

2017
WATER MAIN SPECIFICATIONS

TABLE OF CONTENTS

	<u>Page</u>
1.00 SCOPE.....	1
1.01 General	1
1.02 Work Included	1
1.03 Location of the Work.....	1
1.04 Coordination of Work.....	1
1.05 Working Hours	1
1.06 Reference Requirements.....	1
2.00 MATERIALS.....	3
2.01 General	3
2.02 Ductile Iron Fittings.....	3
2.03 Ductile Iron Pipe.....	3
2.03a Plastic Film Wrap.....	4
2.04 Polyvinyl Chloride Pipe (PVC).....	4
2.05 Trace Wire.....	5
2.06 Resilient Wedge Gate Valves (4” to 18” in diameter).....	9
2.07 Butterfly Valves	10
2.08 Valve Boxes.....	10
2.09 Valve Box Adapters.....	10
2.10 Hydrants	10
2.11 Corporation Stops D.I.P.....	13
2.12 Curb Stop and Box.....	13
2.13 Copper Tubing	13
2.14 Service Saddles	14
2.15 Retainer Glands.....	14
2.16 Mechanical Joint Restraints.....	14
2.17 Electrical Conductivity Materials.....	14
2.18 Air Relief Manholes	14
2.19 Air Relief Valves	15
2.20 Concrete	15
2.21 Soil Materials.....	15
2.21a Normal “Fill Material”	15
2.21b Crushed Rock	15
2.22 Insulation.....	16

3.00 INSPECTION AND TESTING OF MATERIALS	17
3.01 Shop Inspections and Testing	17
3.02 Field Inspection and Testing	17
3.03 Disposition of Defective Material	17
3.04 Concrete Test Cylinders.....	17
4.00 CONTRACTOR'S RESPONSIBILITY FOR MATERIALS	18
4.01 Material Furnished by Contractor.....	18
4.02 Material Furnished by the Owner	18
4.03 Replacement of Damaged Material	18
4.04 Responsibility for Safe Storage	18
5.00 MATERIAL HANDLING, ALIGNMENT AND GRADE.....	19
5.01 Material Handling	19
5.02 Pipe Alignment and Grades	19
5.03 Deviation with Engineer's Consent	20
5.04 Deviations Occasioned by Other Utility Structures	20
6.00 DIRECTIONAL BORE OF HIGH DENSITY POLY ETHYLENE	21
6.01 General	21
6.02 Governing Standard	21
6.03 Submittals	22
6.04 Protection of Underground Facilities	22
6.05 Permits and Approvals	23
6.06 Quality Assurance	23
6.07 Materials	23
6.08 Access	28
6.09 Installation.....	28
6.10 Reaming and Pull Back.....	30
6.11 Drilling Fluids	31
6.12 Field Quality Control	31
7.00 EXCAVATION AND TRENCH PREPARATION.....	33
7.01 General	33
7.02 Trench Width and Description	33
7.03 Pipe Bedding.....	34
7.04 Pipe Foundation in Poor Soil.....	34
7.05 Pipe Clearance in Rock.....	34
7.06 Braced and Sheeted Trenches.....	34
7.07 Piling of Excavated Material	35

7.08	Barricades, Guards and Safety Provisions.....	35
7.09	Traffic and Utility Controls	35
7.10	Private Property Protection.....	35
7.11	Tunneling, Jacking, Boring or Excavation Other Than Open Trench.....	35
7.12	Railroad and Highway Crossings	35
7.13	Interruption of Water Service	36
8.00	PIPE LAYING.....	37
8.01	Installation of Water Main and Appurtenances.....	37
8.02	Laying of Pipe and Fittings.....	37
8.03	Jointing of Pipe and Fittings.....	37
8.04	Setting Hydrants.....	38
8.05	Conductivity.....	38
8.06	Sewer Crossings.....	38
8.07	Valves, Boxes, Manholes, Vaults and Fittings	39
8.08	Building Services	39
9.00	BACKFILLING	40
9.01	General	40
9.02	Backfill Procedure at Pipe Zone.....	40
9.03	Backfill Procedure Above the Pipe Zone	40
9.04	Disposal of Excess Materials and Debris	41
9.05	Fill Material.....	41
9.06	Density Tests.....	41
10.00	TESTING AND DISINFECTING MAINS.....	42
10.01	Pressure Testing.....	42
10.02	Disinfecting Mains and Temporary Water Services	43
10.03	Electrical Conductivity Test	43
10.04	Trace Wire Test - PVC Water Main.....	43
11.00	SURFACE RESTORATION, CLEANUP AND GUARANTEE.....	48
11.01	Restoration of Surface	48
11.02	Dust Control During Construction	48
11.03	Mailbox Restoration	48
11.04	Maintenance of Streets Until Surfaced.....	48
11.05	Clean Up	48
11.06	Guarantee	48
11.07	Failure to Replace Defective Parts	49

12.00 TURF ESTABLISHMENT.....	50
12.01 General	50
 13.00 METHOD OF PAYMENT	 51
13.01 Water Main Pipe	51
13.02 Compact Ductile Iron Fittings	51
13.03 Hydrants	53
13.04 Valves and Boxes	53
13.05 Copper Water Service Pipe	53
13.06 Corporation Cocks	54
13.07 Service Saddles	54
13.08 Curb Stops and Boxes.....	54
13.09 Air Relief Manholes	54
13.10 Piling	54
13.11 Special Conditions	54
13.12 Special Sections	54
13.13 Sheeting Ordered Left in Place.....	54
13.14 Jacking	55

SECTION 1.00 - SCOPE

1.01 GENERAL

It is the intent of these detailed specification requirements to provide the requirements for water main construction in the City of Chanhassen, Minnesota.

