDRANTS*, ANSI/AWWA C502 and subsequent revisions. Hydrants shall be manufactured with "O" ring packing, 5-1/4" valve opening, 6" stand pipe, 6" mechanical joint inlet, two 2-1/2" hose connections (nozzle) with 3-1/16" OD and 7-1/2 threads per inch NST and one 4-1/2" pumper connection (nozzle) with 5-3/4" OD and 4 threads per inch NST. Hydrants shall have a 1-1/2" pentagonal operating and nozzle cap nuts which open left or counterclockwise.

Fire hydrants shall be furnished with all the required connecting bolts, nuts, glands, and gaskets. Unless otherwise specified, all bolt holes shall straddle the vertical centerline of all mechanical joint flanges, fittings, valves, and hydrants. (The vertical centerline of a fitting is determined when the fitting is in the position to change the direction of the fluid flowing in a horizontal plane).

Fire hydrants shall be painted as per City requirements with an industrial enamel exterior grade paint. Public fire hydrants shall be painted to have yellow barrels with red caps and bonnet; private fire hydrants shall be painted solid red. Colors shall be Guardsman Yellow #760-4004-00 and Red #760-7008-00, or Sherwin Williams Yellow #F77Y9 and Red #77R7, or Glidden Yellow #4540 and Red #4520.

Hydrants shall be: American-Darling B-62-B-5 hydrant with five and a half foot bury; or Kennedy Guardian K-81D hydrant with five foot bury; or Mueller Centurion A-423 3-way hydrant with five foot bury.

**31.11 Structural Concrete.** All concrete shall be type 47-B (modified) air-entrained as specified in City of Grand Island Specifications, Division II, "PORTLAND CEMENT CONCRETE

PAVEMENT” or 47B-HE-3500 (high early) as specified in the latest revision of the Nebraska Department of Transportation Standard Specifications for Highway Construction Finish can be either broomed or burlapped.

When average daily temperatures are below 40°F (4.5°C) for more than three consecutive days, the Contractor shall use approved practices and procedures that will assure that placed concrete will be sufficiently strong and durable to fully meet design requirements. The use of insulating coverings, accelerating admixtures, high-early strength cement, or additional cement may be used to develop the level of strength required. All such methods shall fully conform to the American Concrete Institute’s Guide to Cold Weather Concreting (ACI 306R-16). There shall be no additional payment if such cold weather techniques are required.

**31.12 “No-Lead Brass” Fittings and Valves.** This specification shall apply to any waterworks brass goods, such as corporation stops, curb stops, coupling, connectors, nipples, etc. All such goods shall comply with the United States Of America Safe Drinking Water Act, and the U.S. Environmental Protection Agency.

The brass part of any fitting or valve in contact with potable water shall be made of a “No-Lead Brass”, and shall conform to UNS Copper Alloy No. C89520 or C89833 in accordance with the chemical and mechanical requirements of ASTM B584 and AWWA Standard, UNDERGROUND SERVICE LINE VALVES AND FITTINGS, ANSI/AWWA C800 with a maximum lead content of 0.25% by weight.

All brass fittings and valves shall have the manufacturers name or trademark permanently stamped or cast on it. Additional marking such as “NL”, “EBII”, “FD” or other commonly accepted identifier, indicating the alloy as “No-lead” shall also be cast or stamped into the fitting or valve.

**31.13 Corporation Stop.** All corporation stops 1”, 1-1/2”, or 2” in size, shall be Ford Meter Box Co.® FB1000-NL ball valve; A.Y. McDonald Co.® 74701B-22 ball valve; or Mueller Co.® 300-N ball valve.

**31.14 Curb Stop.** All curb stops 1”, 1-1/2”, or 2” in size, shall be Ford Meter Box Co.® B44-NL ball valve; A.Y. McDonald Co.® 76100-22 ball valve; or Mueller Co.® 300-N ball valve.

**31.15 Water Service Valve Box.** Curb stops in service lines 2” dia. or smaller, shall be provided with cast iron, two-piece screw-type, size 94-E valve boxes. The box’s lid shall have the word “WATER” cast thereon and supplied with a standard pentagon head brass screw.

An enlarged base shall be used with a complete service box for all 1-1/2” and 2” curb stops.

Service boxes shall be: Tyler Union – 6500 series; SIP Industries – series 6359; or Star Pipe Products – series SB-0001.

**31.16 Copper Pipe.** All water service lines 1”, 1-1/2”, or 2” in size, shall be flexible Type “K” soft copper pipe.

**31.17 Service Saddle.** All service saddles shall conform to the AWWA Standard, UNDERGROUND SERVICE LINE VALVES AND FITTINGS, ANSI/AWWA C800 and subsequent revisions, and as additionally specified herein.

The saddle body shall be, high strength ductile-iron per ASTM A536, hot dipped zinc galvanized or enamel coated, with outlet tapped for CC taper threads, and a steel double strap design for use on cast iron or ductile-iron pipe. A service saddle shall be required for 1-1/2” and larger service taps on all mains regardless of thickness class.

All service saddles shall be Ford Meter Box Co.® F202; Mueller Co.® DR2A; Romac Industries, Inc.® 202NS; or A.Y. McDonald Co.® 4825A.

### **31.18 Not Used**

**31.19 Solid Sleeve.** Compact ductile-iron sleeves, three (3) inch through forty-eight (48) inches shall conform to the AWWA Standard, *DUCTILE-IRON COMPACT FITTINGS*, ANSI/AWWA C153/A21.53 and subsequent revisions.

All sleeves three (3) inches to twenty-four (24) inches shall be designed for a working pressure of 350. All pipe thirty (30) inches and greater shall be designed for a working pressure of 250. The center sleeve shall have a minimum of a twelve inch (12") wide body and be furnished complete with gaskets, bolts, and nuts.

**31.20 Restrained Couplings and Glands.** With prior approval from the Utilities Department, mechanical joint restraint couplings and glands may be used on fittings, valves, and pipe in lieu of concrete thrust blocks; however, thrust blocks will be required where indicated on plans.

**31.20.1 Retainer Glands.** All retainer glands shall be ductile iron conforming to ASTM A536 and designed for a working pressure rating of 350 psi. Glands shall have a wedge style design and torque limiting bolts to fully restrain the fitting and pipe together.

Retainer glands shall be "EBAA Iron, Inc. – Megalug series 1100", "Romac Industries, Inc. – RomaGrip", "Star Pipe Products – series 3000"; "Tyler Union – TufGrip series 1000" or "SIP Industries – EZ Grip".

**31.20.2 Anchor Couplings.** Anchoring couplings shall be a ductile iron fitting, which provides a restrained connection without the use of braces or blocking and designed to prevent the joint from separating under pressure when all bolts are in place. It shall have a pressure rating of 350 psi; be equipped with freely moving, 360° rotatable couplings conforming to ASTM A536; and manufactured to fit standard mechanical joint connections.

**31.20.3 Ultra-Compact MJ Restraint.** The connector shall be an ultra-compact, bolt-through mechanical joint restraint, for 4", 6", and 8" valves and fittings, manufactured of ductile iron, cement-lined inside, asphalt-coated for corrosion protection, and conform to AWWA Standards, ANSI/AWWA C153/A21.53 and ANSI/AWWA C104/A21.4 and have a working pressure rating of 350 psi.

The bolt-through, positive restraint device shall connect valves and fittings at a linear distance not to exceed one (1) inch and without attachment to the pipe; (the device shall not be used directly on fire hydrant shoes).

Connector shall be furnished complete with all gaskets and bolts, and be "Infact Corporation, Foster Adaptor" or approved equal.

**31.20.4 Hydrant Offset Adapter.** Offset adapters shall be manufactured of ductile iron, cement-lined inside and asphalt-coated for corrosion protection, and conform to AWWA Standards: ANSI/AWWA C153/A21.53 and ANSI/AWWA C104/A21.4 and have a pressure rating of 350 psi. The adapter shall provide a restrained joint and alignment adjustment in a single fitting, allowing fire hydrants to be set to grade without extension kits. Adapters shall come complete with all gaskets, bolts, and rotatable split-retainer glands.