1.02 WORK INCLUDED

The contractor shall, unless specified otherwise, furnish all material, equipment, tools and labor necessary to do the work required under his/her contract and unload, haul and distribute all pipe, castings, fittings, valves, hydrants, and accessories. The contractor shall also remove any street surfacing as required; excavate the trenches and pits to the required dimensions; construct and maintain all bridges for traffic control; sheet, brace and support the adjoining ground or structures where necessary; handle all drainage or ground water; provide barricades, guards and warning lights; lay and test the pipe, castings, fittings, valves, hydrants, and accessories, backfill and consolidate the trenches and pits; maintain the street or other surface over the trench until surface restoration; restore the roadway surface unless otherwise stipulated; remove surplus excavated material; and clean the site of the work.

The contractor shall also furnish all equipment, tools, labor and materials required to rearrange sewers, conduits, ducts, pipes or other structures encountered in the installation of the work. All the above work to completely construct the water main facilities shall be done in strict accordance with the project's contract documents to which these specifications are a part thereof.

1.03 LOCATION OF THE WORK

The location of this work is as shown on the plans.

1.04 COORDINATION OF WORK

The contractor shall be responsible for the satisfactory coordination of the construction of the water main facilities with other construction and activities in the area affected. Delays in work resulting from lack of such harmony shall not in any way be a cause for extra compensation by any of the parties.

1.05 WORKING HOURS

Refer to Section 7.02 of the General Conditions.

1.06 REFERENCE REQUIREMENTS

In the specification requirements, reference is made to "MnDOT Specifications" which shall mean the "Standard Specifications for Highway Construction" of the Minnesota Department of Transportation 2016 Edition and all subsequent amendments, and City Engineers Association

"Standard Utilities Specifications" for Water Main and Service Line Installation and Sanitary Sewer and Storm Sewer Installation, 2013 Edition, and all subsequent amendments shall apply.

SECTION 2.00 - MATERIALS

2.01 GENERAL

The materials used in this work shall be all new, and conform to the requirements for class, kind, size and materials as specified below. All materials permanently incorporated in the work shall be made in America in accordance with Minnesota State Statute 16B.101 PREFERENCE FOR AMERICAN-MADE MATERIALS. The contractor shall submit in writing a list of materials showing the manufacturer designation of all materials. This list must be approved by the engineer.

All materials will be certified lead free with the NSF-372 and NSF/ANSI 61.

2.02 DUCTILE IRON FITTINGS

Ductile iron fittings shall have mechanical joints and shall be Class 350 for sizes up to and including twelve inches (12") in diameter and shall conform to A.W.W.A. Specification C153, covering compact fittings. Ductile iron fittings shall be paid per ductile iron body weights.

Mechanical joints shall conform to A.W.W.A. Specification C111, latest revision, with gaskets. Gaskets shall be made from vulcanized crude rubber compound. All surfaces shall be smooth, free from imperfections and free from porosity. Conductivity straps shall be furnished and installed in accordance with Section 2.15.

All fittings shall be epoxy coated and furnished with either 316 stainless or NSS Cor-Blue nuts and bolts.

2.03 DUCTILE IRON PIPE (DIP)

Ductile iron pipe shall be designed for a minimum working pressure of 150 pounds per square inch and shall conform to the applicable dimensions and tolerances of A.W.W.A. Specification C151, latest revision, for ductile iron pipe.

Fittings shall be ductile iron and shall meet the requirements as specified in Section 2.02.

All ductile iron pipe shall be cement lined and the maximum deflection of the pipe shall not exceed 2% of the pipe diameter to prevent cracking of the lining.

Weighing scales may be required, as specified in Section 2.02, to verify weight of pipe.

Nominal thickness of wall for ductile iron pipe shall be as follows:

<u>Size</u>	<u>Class Pipe</u>	<u>Thickness Inches</u>
6"	Class 52	0.31
8"	Class 52	0.31
10"	Class 52	0.35

12"	Class 52	0.37
14"	Class 51	0.36
16"	Class 51	0.37
18"	Class 51	0.38
20"	Class 51	0.39
24"	Class 51	0.41
30"	Class 51	0.43
36"	Class 51	0.48
42"	Class 51	0.53

Pipe walls shall be of a thickness to support 2½ full threads for the size of service necessary of Standard Corporation stop threads as specified by A.W.W.A. C800. A service saddle shall be used when the corporation stop exceeds the size listed in the following for each diameter of water main.

<u>Water main Size</u>	<u>Maximum Corp Size Without Saddle</u>
6"	1"
8"	1¼"
10"	1½"
12"	2"
14" and larger	2"

All ductile iron pipe shall be marked "DUCTILE IRON" in large letters. The nominal wall thickness shall be plainly marked on each piece of pipe.

2.03a Plastic Film Wrap. An approved plastic film wrap for protection of ductile iron pipe shall be provided at all locations. The wrap shall be the "tube" type having 8-mil thickness. A two (2) inch wide polyethylene adhesive tape shall be used to secure the tube of film to the pipe. The unit bid price per lineal foot shall include the cost of furnishing and installing the plastic wrap and shall be compensation in full regardless of the size of the pipe to be protected.

2.04 POLYVINYL CHLORIDE PIPE (PVC)

Polyvinyl chloride pressure pipe (PVC) for water main shall conform to A.W.W.A. C900. All pipe shall have a minimum dimension ratio (DR) of 18 corresponding to a working pressure of 150 PSI for PVC type 1120 pipe. Laying lengths shall be 20 feet (+1") for all sizes.

Joints. The bell shall consist of an integral wall section with a factory-installed, solid cross-section elastomeric ring which meets the requirements of ASTM F-477. The bell section shall be designed to be at least as hydrostatically strong as the pipe wall and meet the requirements of A.W.W.A. C900. The pipe shall be manufactured to cast iron or ductile iron outside dimensions in accordance with A.W.W.A. C900.

Fittings. Fittings shall be ductile iron, having a minimum working pressure rating of 150 PSI and shall conform to the requirements of A.W.W.A. C110 (ANSI A21.10) or A.W.W.A. C153 (ANSI 21.53) Ductile Iron Compact Fittings. Valves, tees, crosses, hydrant barrels or any other ductile

iron fitting shall be wrapped with a flat sheet or split length polyethylene tube by passing the sheet under the appurtenance and bringing it up around the body. Make seams by bringing the edges of the polyethylene sheet together, folding over twice and taping down. All buried nuts and bolts shall be Cor-Blue or stainless.

Service Saddles. All service saddles shall be constructed of stainless steel installed as per Section 2.14.

Pipe Bedding Material. Pipe bedding material shall be in accordance with Section 7.02 of the Sanitary Sewer Specifications and shall be installed as per Standard Plate No. 2203 of these specifications. Pipe bedding material shall be considered incidental to the pipe installation.

2.05 TRACE WIRE

Materials

General

All trace wire and trace wire products shall be domestically manufactured in the USA.

All trace wire shall have HDPE insulation intended for direct bury, color coated per APWA standard for the specific utility being marked.

Trace Wire

- **Open Trench** – Trace wire shall be #12 AWG Copper Clad Steel, High Strength with minimum 450 lb. break load, with minimum 30 mil HDPE insulation thickness.
- **Directional Drilling/Boring** – Trace wire shall be #12 AWG Copper Clad Steel, Extra High Strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.
- **Trace Wire – Pipe Bursting/Slip Lining** – Trace wire shall be 7x7 Stranded Copper Clad Steel, Extreme Strength with 4,700 lb. break load, with minimum 50 ml HDPE insulation thickness.

Connectors

- All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At crosses, the four wires shall be joined using a 4-way connector. Use of two, 3-way connectors with a short jumper wire between them is an acceptable alternative.
- **Direct Bury Wire Connectors** – Shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure.
- Non-locking friction fit, twist on or taped connectors are prohibited.

Termination/Access

- All trace wire termination points must utilize an approved trace wire access box (grade level/in-ground access box as applicable), specifically manufactured for this purpose.
- All grade level/in-ground boxes shall be appropriately identified with “sewer” or “water” cast into the cap and be color coded.
- A minimum of two feet of excess/slack wire is required in all trace wire access boxes after meeting final elevation.
- All trace wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection.
- Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.
- **Service Laterals on Public Property** – Trace wire must terminate at an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway.
- **Service Laterals on Private Property** – Trace wire must terminate at an approved above-ground trace wire access box, affixed to the building exterior directly above where the utility enters the building, at an elevation not greater than five vertical feet above finished grade, or terminate at an approved grade level/in-ground trace wire access box, located within two linear feet of the building being served by the utility.
- **Hydrants** – Trace wire must terminate at an approved grade level/in-ground trace wire access box, properly affixed to the hydrant grade flange. (Affixing with tape or plastic ties shall not be acceptable.)
- **Long-Runs, In Excess of 500 Linear Feet Without Hydrants** – Trace wire access must be provided utilizing an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway. The grade level/in-ground trace wire access box shall be delineated using a minimum 48” polyethylene marker post, color coded per APWA standard for the specific utility being marked.

Grounding

- Trace wire must be properly grounded at all dead ends/stubs.
- Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20 feet of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the utility.
- When grounding the trace wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.
- When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire nor the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be

trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.

- Where the anode wire will be connected to a trace wire access box, a minimum of two feet of excess/slack wire is required after meeting final elevation.

Installation

General

- Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, property locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.
- Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.
- Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.
- Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at five foot intervals.
- Trace wire must be properly grounded as specified.
- Trace wire on all service laterals/stubs must terminate at an approved trace wire access box located directly above the utility, at the edge of the road right-of-way, but out of the roadway. (See Trace Wire Termination/Access.)
- At all mainline dead-ends, trace wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the trace wire. (See Grounding.)
- Mainline trace wire shall not be connected to existing conductive pipes. Treat as a mainline dead-end ground using an approved waterproof connection to a grounding anode buried at the same depth as the trace wire.
- In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved splice connectors, and shall be properly grounded at the splice location as specified.

Sanitary Sewer System

- A mainline trace wire must be installed with directionally bored sewer lines with all service lateral trace wires properly connected to the drive-in magnesium grounding anode rod driven in at the “Y”.
- Lay mainline trace wire continuously, by-passing around the outside of manholes/structures on the north and east side.

- Trace wire on all sanitary service laterals must terminate at an approved trace wire access box color coded green and located directly above the service lateral at the edge of road right-of-way.

Water System

- A mainline trace wire must be installed, with all service lateral trace wires properly connected to the drive in at the “Y” and driven in at saddle connection point.
- Lay mainline trace wire continuously, by-passing around the outside of valves and fittings on the north and east side.
- Trace wire on all water service laterals must terminate at an approved trace wire access box color coded blue and located directly above the service lateral at the edge of road right-of-way.
- Grade level/in-ground trace wire access boxes will be installed on all fire hydrants.
- All conductive and non-conductive service lines shall include trace wire.

Storm Sewer System

- All PVC draintile must have trace wire as shown in Standard Detail Plate Nos. 5232 and 5233.

Prohibited Products and Methods

The following products and methods shall not be allowed or acceptable:

- Uninsulated trace wire.
- Trace wire insulations other than HDPE.
- Trace wires not domestically manufactured.
- Non-locking, friction fit, twist-on or taped connectors.
- Brass or copper ground rods.
- Wire connections utilizing taping or spray-on waterproofing.
- Looped wire or continuous wire installations that have multiple wires laid side-by-side or in close proximity to one another.
- Trace wire wrapped around the corresponding utility.
- Brass fittings with trace wire connection lugs.
- Wire terminations within the roadway, i.e. in valve boxes, cleanouts, manholes, etc.
- Connecting trace wire to existing conductive utilities.

Testing

All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the contractor, engineer and facility owner as applicable, prior to acceptance of ownership.

This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.

Continuity testing in lieu of actual line tracing shall be not accepted.

Products

The following products have been deemed acceptable and appropriate. These products are a guide only to help in choosing the correct applications for a trace wire project.