Hydrant offset adapters shall be: Assured Flow Sales, Inc. – Gradelok or Star Pipe Products – Compact MJxSwivel w/Swivel Gland.

## SECTION 32 – CONSTRUCTION METHODS

**32.00 Project Supervision.** The general contractor shall be required at all times during construction activities to have a designated Project Supervisor at the work site.

The *Project Supervisor* shall be experienced in all aspects of the project and will be responsible for on-site, day-to-day management of the project.

The Project Supervisor shall have:

- Practical written and verbal communication skills of the English language.
- Ability to read, understand, and accurately interpret the contract documents, plans, specifications, and survey stakes prepared for the project.
- Skilled knowledge of construction techniques.
- Ability to supervise the entire construction crew, including sub-contractors.
- The experience and ability to identify existing and predictable hazards in the surroundings or working conditions, and the authority to take prompt corrective measure to resolve problems and / or eliminate them.
- A set of contract documents, plans and specifications at the work site.

If the Contractor's *Project Supervisor* is not at the work site, the Contractor's office shall notify the City and all construction activities shall cease until such time as a qualified replacement arrives on site. No claims for financial adjustment due to inadequate project supervision shall be permitted by the City.

**32.01 Excavation.** The Contractor shall perform all excavation of whatever substances encountered to the depth shown on the drawings or to provide a minimum cover of five (5) feet over the top of the pipe. The Engineer shall have the right to limit the amount of trench that may be opened in advance of the line of work.

All excavated materials not required for backfill shall be removed from the project by the Contractor. Banks of trenches shall be kept as nearly vertical as practicable and, where required, shall be properly sheeted and braced. Trenches shall be of sufficient width to provide working space for proper installation.

The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length, except for portions of the pipe sections where it is necessary to excavate for bell holes.

Whenever wet or unstable soil that is incapable of properly supporting the pipe, as determined by the Engineer, is encountered in the trench bottom, such soil shall be removed to the depth and length determined by the Engineer and the trench backfilled to grade with sand, gravel, or other suitable material.

All grading in the vicinity of trench excavation shall be controlled to prevent surface water from flowing into the trench. Any water accumulating in the trench shall be removed by pumping or other approved method. Material excavated from the trenches shall be stacked in an orderly manner a sufficient distance back from edge of trenches to avoid overloading and preventing slides or cave-ins. Materials unsuitable for backfilling shall be wasted by the Contractor as directed by the Engineer. Any unauthorized excavation below grade shall be backfilled at the Contractor's expense with good, well-tamped material.

A minimum of one foot of topsoil (unless otherwise noted on the plans) shall be removed in any and all areas covered by vegetation. This topsoil shall be stockpiled separately from the material removed from the remainder of the trench. After the pipe is installed and the trench backfilled to an elevation one foot (unless otherwise noted on the plans) below grade, the topsoil shall be replaced and compacted as previously described.

Excavation will not be classified. Whatever material is encountered shall be excavated to the proper grades and, if in any locations such material is not sufficient to provide a uniform even bed for the pipe, the trench shall be excavated at least three (3) inches deeper than the grade at the bottom of the pipe and the space thus excavated shall be refilled with earth or sand and thoroughly compacted.

**32.02 Protection of Existing Utilities.** The accuracy of location of existing underground utilities as shown on the plans is not guaranteed. It shall be the duty of the Contractor to locate these utilities in advance of excavation and to protect same from damage after uncovering. No house service lines are shown on the plans. The Contractor shall contact the owners of the utilities for assistance in locating these service lines. Any expense incurred by reason of damaged or broken lines shall be the responsibility of the Contractor.

**32.02.1 Excavating Under Existing Water Line.** When crossing under an existing water line, in order to install sanitary sewer or other utilities, a pipe support detail must be provided as part of the plan set prior to construction. This crossing detail must be sealed by an engineer licensed in the State of Nebraska.

**32.03 Tunneling.** Tunneling, when necessary, shall be done under the supervision of the Engineer. Refer to Section 35 – UNDERCROSSING.

**32.04 Pipe Cutting.** Cutting of the pipe shall be kept to a minimum and shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise authorized by the Engineer, cutting shall be done by means of an approved type of mechanical cutter. Wheel cutters shall be used when practicable.

**32.05 Installation.** Pipe and accessories shall be handled in such manner as to insure delivery to the work in a sound, undamaged condition.

While suspended in a sling and before lowering into the trench, all pipe shall be inspected for defects. Defective, damaged, or unsound pipe will be rejected. Deflections from a straight line or grade, as required by vertical or horizontal curves, shall not exceed manufacturer's recommendations and approval by Engineer.

Mechanical joints shall be installed under the provisions of the recommendations of the joint manufacturer. Fittings at bends or deadends shall be firmly blocked against the vertical face of the trench to prevent fittings from being blown off the lines when under pressure. Blocking shall conform to the plan for concrete blocking for fittings. Where pipe ends are left for future connections, they shall be valved, plugged, or capped as shown on the plans. Where connections are made between new work and existing mains, the connections shall be made by using fittings as required.

**32.06 Manholes.** Manholes shall be constructed as indicated on Standard Plan Drawings, No. 136-A, 136-B, or as otherwise shown on the plans. Floors of the manholes shall be earth. Manholes over three (3) feet in depth shall be equipped with cast iron steps placed on approximately sixteen (16) inch centers.

**32.07 Service Interruptions.** When it becomes necessary for the purpose of making connections or for any other reason to shut off or turn on water in any existing mains, it is the sole responsibility of the Contractor to notify the City Water Department through the resident Engineer a minimum of 24 hours in advance as to when and for how long

service will be interrupted and also to notify all water users well in advance so they might prepare themselves for the period during which service might be interrupted. Valves shall not be opened or closed by anyone other than City Water Department personnel.

**32.07.1 Connection to City Mains.** Newly installed piping shall not be connected to existing City mains until acceptance of all pressure and bacteria tests, unless otherwise noted on the plans. Test plugs, corporations, connecting sleeves, dewatering, and temporary piping to a water source, shall be furnished and installed by the Contractor.

City reserves the right to inspect the installation of all private water lines 2" or larger. Contractor must notify Utility Engineering Manager at least 48 hours in advance of installing and pipe, fittings, or appurtenances.

**32.07.2 Line Stoppers.** When necessary to isolate sections of water lines for maintenance, repairs, lowering, or for other reasons when service interruptions in an existing main are not allowed, line-stoppers shall be used to eliminate system shut-down.

Line-stoppers shall be defined as a complete modular system of equipment specifically designed for plugging water lines in order to temporarily stop the flow of water as may be required for repair, replacement, and / or relocation of water main components. The flow control device shall be inserted at normal water main pressure.

Line-stoppers, inserted into mains twenty inch (20") dia. or smaller, shall be furnished and installed by the Grand Island Water Department. The actual material expense and labor costs associated with the use of such line-stoppers shall be charged to the Contractor.

In water lines larger than twenty inch (20") dia., the Contractor shall make arrangements for line-stoppers to be furnished and installed by a firm specializing in their use, with extensive experience in their equipment's operation. Prior to installation, all devices shall be thoroughly checked, cleaned, and sanitized by the Contractor. The City's Water Department shall inspect all equipment and issue final approval before installation of line-stoppers.

The Contractor shall be responsible for all excavations and properly maintaining trench banks, sheeting, and bracing as required. Trenches shall be of sufficient width to provide proper working space. After the work is completed, the Contractor shall backfill the trench with suitable compacted materials as specified.

**32.08 Valve Boxes.** Valves and valve boxes shall be installed in the lines as shown on the drawings and as directed by the Engineer. They shall be set plumb and centered with valve boxes placed directly over the valves. Earth fill shall be carefully tamped around all valve boxes. Valve boxes shall have the interiors cleaned of all foreign matter before installation.

**32.09 Pressure and Leakage Test.** The Contractor shall furnish all labor, pumps, pipe connections, line plugs, adapters, caps, and all other necessary apparatus, except gauges, for performing hydrostatic pressure and leakage tests in accordance with AWWA Standard, *INSTALLATION OF DUCTILE-IRON WATER MAINS AND THEIR APPURTENANCES*, ANSI/AWWA C600, except as otherwise specified. The City will furnish calibrated gauges for the tests and a source of water.

After distribution pipe has been laid, all new potable water systems, 2" dia. and larger, and each valved section thereof, shall be subjected to a hydrostatic pressure of at least one and one half (1-1/2) times the working pressure (100 PSI minimum) at the point of testing. All privately owned lines, 2" dia. and larger, shall be subjected to a hydrostatic pressure of at least 200 psi.

Each valved section of pipe shall be slowly filled with water, and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. When hydrants are in the test section, the pressure test shall be made against closed hydrant valves.

Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, corporation cocks shall be installed at such points so the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed, and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged by the Contractor.

When the specified pressure has been reached, the valve between the pump and the pipeline shall be closed, and the pump shall be disconnected and removed. The test pressure shall remain for a minimum of two (2) hours. If the pressure varies more than two pounds per square inch plus or minus (2 PSI+/-) during the duration of the test, it shall be extended for twenty-four (24) hours to satisfy those concerned that the decrease in the pressure is not due to thermal-volume changes of the water in the line. At the end of the twenty-four (24) hour period, the pressure shall be brought back up to the specified pressure and observed for two (2) hours.

During the pressure test, any exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully. Any damaged or defective pipe, fittings, valves, hydrants, or joints that are discovered shall be repaired or replaced with sound material, and the test shall be repeated until it is satisfactory to the Owner.

**32.10 Sterilization, Flushing and Sampling of Lines.** All new potable water systems, 2" dia. and larger, and each valved section thereof, shall be disinfected before they are placed in service. All water mains taken out of service for inspecting, repairing, or other activity that might lead to contamination of water shall be disinfected before they are returned to service. The Contractor shall furnish all labor, pumps, pipe connections, additional line plugs, adapters, caps, and all other necessary apparatus and materials. All work shall conform to the AWWA Standard, *DISINFECTING WATER MAINS*, ANSI/AWWA C651 and subsequent revisions, except as otherwise specified.

Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination. All materials delivered for construction shall be stored so as to minimize entrance of foreign material. All openings in the pipeline shall be closed with water tight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods.

Immediately prior to installing any pipe or fittings, the Contractor shall swab the interior of the pipe or fittings with a minimum 2% hypochlorite disinfecting solution. After acceptance of the pressure and leakage test, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than one (1) foot per second. Precautions shall be taken to assure that air pockets are eliminated. When all air has been eliminated, the main shall be flushed to remove particulates. The flushing velocity in the main shall not be less than three (3) feet per second for distribution mains and domestic services and ten (10) feet per second for fire service lines, unless the City determines that conditions do not permit the required flow to be discharged to waste. The main isolation valve shall not be operated for flushing or re-chlorination until a downstream hydrant is opened. During such operations, the main isolation valve shall only be operated by Utility Department personnel.

After the initial flushing operation, the main shall be disinfected by chlorination. Chlorination will commence at a point not more than ten feet (10') downstream from the beginning of the new main. Water from an approved supply source, shall be made to flow at a constant and measured rate into the newly laid water main, and shall receive a dose of chlorine, fed at a

constant rate such that the water will have not less than twenty five (25) mg/L free chlorine. The chlorine shall be applied to the water main by injecting a hypochlorite solution by means of a chemical-feed pump designed for feeding chlorine solutions.

Feed lines shall be of such material and strength as to safely withstand the corrosion caused by the concentrated chlorine solutions and the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main. During the application of chlorine, valves shall be positioned so the strong chlorine solution in the main being treated will not flow into water mains in active service. Chlorine application shall not cease until the entire main is filled with heavily chlorinated water.

The chlorinated water shall be retained in the main for at least twenty-four (24) hours and a maximum ninety-six (96) hours, during which time all valves and hydrants in the treated section shall be operated to ensure disinfection of the appurtenances. At the end of this retention period, the treated water in all portions of the main shall have a residual of not less than ten (10) mg/L free chlorine. After the applicable retention period, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than five-tenths (0.5) mg/L or as prevailing in the system.

The Contractor shall provide a means of disposing of the water and sterilizer so as to prevent damage to the environment during flushing operations. If there is any question that the chlorinated discharge will cause damage to the environment, then the Contractor shall supply a reducing agent to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water. Where necessary, Federal, State and local regulatory agencies shall be contacted to determine special provisions for the disposal of heavily chlorinated water.

After final flushing and before new water main is connected to the main system, two consecutive sets of acceptable samples, taken at least twenty-four (24) hours apart, shall be collected from the new main. At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set from the end of the line, and one set from each branch.

Samples shall show the absence of coliform bacteria, per Nebraska DHHS requirements, to pass. Following successful sampling and testing of the line, the Contractor shall remove all testing apparatus and plug the main at the point of injection of the disinfectant and flushing discharge.

Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate as required by "Standard Methods for the Examination of Water and Wastewater." No hose or fire hydrant shall be used in collection of samples. Sample tubing shall be a maximum of one inch (1") dia. and devices shall be clean and disinfected with isopropyl rubbing alcohol or a 2% chlorine solution, and flushed prior to sampling. Sterilization by flame is not permitted. The Utility Department shall collect the final certification samples of record to check for complete disinfection. If the initial disinfection fails to produce satisfactory bacteriological samples, the main shall be re-chlorinated in accordance with this section until satisfactory results are obtained.

The Contractor shall have the opportunity to perform the actual chlorination using the Contractor's own personnel and equipment. The Contractor shall notify the Utility Engineering Division in writing at least 48 hours in advance of any work to disinfect the main. If the Contractor's personnel or equipment do not demonstrate the capabilities or methodology to properly disinfect the newly installed main they shall immediately suspend all such work upon written notification from the Utility Department. The disinfection will then be performed by the City and the expense charged to the Contractor.

**32.10.1 Contractor's Expense.** Flushing, disinfection, testing and sampling will be repeated at the Contractor's expense until tests conducted by the Grand Island Utilities Department indicate the pipeline is certified for acceptance into the City's water system.

The rate charged by the City for each chlorination application will be \$0.25 per linear feet of pipeline.



The rate charged by the City for each set of certification samples will be five hundred dollars (\$500.00).

The City will furnish personnel, pumps, and chemicals for the actual chlorination. All temporary discharge hoses, dewatering, piping, excavations, sample taps and corporations, other personnel or equipment, necessary for doing the work will remain the contractor's responsibility.

**32.11 Tapping of Water Mains.** The Contractor shall furnish the necessary excavation, shoring, tapping valve, tapping sleeve, dewatering, and/or specials, and do all work necessary to make the connection to the water main without interruption of service on the tapped line. The actual tapping of the main will be performed by City personnel and the expense charged to the Contractor unless otherwise noted on the plans.

**32.12 Separation from Sanitary Sewer / Storm Sewer Lines (Sewers) / Other Utility Lines.**

There shall be a minimum of eighteen (18) inches vertical clearance between water lines crossing either above or below sewers. Distances shall be measured from outside of water line to outside of sewer lines. Variance requests to this rule must be in compliance with Nebraska DHHS guidance document entitled "Design and Installation Guide for Water Main and Sanitary/Storm Sewer Separations"

For situations where water lines are parallel to sewer lines, water lines shall be installed at least ten (10) feet horizontally from any existing or proposed sewer line. Distances shall be measured from outside of water line to outside of sewer facilities. Variance requests to this rule must be in compliance with Nebraska DHHS guidance document entitled "Design and Installation Guide for Water Main and Sanitary/Storm Sewer Separations"

For situations where water lines are parallel to other utility lines, water lines shall be installed at least three (3) feet horizontally from any existing or proposed utility line. Distances shall be measured from the outside of the water line to outside of other utility line.