- Copper Clad Steel (CCS) Trace Wire
 - Open Trench – Copperhead #12 High Strength Part #1230-HS
 - Directional Drilling/Boring – Copperhead Extra High Strength Part #1245*EHS
 - Pipe Bursting/Slip Lining – Copperhead SoloShot Extreme Strength 7x7 Stranded Part #PBX-50
- Connectors
 - Copperhead 3-way Locking Connector Part #LSC1230*
 - DryConn 3-way Direct Bury Lug: Copperhead Part #3WB-01
- Termination/Access
 - Fire Hydrant and Non-Roadway access box applications: Trace wire access boxes grade level Copperhead adjustable lite duty Part #LD14*TP
 - Concrete/Driveway access box applications: Trace wire access boxes grade level Copperhead Part #CD14*TP 14”.
- Grounding
 - Drive-in Magnesium Anode: Copperhead Part #ANO-1005 (1.5 lbs.)

Manufacturers Product Options

The information provided by Copperhead Industries gives project options to help in choosing the correct wire, termination/access points, connectors and grounding products. Other manufacturers provide these products as well. This information is only a guide.

2.06 RESILIENT WEDGE GATE VALVES (4" TO 18" IN DIAMETER)

Gate valves shall be Clow, Mueller or approved equal. Gate valves shall be resilient wedge type, manufactured to meet all applicable requirements of A.W.W.A. Standard for Resilient Sealed Gate Valves C509. Valves shall have non-rising stems, opening in a counterclockwise direction. Valves shall be furnished with all exterior solid stainless steel nuts and bolts and a bronze operating nut 2” A.W.W.A. square.

Valves shall have full epoxy coating on the inside with full epoxy coating on the exterior of valve, or approved equal, and a 10-year warranty. Payment shall be at the bid unit price stated on the proposal and shall include all miscellaneous items associated with the work.

2.07 BUTTERFLY VALVES

Butterfly valves shall be Clow or approved equal. Butterfly valves shall be located as shown on the plans positioned as shown on the standard plates and be constructed for buried service. Bodies shall be of cast or ductile iron with mechanical joint to fit ductile iron pipe and be furnished with all solid stainless steel nuts and bolts. Valve bearings shall be of nylon or permanently lubricated bronze. The rubber seat shall be permanently bonded to the body. The shaft shall be 316 stainless steel with a disc Ni-resist Type 1 with polished edge. The operator shall be constructed and sealed for buried or submerged service. This unit shall be equipped with an A.W.W.A. two-inch (2") square bronze operating nut, and open in a counterclockwise direction. The valve and operator assembly and all components shall be equal or exceed all recognized standards and shall be Clow, or approved equal. Minimum requirements for butterfly valves shall conform to A.W.W.A. C504, latest revision. Valves shall be furnished with all exterior stainless steel nuts and bolts.

2.08 VALVE BOXES

Valve boxes shall be cast iron of the three piece type suitable for a depth of 7½ feet of cover over the top of the pipe or to a depth as shown on the plans. For valves buried to a depth greater than 8 feet from the top of operating nut to the top of the finished grade, the valve box shall be equipped with a riser rod in a length when connected to the operating nut is 6" below the top of the finished grade. Boxes shall be 5¼" diameter, bases may be round or oval and length adjustment shall be screw type. Valve boxes shall be Tyler 6860 G, Mueller H10361 or Bibby-Ste.-Croix or approved equal as shown on City Standard Plate No. 1006.

Drop covers on valve boxes shall bear the word "water" on the top.

2.09 VALVE BOX ADAPTERS

Valve box adapters shall be installed on all gate valves and butterfly valves as manufactured by Adapter, Inc. or approved equal. Payment for said adapters shall be considered incidental to the price of gate valves or butterfly valves.

2.10 HYDRANTS

Fire hydrants purchased or installed shall meet or exceed all applicable requirements and tests of ANSI and the latest revisions of AWWA Standard C502. Fire hydrants shall meet all test requirements and be listed by Underwriters Laboratories Inc. Fire hydrants shall meet all test requirements and have full approval of Factory Mutual. Fire hydrants shall meet the following requirements.

Fire hydrants shall be rated for a working pressure of 250 Psig. (1825 kPa).

Fire hydrants shall be of the compression type, opening against the pressure and closing with the pressure.

Fire hydrants shall have a minimum 5¼" main valve opening and a minimum inside lower/upper barrel diameter (I.D.) of 7" to assure maximum flow performance. Pressure loss at 1,000 GPM shall not exceed the following value.

4½" Pumper Nozzle: 2.50 psi

Fire hydrants shall be three-way in design, having one 4½" pumper nozzle and two 2½" hose nozzle(s). Nozzle thread type shall be national standard fire coupling screw threads. Nozzles shall thread counterclockwise into hydrant barrel utilizing "o" ring seals. A suitable nozzle lock shall be in place to prevent inadvertent nozzle removal.

The operating nut shall be a one-piece design, manufactured of ASTM B-584 bronze. It shall be national standard pentagon in shape and the nut dimensions shall be measuring 1½" from point to flat.

The direction of the opening shall be counter-clockwise and an arrow shall be cast on the bonnet flange to indicate the specified opening direction.

Hydrants shall be a "traffic-model" having upper and lower barrels joined at the ground line by a separate and breakable "swivel" flange providing 360° rotation of upper barrel for proper nozzle facing. This flange shall employ not less than eight bolts. The safety flange segments shall be located under the upper barrel flange to prevent the segments from falling into the lower barrel when the hydrant is struck. The pressure seal between the barrels shall provide not less than 24" of clearance from the centerline of the lowest nozzle to the ground.