**32.12.1 Separation from Storm Water Drain-Ways.** Water lines crossing open storm water drain-ways or other surface water crossings shall be adequately supported and anchored; and accessible for repair or replacement. Pipe shall be of special construction, having flexible, restrained, watertight joints.

The water main shall be installed with sufficient earth cover to protect the line from damage due to: freezing; flow characteristics within the channel; depth of scour from flooding; and future channel widening and deepening.

When crossing waterways in excess of fifteen (15) feet in width, valves shall be provided at both ends of the crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and located so as to not be subject to flooding.

**32.12.2 Separation from Inlets and Manholes**

In addition to the requirements detailed in Nebraska DHHS guidance document entitled "Design and Installation Guide for Water Main and Sanitary/Storm Sewer Separations", any inlet or manhole requiring variance from the minimum requirements notes in Section 32.12, must be:

- 1) All construction Joints, between the inlet base and sidewall, must have a Tremco Superstop Waterstop, or an approved equal, installed per manufacturer recommendations
- 2) Inlet interior must be coated with a Krystol T1 & T2 Waterproofing System, or an approved equal, installed per manufacturer recommendations.

**32.13 Backfilling.** Trenches shall not be backfilled until all required tests are performed and until the water system installed conforms to the requirements of the plans and specifications.

Materials for tamped backfill and the method of placement shall be as specified per ANSI/AWWA C600 Type 2 pipe bedding. The trenches shall then be carefully backfilled up to one foot above the top of the pipe with sand or fine earth, in layers of not more than six (6) inches thick and carefully tamped to form a solid bedding for the pipe.

The balance of the excavated material shall be consolidated in the following manner. Tamped backfill will be required for the full depth of the trench above the pipe bedding in layers not to exceed twelve (12) inches in depth. As backfilling proceeds, the entire mass shall be vibrated with a mechanical vibrator, provided, however, in all locations where plastic soils are encountered, the backfill material shall not be placed until the moisture content is low enough to obtain maximum density when tamped into place with mechanical tampers.

**32.13.1 Compaction Testing.** When standard backfill methods are used, density tests will be required for each twelve (12) inch vertical lift of compacted material placed at a frequency of not greater than three hundred (300) lineal feet of trench. Density testing shall be required on each trench crossing a public right-of-way or easement. Test locations, to verify trench backfill integrity and methodology, may be specified by the City as required. The Contractor shall maintain the trench backfill for one (1) year from the date of acceptance of the project by the City.

The Contractor shall be required to hire an independent soil testing laboratory to test separately each lift for density and certify that each and every lift was compacted to 95% of maximum density within the public right-of-way and to 90% of maximum density within public easements. Density test results shall be submitted to the City before acceptance of the project by the City.

**32.14 Backfilling Under Pavement.** All soil backfill under existing sidewalks, curb, gutter, paved street, must be compacted to 95% of maximum density.

**32.15 Nonshrinkable Backfill.** All excavations where a sidewalk, curb, gutter, or paved street has been cut or where new paving (concrete or asphalt) will be placed, may be backfilled, using non-shrinkable backfill, at the discretion of the City. The backfill shall be filled to the subgrade of the undisturbed sidewalk, curb, gutter, paving, or earth surface. There should also be a 1' buffer of soil, compacted to 95% of maximum density, between the pipe and non shrinkable backfill.

The non-shrinkable backfill shall be a mixture of sand, gravel, Portland cement, flyash and water (Per the State of Nebraska Department of Roads Standard Specifications for Highway Construction, Section 1003.02) which flows easily around the utility being covered and develops a 28-day compressive strength of from 85 to 175 psi. No non-shrinkable backfill mix designs shall be used without the approval of the Public Works Director.

The mix design shall meet the following requirements:

Portland Cement	50 lb/cy
47-B Sand - Gravel	2,700 lb/cy
Water	420 lb/cy
Air	10%
Fly Ash	200 lb/cy

**32.16 Acceptance.** Upon completion of a job, all debris and surplus material shall be removed from the job by the Contractor. The Engineer shall be notified so that an inspection of the work can be made.

**32.17 Water Services.** Water services shall be installed as indicated on the construction plans. The City Water Department will tap the water main and install the corporation stop. The Contractor shall furnish the corporation stop, dewater the trench, and pay the City Water Department for making the tap unless otherwise noted on the plans. Service lines shall be buried a minimum of five (5) feet in depth from future finished grade. No splices, joints, or unions in copper water service lines will be allowed between the water main and the curb stop if the total service length is less than 100 L.F. The service shall extend perpendicularly (90°) from the main's horizontal alignment to the curb stop or service valve location.

All water facilities shall be filled, pressure tested, disinfected, flushed, and acceptable water sample test results obtained, prior to being placed in service.

Following installation of water service lines, the Contractor shall furnish and install a seven (7) foot long, steel studded "T" post, adjacent to each stop box to identify its location. Posts shall be new, painted dark blue in color, and set three (3) feet into the ground. All marking posts shall be incidental to the service line and not a claim for extra material or work.

All work shall be per AWWA standard, *UNDERGROUND SERVICE LINE VALVES AND FITTINGS*, ANSI/AWWA C800 and subsequent revisions, City specifications, and Standard Plan 152.

**32.17.1 Service Ownership.** Water is conveyed from mains owned by the City of Grand Island to the consumer's premises by service lines and their appurtenances. The service line, pipes, valves, fittings and appurtenances, including the meter, through which a consumer receives water shall be owned by, installed, and maintained at the expense of the consumer.

The dividing point between the City Of Grand Island owned mains and consumer owned service line shall be defined as the connection on the discharge side of the City Of Grand Island owned main. At the dividing point, water irrevocably leaves the public system and enters privately owned facilities to serve the consumer premises.

The maintenance and protection of privately owned piping, service pipes, fittings, meters, fixtures, and water using appliances, is the exclusive responsibility and expense of the consumer; including but not limited to, protection of water using device by reason of temporary or permanent pressure changes; the stoppage of the flow of water; limited or sustained water pressure; or from dirt or debris that may enter the service connection.

**32.18 Water Meter Installations.** Meters shall be installed in a clean pipeline, free from foreign materials. The meter shall be installed horizontally with the register facing upward; with the direction of flow as indicated by the arrow cast in the meter case; and protected from freezing, damage, and tampering.

Meters shall be equipped with a strainer, and shall be installed with a minimum of five (5) pipe diameters of straight run of pipe or equivalent full open components, upstream of the meter-strainer inlet flange; two and one-half (2.5) pipe diameters of straight run of pipe or equivalent full open components, downstream of the meter outlet flange. Full open components may consist of: straight pipe, full open gate valves and ball valves, tees, and concentric reducers.

No elbows, bends, non-concentric reducers, check valves, butterfly valves, back flow preventers and/or pressure reducing devices shall be installed within five (5) pipe diameters upstream or four (4) pipe diameters downstream of the meter set.

Full port ball valves or gate valves may be installed immediately upstream of the meter set, provided they are fully opened and not used to throttle flow rates through the meter.

All meters shall be equipped and installed with a remote meter reading system, to enable obtaining register reading without directly accessing the meter's location. The system shall be suitable for indoor and/or outdoor use and shall be factory sealed to prevent tampering.

**32.18.1 Meter Ownership.** A water meter is a device used to measure and record a consumer's water utilization. All water meters shall be purchased from the City of Grand Island; and owned by, installed, and maintained at the expense of the consumer.

**32.18.2 Meter Pits and Vaults Prohibited.** The water meter shall be located so that it may be easily examined and read by any such person designated by the Utilities Director to perform such functions.

Water meters shall not be located in any pit, manhole, or vault, nor an area containing fumes that are toxic, poisonous or corrosive; nor in any area in which the meter could be damaged by freezing, vibration, physical impact or structural stress; nor knowingly be allowed to conduct excessively high velocity waters.