The operating stem shall consist of two pieces not less than 1¼" diameter (excluding threaded or machined areas) and shall be connected by a stainless steel safety coupling. The safety coupling shall have an integral internal stop to prevent the coupling from sliding down into the lower barrel when the hydrant is struck. Screws, pins, bolts, or fasteners used in conjunction with the stem couplings shall also be stainless steel. The top of the lower stem shall be recessed 2" below the face of the safety flange to prevent water hammer in the event of a "drive over" where a vehicle tire might accidentally depress the main valve.

The lower barrel shall be an integrally cast unit. The use of threaded on or mechanically attached flanges is deemed unacceptable. The hydrant bury depth shall be a minimum of 7.5' of cover over the hydrant service.

All buried bolts and nuts shall be high-strength, ductile iron T-bolts and hex nuts with composition, dimensions, and threading in accordance with the latest revision of ANSI/AWWA Standard C111/A21.11. The T-bolts and hex nuts shall be stainless steel NSS Cor-Blue or an approved equal.

Composition of the main valve shall be a molded rubber having a durometer hardness of 95 +/- 5 and shall be reversible in design to provide a spare in place. Plastic (polyurethane) main valves are unacceptable. The main valve shall have a cross section not less than 1".

Hydrants shall be equipped with two (2) drain valves that drain the barrel when the hydrant is closed and seal shut when the hydrant is opened. These drain valves shall be an integral part of the one piece bronze upper valve plate. They shall operate without the use of springs, toggles, tubes, levers or other intricate synchronizing mechanisms.

The upper valve place, seat ring and drain ring (she bushing) must be ASTM B-584 bronze and work in conjunction to form an all bronze drain way. A minimum of two (2) internal and two (2) external drain openings are required. Drains ported through an iron shoe must be bronze lined.

The bronze seat ring shall thread into a bronze drain ring (or shoe bushing) providing a bronze-to-bronze connection. Seat rings shall be "o" ring pressure sealed.

The shoe inlet size and connection type shall be MJ having ample blocking pads for sturdy setting and the MJ connection must have two strapping lugs to secure the hydrant to piping. A minimum of six solid stainless steel bolts and nuts are required to fasten the shoe to the lower barrel.

The interior of the shoe including the lower valve plate and stem cap nut shall have a protection coating that meets the requirements of AWWA C-550. If a stem cap nut is utilized, a stainless steel lock washer or similar non-corrosive device that will prevent the cap nut from backing off during normal use must lock it in place.

Hydrants shall be warranted by the manufacturer against defects in materials or workmanship for a period of ten years (10) from the date of manufacture. The manufacturing facility for the hydrant must have current ISO certification.

Hydrants shall be Clow Medallion, Mueller Super Centurion, or approved equal.

All painted surfaces shall be warranted for a period of two years from the time the City accepts the public utility improvements. In the event the hydrant paint is not in satisfactory condition at the end of the warranty period, the entire hydrant shall be prepared (scraping, sanding) and repainted in accordance with these specifications.

Any hydrant that is extended 6" or more shall be supplied with an extra-heavy operating rod from the base to top of hydrant.

All hydrant installations shall include a location marker as shown on Detail Plate No. 1004. **Immediately after installing or relocating a fire hydrant, it must be securely covered by the contractor with a plastic bag to indicate it is "out of service"**. The plastic bag may only be removed for testing purposes by a city representative.

Upon approval of all testing (hydro, bacteria, flush and conductivity) and city acceptance, the Chanhassen Utility Department will open the gate valve, remove the plastic bag and flush the hydrant.

****PLEASE NOTE:** The Utility Department requires a 48-hour advance notice to schedule turning on or off water lines.

2.11 CORPORATION STOPS (D.I.P)

Corporation stops shall be installed using a snug fitting smooth jaw wrench and as per manufacturer's recommendations. Corporation stops shall be quick compression-type fittings and shall be one of the following, or approved equal:

Mueller B-25008; or
Ford FB-1000 Q; or
McDonald 47101 BCAPQ

2.12 CURB STOP AND BOX

Curb stop valves shall be of the compression-type fitting and shall be one of the following and specifically for the use with copper inlet and outlet service pipe (without a set screw):

Mueller H-15155 or Mueller B-25155 or approved equal; or
McDonald 76104Q or approved equal; or
Ford B44-444 (1"), Ford B44-666 (1 1/2"), Ford B44-777 (2") with quick joint option, or approved equal.

All curb stop valves shall be threaded and conform to the Minneapolis Pattern. Curb stop fittings shall be tightened with a snug fitting smooth jaw wrench and as per manufacturer's recommendations.

Curb box shall be Mueller H-10300, McDonald 5614 or equal, which can be extended from 72" to 84" high and shall conform to the Minneapolis Pattern.

Where curb boxes are placed in paved or concrete areas, a curb box cover and frame shall be installed (McDonald 74 Series Standard "A" or approved equal).

2.13 COPPER TUBING

Copper tubing shall comply with the following and shall be manufactured in the United States of America:

Federal Specification	WW-T-799 Type K
ASTM Specification	B-88-62 Type K
AWWA Specification	C-800-55 Type K

One-inch (1") seamless copper service lines shall be of minimum size for all water service, except where specified by City of Chanhassen in high-pressure water areas or where there are other unusual circumstances.

In instances where a 1” CTS coupler must be used, the coupler shall be the quick compression-type McDonald 74104BCAPQ or approved equal. Flare couplers shall not be used.

2.14 SERVICE SADDLES

All service saddles will be made of stainless steel and tightened to manufacturer’s specifications, and verified with a torque wrench.

Service saddles shall be Romac Style 304, Cascade CSC-2, Smith Blair 371-372, or approved equal.

2.15 RETAINER GLANDS

All retainer glands shall be ductile iron with set screws being solid stainless steel similar to American Double-X mechanical joint retainer glands or approved equal and shall be capable of withstanding torque of not less 80-foot pounds.

2.16 MECHANICAL JOINT RESTRAINTS

Mechanical joint restraints shall be manufactured of ductile iron conforming to ASTM A 536-80 with ductile iron restraining devices heat treated to a minimum hardness of 370 GHN.