**32.19 Fire Hydrant.** All fire hydrants shall be set so that the manufacturer's "bury line" mark on the barrel of the hydrant is at the final grade for the project. The traffic flange and bolts shall not be below grade. The Contractor shall furnish and install all fittings, offsets, and blocking required to adjust the hydrant's elevation. Hydrant extensions shall be supplied by the Contractor and installed by the City Water Department at the Contractor's expense. The method of adjustment shall have prior approval of the Utilities Department.

Service lines shall not be allowed to extend from the hydrant lead. The hydrant lead shall be defined as all piping downstream from the water main fitting supplying the hydrant.

**32.20 Relocation of Mains and Service Lines.** When proper management, operation or maintenance of the Water System requires; or when new construction or reconstruction projects require existing water mains, lines or services to be moved, lowered, or relocated, the City Of Grand Island shall have the right to make such changes as required. All water lines that are relocated or reconstructed shall be inspected by the Grand Island Utilities Department.

**32.20.1 Pressure and Leakage Testing of Relocated Mains and Service Lines.** After each section of the water piping system has been relocated, and prior to being placed back in normal operation, it shall be subjected to a hydrostatic pressure test. All distribution mains will be tested at 100 PSI (minimum) and all service lines will be tested at 200 PSI (minimum at the point of relocation. This will include testing the entire section of piping isolated and taken out of service to allow the relocation work.

**32.20.2 Sterilization, Flushing and Sampling of Relocated Mains & Service Lines.** All sections of the water system taken out of service for relocation, or any other activities that might lead to contamination of water, shall be disinfected before being returned to service. The Contractor shall provide a temporary connection for disinfecting the newly relocated lines. Additionally, the Contractor shall provide a temporary means for flushing the isolated sections. The discharge connection shall be sized for flushing velocities not less than three (3) feet per second, and shall include: valves, connecting piping, and hoses as required to discharge to waste.

After final flushing and before new water main is connected to the main system, two consecutive sets of acceptable samples, taken at least twenty-four (24) hours apart, shall be collected from the new main. At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set from the end of the line, and one set from each branch. Samples shall show the absence of coliform bacteria, per Nebraska DHHS requirements, to pass.

Following successful sampling and testing of the line, the Contractor shall remove all testing apparatus and plug the main at the point of injection of the disinfectant and flushing discharge.

The City will furnish personnel, pumps, chemicals, and perform the actual chlorination of the water lines taken out of service during the repair / relocation work. The City's rate for each chlorination application will be \$0.25 per linear feet of pipeline. The rate charged by the City for each set of certification samples will be five hundred dollars (\$500.00). All temporary discharge hoses, dewatering, piping, excavations, sample taps and corporations, other personnel or equipment, necessary for doing the work will remain the Contractor's responsibility.

**32.20.3 Water Services on Relocated Mains.** All materials necessary to relocate water service lines shall be new and un-used. Copper service pipe, laid between the water main and the curb stop, shall be built of continuous construction without joints, unions, or splices.

When required to relocate service lines under undisturbed hard surfaced roadways or driveways, trenchless methods shall be used. Any standard method of trenchless pipe installation that provides the best overall system, while providing the least disruption to the area, shall be considered for approval by the City. All service pipes shall have no less than five feet of earth cover, and in all cases shall be so protected as to prevent rupture by freezing.

The new service shall normally extend perpendicularly (90°) from the main's horizontal alignment; and connected to the existing water service at the new curb stop or valve location. All work shall be done under the direction of a licensed plumber, including the abandonment of the existing service. The Contractor shall salvage the existing curb stop (or valve) and box for the City.

**32.20.4 Abandonment of Service Pipes on Relocated Mains.** Water services shall be abandoned by a licensed plumber. For lead service lines, cut and crimp the line. For copper service lines, cut and sweat a cap onto the pipe. All work shall be done as close as possible to, but not to exceed one foot from the tap. The City Utilities Department shall be notified whenever a service pipe is abandoned and shall inspect and approve all work done in connection with such abandonment.

## **SECTION 33 – METHOD OF MEASUREMENT AND BASIS OF PAYMENT**

**33.01 Water Main.** Water mains shall be measured for payment by measuring the length down the centerline of construction of all pipelines installed, with no deduction for fittings or valves. Payment shall be made at the contract unit price per lineal foot for various sizes, including fittings, excavation, and backfill complete in place.

It is intended that all water main pipe fittings, service lines, and appurtenances shall have five (5) feet of earth cover, or as otherwise indicated on the plans and specifications. The elevation of the piping may vary depending upon existing obstructions and proposed improvements encountered during the construction. Any deviations in alignment or grade shall have the prior approval of the Utilities Department. Where additional depth is required to clear encountered or proposed grade interference, the additional excavation and backfill shall be incidental to the project and not a claim for extra work.

**33.02 Valves and Boxes.** Valves and valve boxes shall be paid for at the contract unit price complete in place.

**33.03 Hydrants.** Fire hydrant assemblies should be itemized and bid out as individual components. .

**33.04 Manholes.** Manholes shall be paid for at the contract unit price bid per manhole, for a depth of five (5) feet, which pyment shall include footings, ring and cover. Additional payment

shall be made for manholes more than five (5) feet in depth, measuring from top of footings to top of cover, at the contract price for each vertical foot or fraction thereof in excess of five (5) feet.

**33.05 Fittings.** Fittings such as tees, bends, and reducers shall be paid for at the contract unit price complete in place.

**33.06 Concrete Blocking.** Payment will be made as one unit for each thrust block built at the contract unit price.

**33.07 Corporation Stop.** Corporation stops shall be paid for at the contract unit price complete in place.

**33.08 Curb Stop.** Curb stops shall be paid for at the contract unit price complete in place.

**33.09 Water Services.** Water services shall be measured for payment by measuring the length down the center of the pipeline from the corporation stop to the curb stop. Payment shall be made at the contract unit price per lineal foot for various sizes. All excavation and backfill shall be considered subsidiary.

## **SECTION 34 – POLYETHYLENE ENCASEMENT**

**34.01 Scope of Work.** This section includes the Contractor furnishing materials and installation procedures for polyethylene encasement to be applied to all underground installations of ductile-iron pipe, fittings, valves, and other appurtenances to ductile-iron pipe systems. In general, all materials and installation shall conform to the AWWA Standard, *POLYETHYLENE ENCASEMENT FOR DUCTILE-IRON PIPE SYSTEMS*, ANSI/AWWA C105/A21.5 and subsequent revisions, and as additionally specified herein.

**34.01.1 Soil Testing.** The Contractor shall furnish materials and shall field apply polyethylene encasement to all ductile-iron pipe, fittings, valves, and other appurtenances associated with the piping system unless such corrosion protection measures shall not be required as determined by soil testing previously conducted by the City of Grand Island.

In areas where the Utilities Department has not yet made a determination on soil characteristics, the Contractor shall have the opportunity to have performed soil tests to determine if polyethylene pipe encasement should be used. If this option is selected, the Contractor shall hire an independent testing laboratory to evaluate conditions that may affect their corrosive rate on ductile-iron pipe. Analysis shall only be conducted by personnel who are experienced in environmental factors which may contribute to the corrosion of the proposed piping system. Such test shall be at the Contractor's expense and not a claim for extra work.

All sampling collection, analysis, and evaluation shall fully comply and conform to the AWWA Standard, *POLYETHYLENE ENCASEMENT FOR DUCTILE-IRON PIPE SYSTEMS*, ANSI/AWWA C105/A21.5; APPENDIX A – “Notes on Procedures for Soil Survey Tests and Observations and Their Interpretation to Determine Whether Polyethylene Encasement Should Be Used”, and subsequent revisions.

The Contractor shall deliver to the Utilities Director certified copies of such soil test results at least 48 hours in advance of any work on the installation of the water main. The Utilities Department shall review and make a determination from the data submitted.

**34.02 Materials.** Film shall be high-density, cross-laminated polyethylene or linear low-density polyethylene film manufactured of virgin polyethylene material. Film shall meet all the listed

requirements for polyethylene film specified in the AWWA Standard, *POLYETHYLENE ENCASEMENT FOR DUCTILE-IRON PIPE SYSTEMS*, ANSI/AWWA C105/A21.5.