Thrust Restraint Criteria:

- A) Megalug, or approved equal, joint restraining glands are required at pipe joints.
- B) For restrained joints, the number of feet (m) of tied pipe required shall be in accordance with the table shown on Detail Plate No. 1011.
- C) For special cases not covered by the standard plate design of thrust restraint, the construction shall be in accordance with *Thrust Restraint Design for Ductile Iron Pipe*, Ductile Iron Pipe Research Association (1989). A working pressure of 250 psi (1725 kPa), shall be used for design calculation.

The mechanical joint restraint shall have a working pressure of at least 250 psi and shall be MegaLug manufactured by EBAA IRON, INC. or approved equal. Restraints for C900 PVC shall be Ebba IRON Mega-Lug Series 2000 PV or approved equal. All mechanical joint restraints shall be spray-coated with a bituminous coal tar supplied by the manufacturer.

2.17 ELECTRICAL CONDUCTIVITY MATERIALS

All joints on ductile iron pipe and fittings shall be connected with an electrical conducting copper strap, clips or cable designed and tested to withstand 400 amps.

2.18 AIR RELIEF MANHOLES

Air relief manholes shall be constructed using pre-cast sections conforming to ASTM Specification C478 according to the standard plate.

The standard manhole casting shall be as shown on the Standard Detail Plate Nos. 1008 and 2111.

Lettering on the manhole castings shall be as shown on the standard plate.

All castings shall conform to the requirements and dimensions shown on the drawings. All covers must fit closely in the rings in any and all positions and, when placed in the rings, must fit the ring solidly in all positions so that there will be no rocking from pressure applied on any point of the cover.

2.19 AIR RELIEF VALVES

Air relief valves shall be CrispeX Universal air valves manufactured by Multiplex Manufacturing Company or approved equal.

The valve shall be furnished with a 1" inlet, a 1" shut-off valve (ball valve), and all other accessories needed as per Standard Detail Plate No. 1008.

An operating instructions and maintenance manual shall be included with the valve.

2.20 CONCRETE

Concrete to be used shall be composed of a mixture of fine and coarse aggregate and a Portland Hydraulic Cement conforming to the ASTM Specification designation C-150, Type 1, with the proper water-cement ratio to obtain a compressive strength not less than 3,000 pounds per square inch in 28 days. The fine aggregate for concrete shall be composed of a clean washed sand of hard, sharp, durable particles. Coarse aggregate for concrete shall be composed of a gravel uniformly graded three-fourth inch (3/4") maximum size to #4 sieve. Coarse aggregate shall be composed of hard durable particles free of shale, chert, flat or elongated pieces. Fine and coarse aggregate shall conform to the A.S.T.M. Specification for Concrete Aggregates, Designation C-33. Mixing water shall be suitable for drinking purposes, containing no acids, alkalis, oils or other deleterious materials. Concrete shall be mixed in a mechanically operated mixer so controlled that the drum shall operate a minute and one-half after all materials including water are in the drum. Concrete mixtures shall conform to MnDOT Specification 2461. The slump shall not exceed four inches (4") plus or minus one inch (1").

2.21 SOIL MATERIALS

2.21a Normal "Fill Material"

Is defined under the backfilling Section No. 9.05

2.21b Crushed Rock

The material shall consist of durable crushed quarry rock of which 100% passes a 2" sieve and of which 95% is retained on a #4 sieve size. It shall not contain soil overburden, sod, roots, plants, and other organic matter, or any other materials considered objectionable by the engineer.

2.22 INSULATION

Sheet insulation shall be two-inch thick, four-foot wide Direct Bury Styrofoam. Sheets shall be centered on the pipe and installed above or below the pipe in accordance with typical Detail Plate No. 2204.

Site specific requirements shall be determined by the engineer and shall be preapproved prior to construction.

SECTION 3.00 - INSPECTION AND TESTING OF MATERIALS

3.01 SHOP INSPECTIONS AND TESTING

All materials furnished by the contractor are subject at the discretion of the engineer, to inspection and/or testing by accepted methods at the plant of the manufacturer. This inspection and/or testing is to be made at the cost of the owner. The material supplier shall provide the city with copies of test results on materials that are furnished to the contractor.

3.02 FIELD INSPECTION AND TESTING

All materials furnished by or for the contractor for incorporation into the work under contract shall, at the discretion of the engineer, be subject to inspection and/or testing by methods acceptable to the engineer.

3.03 DISPOSITION OF DEFECTIVE MATERIAL

All material found during the process of inspecting and testing to be defective, or defective material encountered at any time during the progress of the work, will be rejected by the engineer and the contractor shall promptly remove from the site all such material.

3.04 CONCRETE TEST CYLINDERS

On all types of concrete construction, up to four (4) test cylinders may be taken from each section of the structure cast in one operation. The project engineer or authorized representative shall, within four (4) days of their origin, deliver all cylinders to an approved testing laboratory. The actual cost of testing shall be paid by the owner.

SECTION 4.00 - CONTRACTOR'S RESPONSIBILITY FOR MATERIALS

4.01 MATERIAL FURNISHED BY CONTRACTOR

The contractor shall be responsible for all material furnished by him, and she shall replace at his/her own expense all such material that is found to be defective in manufacture or that has become damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of installed material discovered defective prior to the final acceptance of the work, or during the warranty period of the work.

4.02 MATERIAL FURNISHED BY THE OWNER

The contractor's responsibility for material furnished by the owner shall begin at the point of delivery by the manufacturer, or owner, and upon acceptance of the material by the contractor. The contractor shall examine all material furnished by the owner at the time and place of delivery and shall reject all defective material. The point of delivery shall be stated in the "Special Provisions".

4.03 REPLACEMENT OF DAMAGED MATERIAL

Any material furnished by the owner that becomes damaged after acceptance by the contractor shall be replaced by the contractor at his/her own expense.

4.04 RESPONSIBILITY FOR SAFE STORAGE

The contractor shall be responsible for the safe storage of material furnished by or to him, and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage and freezing.