The polyethylene film shall have a nominal thickness of 0.008 in. (8 mil). Tube size or sheet width for each pipe diameter shall be as listed on Standard Plan No. 155.

**34.03 Installation.** The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material, but is not intended to be a completely airtight or watertight enclosure. All lumps of clay, mud, cinders, etc. on the pipe surface shall be removed prior to installation of the polyethylene encasement. During the installation, care shall be exercised to prevent soil or embedment material from becoming trapped between the pipe and the polyethylene.

The polyethylene film shall be fitted to the contour of the pipe to affect a snug, but not tight, encasement with minimum space between the polyethylene and the pipe.

Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to the polyethylene due to backfilling operations. Overlaps and ends shall be secured with adhesive tape or other material capable of holding the polyethylene encasement in place until backfilling operations are complete.

For installations below the water table, both ends of the polyethylene tube shall be sealed as thoroughly as possible with adhesive tape at the joint overlap. This standard includes three methods of installation of polyethylene encasement on pipe. Methods A and B are for use with polyethylene tubes and Method C is for use with polyethylene sheets.

**34.03.1 Method A.** (Refer to Standard Plan No. 155) Cut polyethylene tube to a length approximately two (2) ft. longer than the pipe section. Slip the tube around the pipe, centering it to provide a one (1) ft. overlap on each adjacent pipe section, and bunching it accordion-fashion lengthwise until it clears the pipe ends.

Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation of the polyethylene tube.

After assembling the pipe joint, make the overlap of the polyethylene tube. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe, and secure it in place. Take up the slack width at the top of the pipe to make a snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points.

Any cuts, tears, punctures, or other damage to the polyethylene shall be repaired. Proceed with installation of the next section of pipe in the same manner.

**34.03.2 Method B.** (Refer to Standard Plan No. 155) Cut polyethylene tube to a length approximately one (1) ft. shorter than that of the pipe section. Slip the tube around the pipe, centering it to provide 6" in. of bare pipe at each end. Take up the slack width at the top of the pipe to make a snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points.

Before making up a joint, slip a 4-ft length of polyethylene tube over the end of the preceding pipe section, bunching it accordion-fashion lengthwise. After completing the joint, pull the 4-ft length of polyethylene over the joint, overlapping the polyethylene previously installed on each adjacent section of pipe by at least one (1) ft., make each end snug and secure.

Any cuts, tears, punctures, or other damage to the polyethylene shall be repaired. Proceed with installation of the next section of pipe in the same manner.

**34.03.3 Method C.** (Refer to Standard Plan No. 155) Cut polyethylene sheet to a length approximately two (2) ft. longer than that of the pipe section. Center the cut length to provide a one (1) ft. overlap on each adjacent pipe section, bunching it until it clears the pipe ends. Wrap

the polyethylene around the pipe so that it circumferentially overlaps the top quadrant of the pipe. Secure the cut edge of polyethylene sheet at intervals of approximately 3 ft.

Lower the wrapped pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation of the polyethylene. After completing the joint, make the overlap and secure the ends.

Any cuts, tears, punctures, or other damage to the polyethylene shall be repaired. Proceed with installation of the next section of pipe in the same manner.

**34.03.4 Appurtenances.** Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in the same manner as the pipe. When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in a tube, wrap with a flat sheet or split length of polyethylene tube by passing the sheet under the appurtenance and bringing it up around the body. Make seams by bringing the edges together, folding over twice, and taping down. Tape polyethylene securely in place at valve stem and other penetrations.

**34.03.5 Repairs.** Repair all cuts, tears, punctures, or damage to polyethylene with adhesive tape or with a short length of polyethylene sheet or a tube cut open, wrapped around the pipe to cover the damaged area, and secured in place.

**34.03.6 Openings in Encasement.** Provide openings for branches, service taps, blowoffs, air valves, and similar appurtenances by making an X-shaped cut in the polyethylene and temporarily folding back the film. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as any other damaged areas in the polyethylene, with tape. Service taps may also be made directly through the polyethylene, with any resulting damaged areas being repaired as described above.

**34.03.7 Junctions between Wrapped and Unwrapped Pipe.** Where polyethylene wrapped pipe joins an adjacent pipe that is not wrapped, extend the polyethylene wrap to cover the adjacent pipe for a distance of at least 3 ft. Secure the end with circumferential turns of tape.

Service lines of dissimilar metals shall be wrapped with polyethylene or a suitable dielectric tape for a minimum clear distance of 3 ft. away from the ductile-iron pipe.

**34.03.8 Backfill for Polyethylene-Wrapped Pipe.** Use the same backfill material as that specified for pipe without polyethylene wrap, exercising care to prevent damage to the polyethylene wrapping when placing backfill. Backfill material shall be free from cinders, refuse, boulders, rocks, stones, or other material that could damage polyethylene. In general, backfilling practice should be in accordance with the AWWA Standard, *INSTALLATION OF DUCTILE-IRON WATER MAINS AND THEIR APPURTENANCES*, ANSI/AWWA C600, subsequent revisions, and City of Grand Island Specification Division VI, Water Mains, Section 32.13, 32.14 and 32.15, and as specified with the contract.

## **SECTION 35 – UNDERCROSSING**

**35.01 Scope of Work.** This section includes the Contractor furnishing all the materials and installing complete the casing and carrier pipes. This work shall include, but is not limited to, dewatering, shoring, excavating, tunneling, jacking casing, placing casing with specified support, sealing, compacting, backfilling, and fine grading.

**35.02 Casing Material.** The steel casing pipe shall have a minimum wall thickness of in accordance with Standard Plan 141-A, coated inside and outside with asphalt coating double full dipped. The casing for the under crossing shall be entirely of one (1) material.



The design of such pipe is based upon the superimposed loads and not upon the loads which may be placed upon the pipe as a result of the jacking operations. Increases in pipe strength to withstand jacking loads shall be the responsibility of the Contractor.

Sections of the steel pipe casing shall be joined with a continuous full penetration butt weld for the full circumference. Joints shall be beveled before welding. No other methods shall be acceptable unless prior approval is obtained from the City. Welds shall be in full compliance with AWS D1.1-80 standards.

**35.03 Procedure for Notifying Railroad/Public Entities.** Unless otherwise noted on the plans, notification of work commencement must be sent to the entities noted below as indicated:

Railroad – 10 days prior to occupying or working within 25 feet of tracks and at completion of work. All aspects of the latest version of AREMA (American Railway Engineering and Maintenance-of-Way Association) must also be adhered to.

NDOT/Hall County – 48 days prior to occupying or working in Right-Of-Way and also at completion of work.

**35.04 Protection of Public.** During the period that any work is being performed within the public right-of-way, or that an open trench or pit exists within the limits of said right-of-way, the Contractor shall furnish and utilize such signs, lights, barricades, and other devices to the extent necessary, in order to properly guide and protect the public; and shall be in accordance with State of Nebraska Department of Roads guidelines.

The Contractor shall accept full responsibility to the public, and to the right-of-way itself, for loss or damage caused by or directly traceable to his operations, actions, or inactions on or near the right-of-way.

**35.05 Installation of Casing Pipe.** The casing shall be so constructed and installed as to prevent leakage of any substance from the casing through its length, except at the ends. Casing shall be so installed as to prevent the formation of a waterway under the railroad or roadway, with an even bearing throughout its length, and shall slope to one (1) end. The casing shall be placed at the location and elevation shown on the drawing. No change in elevation from that shown shall be permitted without written approval from the City. Excavation shall be held to the minimum possible required for installation of liner plate. The casing shall be installed, using structural steel, plates, field bolted, to provide full round casing pipe. In advancing the casing operation, shielding or poling

shall be used, together with such other measures as may become advisable to prevent settlement of the overburden. Casing pipe shall extend the entire distance, between the limits indicated on the plans. Liner plates may extend further than this minimum requirement at no additional cost to the City, if the Contractor so elects.