SECTION 5.00 - MATERIAL HANDLING, ALIGNMENT AND GRADE

5.01 MATERIAL HANDLING

Pipe and other accessories shall, unless otherwise directed in the special provisions, be unloaded at the point of delivery, hauled to and distributed at the site of the project by the contractor. They shall at all times be handled with care to avoid damage. In distributing the material at the site, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pipe shall be so handled such that the coating and lining will not be damaged. If, however, any part of the lining or coating is damaged, the repair shall be made by the contractor at his/her expense in a manner satisfactory to the engineer.

5.02 PIPE ALIGNMENT AND GRADES

All pipe shall be laid and maintained to the required lines and grades; with hydrants, valves and fittings at the required locations; and with joints centered and drawn "home"; and with all valve and hydrant stems plumb. The owner will furnish line and grade stakes necessary for the work. It shall be the contractor's responsibility to preserve these stakes from loss or displacement. The engineer may order replaced any stakes she deems necessary for the proper protection of the work. Any replacements shall be at the contractor's expense. All pipes shall be laid to the depth shown on the contract drawings. The contractor shall satisfactorily maintain the specified cover. If additional bends are required where not shown on the drawings to maintain alignment around curves, the contractor shall provide the required number and be compensated at the unit price as proposed on the bid form. The following is the maximum allowable joint deflection for the cast iron pipe.

A.W.W.A. C-600 TABLE 1 & 2 - SUMMARY

(20' Pipe Length - except as noted)
Maximum Allowable Deflections (inches)

<u>Pipe Size</u>	<u>Mechanical Joint</u>	<u>Push-on Joint</u>
4	31"*	21"
6	27"*	21"
8	20"	21"
12	22"	21"
16	15"	12"
18	12"	12"
20	12"	12"
24	10"	12"
30	10"	8"
36	9"	8"
42	8"	8"
48	8"	8"

*18' length

5.03 DEVIATION WITH ENGINEER'S CONSENT

No deviation shall be made from the required line or grade except with the written consent of the engineer.

5.04 DEVIATIONS OCCASIONED BY OTHER UTILITY STRUCTURES

Wherever existing utility structures or branch connections leading to main sewers or to main drains or other conduits, ducts, pipe or structures present obstructions to the grade and alignment of the pipe, they shall be permanently supported, removed, relocated or reconstructed by the contractor through cooperation with the owner of the utility, structure or obstruction involved. In those instances where their relocation or reconstruction is impracticable, a deviation from the grade will be ordered and the change shall be made in the manner directed with extra compensation allowed therefore at unit prices, if applicable.

SECTION 6.00 – DIRECTIONAL BORE OF HIGH DENSITY POLY ETHYLENE

6.01 GENERAL

This section covers the directional bore of High Density Poly Ethylene pipe (HDPE). The HDPE pipe shall be designed, furnished, and installed complete with all fittings, jointing materials, anchors, blocking, encasement, and other necessary appurtenances. All materials and equipment used in the drilling systems shall be of high quality and generally accepted in the industry. The services furnished by the contractor shall be performed in accordance with standard HDD industry practice and these documents and shall include all labor, equipment, and consumables necessary to accomplish the following tasks:

- a. Clearing, grading, and general site/access preparation necessary for construction operations.
- b. Transportation of all equipment, labor, materials, and consumables to and from the jobsite.
- c. Erection of horizontal drilling equipment at the rig site indicated on the drawings.
- d. Drilling of a pilot hole to a diameter suitable for installation of the prefabricated pull section.
- e. Reaming the pilot hole along the path indicated on the drawings.
- f. Prefabrication of the pull section including thermal butt fusion of the individual HDPE pipes in accordance with the applicable specification.
- g. Installation of the prefabricated pull section in the reamed hole.
- h. Fusion of HDPE fittings to the ends of each individual HDPE pipe following installation of the pull section.
- i. Pre-installation and post-installation hydrostatic testing of each individual HDPE pipe in accordance with the applicable specification.
- j. Clean-up and restoration of all work areas.

6.02 GOVERNING STANDARD

Except as modified or supplemented herein, all HDPE pressure pipe shall conform to the applicable requirements of ANSI/AWWA C906.

The supplementary information required in the foreword of the governing standard is as follows:

Affidavit of Compliance (Sec. 6.3)	Required
Plant Inspection (Sec. 5.9)	Not Required
Special Markings (Sec. 6.1.4)	Not Required
Special Preparation for Shipment (Sec. 6.2)	Not Required
Special Quality Assurance Testing (Sec. 5)	Required

6.03 SUBMITTALS

All procedures or material descriptions requiring the engineer's approval shall be submitted not less than 3 weeks prior to commencing any horizontal directional drilling activities. Submittals shall include but are not limited to the following:

- a. Composition of drilling fluid.
- b. Description of the drilling fluid solids control system (plan for minimization and disposal of excess drilling fluids).
- c. Buoyancy control plan (if applicable).
- d. Drilling fluid disposal plan.

6.04 PROTECTION OF UNDERGROUND FACILITIES

The contractor shall undertake the following steps prior to commencing drilling operations.

- a. Contact the utility location/notification service and all other utilities not covered by this service for the construction area.
- b. Positively locate and stake all existing lines, cables, or other underground facilities including exposing any facilities which are horizontally located within 10 feet of the designed drilled path.
- c. Modify drilling practices and downhole assemblies to prevent damage to existing facilities.

The contractor shall be responsible for locating any and all underground facilities regardless of the engineer's previous efforts in this regard. The contractor shall be responsible for all losses and repairs to underground facilities resulting from drilling operations.

6.05 PERMITS AND APPROVALS

The Contractor shall obtain all other necessary permits and approvals. All work performed shall comply with the requirements of the permits obtained.