After installation, the entire length of the casing shall be pressure grouted between the exterior of the tunnel liner and the adjacent soil, using a cement-sand grout of one (1) part cement to six (6) parts sand.

The casing pipe jacked into place shall be accomplished without disturbance of the road surface above. The pipe shall be jacked in the up-slope direction.

After installation of casing, and prior to backfilling any excavations, both ends of the casing shall be closed by a manner approved by the City, so as to prevent any infiltration of dirt, water, or refuse into the casing, prior to the future installation of the carrier pipe.

**35.06 Excavation.** The Contractor shall perform all excavations necessary for installation of the casing. The City shall have the right to limit the amount of trench that may be opened in advance

of the line of work. All excavated materials not required for backfill shall be removed from the project by the Contractor. Banks of trenches shall be kept as nearly vertical as practical and, where required, shall be properly sheeted and braced. Trenches shall be held to the minimum width needed to provide working space for proper installation.

All grading in the vicinity of trench excavation shall be controlled to prevent surface water from flowing into the trench. Any water accumulating in the trench shall be removed by pumping or other approved method. Material excavated from the trenches shall be stacked in an orderly manner, a sufficient distance back from edge of trenches to avoid overloading and preventing slides or cave-ins. Materials unsuitable for backfilling shall be wasted by the Contractor as directed by the City.

**35.07 Backfilling.** After installation of the casing, all excavations and trenches shall then be carefully backfilled as per Division VI, Water Mains Specifications, Sections 32.13, 32.14, 32.15, and other Divisions as appropriate.

**35.08 Carrier Pipe.** Carrier pipe shall be ductile-iron pipe with restrained joints conforming to Section 37.02.1, Division VI of the City of Grand Island Standard Specifications.

**35.08.1 Carrier Pipe – Casing Spacers.** Carrier pipes shall be centered within the casing by using full circle designed spacers. Spacers shall be constructed of 14 gauge, T-304 stainless steel, with a ribbed PVC extrusion insulating liner that overlaps the edges of the band and prevents slippage. Spacers, for carrier pipe diameters of 16 inches or less, shall have a minimum body width of 8 inches, and for carrier pipes, 18 inches and above, the spacer band width shall be increased to 12 inches.

Spacers risers and runners shall be properly designed to position and support the carrier pipe within the casing. Risers shall be a minimum of 10 gauge, T-304 stainless steel, MIG welded to the stainless steel body. Runners shall be ultra-high molecular weight polymer (UHMW) with a high resistance to abrasion and frictional slid wear. The runners shall be mechanically attached to the riser and the bolt heads shall be welded for strength.

Casing spacers, for pipe diameters up to 16 inches, shall have two runners on the top and two runners on the bottom. For pipe diameters 18 inches through 36 inches, spacers shall be supplied with 4 runners on the bottom and two on the top.

**35.08.2 Carrier Pipe – Installation.** Casing spacers shall be installed on the carrier pipe within one foot from each end of the casing pipe. For carrier pipe diameters of 16 inches or less, three spacers per length of pipe shall be installed. For carrier pipes 18 inches and above, four spacers per length of pipe shall be used.

Pipelines shall normally be installed in the center of straight casings. Risers and runners shall be dimensioned to provide a clearance of  $\frac{3}{4}$  inch to the top of the casing. Refer to Standard Plan 141-A for minimum clearances between pipe bells and casing. Carrier pipes shall be pulled not pushed through the casing.

**35.08.3 Carrier Pipe – Casing End Seals.** After installation of the carrier pipe, the ends of the casing shall be closed against the carrier pipe to provide a backfill barrier to debris and seepage. End seals shall be made of heavy-duty neoprene or other synthetic rubber. Each end of the seal shall be secured to the pipe with T-304 stainless steel bands.

## **SECTION 36 – DEWATERING**

**36.01 General.** The Contractor is responsible for devising and operating a construction dewatering system if required to install any part of the water main.

**36.02 Discharge Permit.** When required, facilities shall apply for authorization to discharge under a permit in compliance with the National Pollution Discharge Elimination System (NPDES).

The Owner or Operator shall use the Notice of Intent (DW-NOI) procedures to notify the Nebraska Department of Environmental Quality (NDEQ) that as a Permittee, they intend to meet all conditions of the permit. Complete and accurate information shall be submitted to the NDEQ for permission to discharge ten (10) calendar days prior to dewatering to use the construction-dewatering permit.

Nebraska Department of Environmental Quality  
Wastewater Section  
1200 'N' Street, Suite 400, The Atrium  
PO Box 98922  
Lincoln, NE 68509-8922  
Tel (402) 471-4220  
Fax (402) 471-2909

**36.03 Dewatering Wells.** If dewatering wells are used, the Contractor is required to secure all permits, properly install, and abandon the wells as per Nebraska State Statute.

## **SECTION 37 -- TRENCHLESS INSTALLATION OF WATER MAIN**

**37.01 General.** Trenchless methods for the installation of pipelines requires using specialized tools, equipment and experience. The Contractor shall be well practiced with such techniques, with a minimum of five years' experience in successfully completed projects of similar size, length, and soil conditions. When required, the Contractor shall furnish the Utilities Department with a list of such jobs with the name of the purchaser, location, date, size, type, and operating conditions.

The Contractor shall provide all labor, materials, equipment, tools, dewatering, shoring, excavating, tunneling, boring with specified support, sealing, compacting, backfilling, clean-up, fine grading, and restoration of all required surface access pits, and launching and receiving pits. Additionally, it includes transporting and setting up all equipment used to perform the operations.

All work shall comply with the Ductile Iron Pipe Research Association's guidelines for "Horizontal Directional Drilling With Ductile Iron Pipe," the pipe manufacturer's recommendations, and other specifications referenced within these contract documents.

The Utilities Department reserves the right to modify sections and location of pipe installed by trenchless methods due to such factors as: soil conditions, material limitations, installation methodology, obstacles, or other causes.

**37.01.1 Permits.** The Utilities Department shall obtain ingress and egress permits, right-of-way, and easements required for the work, where required. Other permits required for the performance of the work shall be obtained by the Contractor.

**37.01.2 Site Investigation.** The Contractor shall determine the types and locations of surface and subsurface utilities and materials, soil types, groundwater, and other environmental factors and shall determine their effect on the bore installation.

All site investigations required shall be the responsibility of the Contractor. If utilities of unknown depth or other obstructions will require grade or alignment deviations from the plans, the grade or alignment may be adjusted with the prior approval of the Utilities Department.

## **37.02 MATERIALS**

**37.02.1 Restrained Joint Pipe.** Pipe shall be ductile iron with restrained push-on joints conforming to the AWWA Standard, *DUCTILE-IRON PIPE, CENTRIFUGALLY CAST*, ANSI/AWWA C151/A21.51 and Section 31, Division VI of the City of Grand Island Standard Specifications.

Pipe shall be cement mortar lined conforming to the AWWA Standard, *CEMENT-MORTAR LINING FOR DUCTILE-IRON PIPE AND FITTINGS*, ANSI/AWWA C104/A21.4 and subsequent revisions. All cement mortar lining shall be coated with asphaltic seal coat in conformity with referenced standard specifications.

Pipe shall be designed for a working pressure of 350 psi, with boltless, restrained, flexible joints, that have smoothly contoured bells. Joint designs that restrict smooth installation, increase pulling forces, or degrade the flow of drilling fluid around the joint shall not be used. Pipe and joint seals shall be capable of handling the internal pressures, external pressures, torque, and vacuum that can occur during pull-back along the bore path.

**37.02.2 Pulling Heads.** The pipe pulling head shall have the same characteristics as the pipe to which it is attached. Pulling heads, reamers, and swivel assemblies shall be designed and furnished by the pipe manufacturer, or an approved equal in full compliance with the pipe manufacturer's requirements.

**37.02.3 Polyethylene Encasement.** All pipe shall have polyethylene encasement, as per Grand Island Standard Specifications, Section 34, and as additionally specified herein.

Use only tube-type polyethylene sleeves with a nominal thickness of 0.008 in. (8 mil). Installation shall be per AWWA Standard, ANSI/AWWA C105/A21.5 "Alternate Method 'A' or Wet Trench Conditions" as modified herein. Polyethylene tubing shall be secured to the first length of pipe with several wraps of tape directly to both the pipe barrel and tubing, approximately one foot from the spigot end. Ensure that all excess material is neatly folded longitudinally, and secured around the barrel section by circumferential tape wraps at a maximum of two foot spacing. The polyethylene tubing should always overlap back over the bell and joint section to ensure that drilling fluid is not forced under the polyethylene during pull-back. Secure the polyethylene at the joint area with circumferential tape wraps on each side of the joint. Continue installation opposite to the direction of pull-back.

## **37.03 PIPE INSTALLATION**

**37.03.1 Drilling System.** The Contractor shall have the equipment and expertise appropriate for horizontal direction drilling operations and pipeline installation.

The equipment shall consist, as a minimum of a system capable of performing the bore and pulling back the pipe, with a boring mixture delivery and fluid recovery system of sufficient appropriate capacity, and a guidable drill head capable of carrying out the drilling and piping installation. The equipment shall be designed to withstand the pulling, pushing and rotating pressure involved to complete the work, and equipped to monitor and record the pull-back pressure during the pull-back operation. The drill head shall be steerable and shall be provided with necessary cutting surfaces and drilling fluid jets as required.

**37.03.2 Guidance System.** The bore shall utilize a proven guidance probe and interface to accurately determine the location of the drill head during the drilling operation. It shall be capable of tracking at the required installation depth in any soils encountered and enable the operator to adjust the drill head both horizontally and vertically.

**37.03.3 Drilling Fluid System.** A self-contained system of sufficient size to mix and deliver the boring fluid shall be provided. Tank capacities shall be sized to hold excess material completely by containing “mud” quantities without spillage. The entry point shall be appropriately enclosed and equipped with a sump pump to reclaim or discharge excess drilling fluids to a reuse or disposal tank. The system shall be able to ensure thorough mixing of all components of the slurry to avoid clumping. The boring fluid shall be continually agitated by the mixing system. No discharge of excess material or site runoff will be allowed.

**37.03.3.1 Drilling Fluid.** The drilling fluid shall be comprised of clean potable water, bentonite clay, and appropriate additives. The Contractor shall be responsible for obtaining, transporting, and/or storage of any water required for drilling fluids. Additives shall be environmentally safe, non-toxic, and approved for such usage. The boring fluid shall be of a consistency to suspend the cuttings and maintain the integrity of the bore walls.

**37.03.4 Excavations.** The Contractor shall be responsible for all excavations and properly maintaining trench banks, sheeting, and bracing as required. Excavations shall be of sufficient width to provide proper working space for drilling operations and down hole assemblies. Material excavated from the trenches shall be stacked in an orderly manner a sufficient distance back from edge of excavations to avoid overloading and preventing slides or cave-ins.

Excavations shall be located for proper installation of the pipeline. The insertion / assembly pits may also subsequently be used for connections, installing valves, fittings, or hydrant assemblies at locations indicated on the plans.

**37.03.5 Pilot Hole.** Install the pilot hole using a steerable drilling head. The pilot hole shall be drilled along the planned bore path and alignment, to the tolerances listed and concurrent with safe operations. Proper setbacks shall be maintained to avoid excessively steep entry and exit of the pilot hole. In all cases, the transition from the surface to the bore path shall be within the pipe manufacturer’s allowable joint deflection.

The Contractor has the option to pre-ream the pilot hole. However, lack of pre-reaming shall not place excessive loading on the installation of the pipeline. Any damage to the pipeline resulting from inadequate pre-reaming shall be the responsibility of the Contractor.

**37.03.6 Alignment.** The bore path shall be to the elevations and alignment indicated on the drawings and as staked for the contractor. The installation shall be guided by equipment that gives continuous, accurate monitoring and done without disturbing the area surfacing, ditch lines, or waterways.

The Contractor shall continuously monitor the bore alignment at all times when the bore operation is proceeding. When the alignment goes beneath a body of water, a visual inspection shall be made at the most accessible point immediately downstream of the bore alignment for changes in turbidity or color, which may indicate a subsurface breach in the boring operation.

Pipe entry and exit points may be moved further from the original plan only with prior approval of the Utilities Department. Any bore exit to the surface, other than for the final location, shall be plugged and stabilized before proceeding, and the exit site shall be restored to its original condition.

Deviations from the alignment indicated on the plans may be allowed providing:

- No deviation shall be greater than 5% of depth per 100' of installed length;
- All piping shall be installed with a minimum of five (5) feet of earth cover;
- The pipeline shall not interfere with proposed infrastructure locations, or the safe operation and maintenance of existing utilities or structures;
- The pipeline shall not encroach beyond the right-of-way, easement, or construction limits.

In cases where the pipe is outside of the specified limits, or otherwise deviates more than the approved maximum, the Contractor shall re-install the pipe to the accepted alignment and elevation at their own expense.

**37.03.7 Installation – Cartridge Method.** The Cartridge Assembly Method shall be the preferred option for assembling pipe sections due to right-of-way limitations.

The individual pipe sections shall be joined in the insertion pit. Each section shall then be progressively pulled into the bore path a distance equivalent to a single pipe section. The process is repeated until the entire length is pulled through the bore path to the exit point.

**37.03.8 Pull-Back.** After successfully reaming of the bore hole, the Contractor shall attach a swivel connector between the final reamer and the pulling head and pull the pipe through the bore hole. Once pull-back operations have commenced, the operations shall continue without interruption until the pipe is completely pulled back through the bore hole. Pipe shall only be pulled from the plain end to minimize pulling forces and to take advantage of the bell transition.

If excessive pull-back is encountered, or the pipe becomes immovable, the Contractor shall stop the pull-back operations to allow any potential hydro-lock to subside, then pulling operations will again commence. If the pipe remains stuck, the Contractor shall notify the City to discuss options or alternatives, and then work shall proceed in accordance with those decisions.

**37.03.9 Pulling Force.** Restrained push-on joint pipe must be capable of withstanding the pulling forces used to install the pipe through the bore hole. The pulling force shall be limited to the joints maximum dead-end thrust load at the rated working pressure, and in full compliance with the pipe manufacturer's recommendations.

**37.03.10 Backfill and Clean-Up.** Disposal and clean-up of excess drilling fluid and pits shall be the responsibility of the Contractor. Disposal shall not be allowed on the project site. All work shall be done in accordance with environmental regulations, right-of-way limits, and permit requirements.

The Contractor shall backfill all excavations with suitable compacted materials as required. Earth spoiled by drilling mud or where other deleterious backfill substances are encountered, the material shall be rejected, hauled away, and disposed of by the Contractor and the site refilled with clean material. The area shall be restored to a condition equal to or better than its original condition.

Materials to be removed from the job site shall be disposed of properly. If materials are to be disposed of on private property, prior written permission shall be obtained from the owner of the property, and submitted to the City's designated representative.

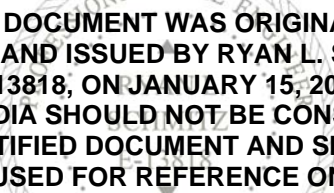
All materials, trash, and debris shall be removed by the Contractor from the construction limits in a timely manner.

## **37.04 RECORDS AND MEASUREMENTS**

**37.04.1 Records.** The Contractor shall keep a daily log of all drilling activities and records indicating the pull-back loads exerted on the pipe for each section installed. A copy shall be provided to the City Utilities Department upon completion of the boring procedure. When monitoring records indicated the pullback forces exceed the pipe manufacturer's loading recommendations, the pipeline may be rejected.

The field records and notes shall additionally specify: the type of equipment used; the length and depth of the installation; and existing utility locations.

**37.04.2 Measurement for Payment.** The installation of bored pipe will be measured for payment by the linear foot of the various sizes of pipe acceptably installed. Measurement will be for full length of placement as verified in the field.



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