6.06 QUALITY ASSURANCE

Qualifications - The pipe manufacturer shall provide the services of an experienced, competent, and authorized representative to visit the site of the work to advise and consult with the contractor during joining and installation of the pipe. The manufacturer's representative shall not directly supervise the contractor's personnel, and the contractor shall remain responsible for the pipeline work.

Storage and Handling - Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in sound, undamaged condition. Pipe shall not be stored uncovered in direct sunlight.

6.07 MATERIALS

Pipe/Fittings - Chevron "Plexco" or Phillips "Driscopipe", ANSI/AWWA C906; material designation (ASTM D3350), PE 3408, minimum cell classification 334434C, DIPS (Ductile Iron Pipe Size) OD, DR 11.0.

Joints - Thermal butt fusion joints, ASTM D3261.

Couplings - Electrofusion Couplers.

Connections with DIP - Connections shall be made using fittings suitable for such purposes. Mechanical joining to the ductile iron pipe shall be made using polyethylene flange adapter and metal backup ring. The adjoining ductile iron fitting shall be of an equivalent internal diameter as the polyethylene piping.

Trace Wire

Materials

General

All trace wire and trace wire products shall be domestically manufactured in the USA.

All trace wire shall have HDPE insulation intended for direct bury, color coated per APWA standard for the specific utility being marked.

Trace Wire

- **Open Trench** – Trace wire shall be #12 AWG Copper Clad Steel, High Strength with minimum 450 lb. break load, with minimum 30 mil HDPE insulation thickness.
- **Directional Drilling/Boring** – Trace wire shall be #12 AWG Copper Clad Steel, Extra High Strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.
- **Trace Wire – Pipe Bursting/Slip Lining** – Trace wire shall be 7x7 Stranded Copper Clad Steel, Extreme Strength with 4,700 lb. break load, with minimum 50 ml HDPE insulation thickness.

Connectors

- All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At crosses, the four wires shall be joined using a 4-way connector. Use of two, 3-way connectors with a short jumper wire between them is an acceptable alternative.
- **Direct Bury Wire Connectors** – Shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure.
- Non-locking friction fit, twist on or taped connectors are prohibited.

Termination/Access

- All trace wire termination points must utilize an approved trace wire access box (grade level/in-ground access box as applicable), specifically manufactured for this purpose.
- All grade level/in-ground boxes shall be appropriately identified with “sewer” or “water” cast into the cap and be color coded.
- A minimum of two feet of excess/slack wire is required in all trace wire access boxes after meeting final elevation.
- All trace wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection.
- Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.
- **Service Laterals on Public Property** – Trace wire must terminate at an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway.
- **Service Laterals on Private Property** – Trace wire must terminate at an approved above-ground trace wire access box, affixed to the building exterior directly above where the utility enters the building, at an elevation not greater than five vertical feet above finished grade, or terminate at an approved grade level/in-ground trace wire access box, located within two linear feet of the building being served by the utility.

- **Hydrants** – Trace wire must terminate at an approved grade level/in-ground trace wire access box, properly affixed to the hydrant grade flange. (Affixing with tape or plastic ties shall not be acceptable.)
- **Long-Runs, In Excess of 500 Linear Feet Without Hydrants** – Trace wire access must be provided utilizing an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway. The grade level/in-ground trace wire access box shall be delineated using a minimum 48” polyethylene marker post, color coded per APWA standard for the specific utility being marked.

Grounding

- Trace wire must be properly grounded at all dead ends/stubs.
- Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20 feet of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the utility.
- When grounding the trace wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.
- When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire nor the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.
- Where the anode wire will be connected to a trace wire access box, a minimum of two feet of excess/slack wire is required after meeting final elevation.

Installation

General

- Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, property locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.
- Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.
- Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.
- Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at five foot intervals.
- Trace wire must be properly grounded as specified.

- Trace wire on all service laterals/stubs must terminate at an approved trace wire access box located directly above the utility, at the edge of the road right-of-way, but out of the roadway. (See Trace Wire Termination/Access.)
- At all mainline dead-ends, trace wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the trace wire. (See Grounding.)
- Mainline trace wire shall not be connected to existing conductive pipes. Treat as a mainline dead-end ground using an approved waterproof connection to a grounding anode buried at the same depth as the trace wire.
- In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved splice connectors, and shall be properly grounded at the splice location as specified.

Sanitary Sewer System

- A mainline trace wire must be installed with directionally bored sewer lines with all service lateral trace wires properly connected to the drive-in magnesium grounding anode rod driven in at the “Y”.
- Lay mainline trace wire continuously, by-passing around the outside of manholes/structures on the north and east side.
- Trace wire on all sanitary service laterals must terminate at an approved trace wire access box color coded green and located directly above the service lateral at the edge of road right-of-way.

Water System

- A mainline trace wire must be installed, with all service lateral trace wires properly connected to the drive in at the “Y” and driven in at saddle connection point.
- Lay mainline trace wire continuously, by-passing around the outside of valves and fittings on the north and east side.
- Trace wire on all water service laterals must terminate at an approved trace wire access box color coded blue and located directly above the service lateral at the edge of road right-of-way.
- Grade level/in-ground trace wire access boxes will be installed on all fire hydrants.
- All conductive and non-conductive service lines shall include trace wire.

Storm Sewer System

- All PVC draitile must have trace wire as shown in Standard Detail Plate Nos. 5232 and 5233.

Prohibited Products and Methods

The following products and methods shall not be allowed or acceptable:

- Uninsulated trace wire.
- Trace wire insulations other than HDPE.
- Trace wires not domestically manufactured.
- Non-locking, friction fit, twist-on or taped connectors.
- Brass or copper ground rods.
- Wire connections utilizing taping or spray-on waterproofing.
- Looped wire or continuous wire installations that have multiple wires laid side-by-side or in close proximity to one another.
- Trace wire wrapped around the corresponding utility.
- Brass fittings with trace wire connection lugs.
- Wire terminations within the roadway, i.e. in valve boxes, cleanouts, manholes, etc.
- Connecting trace wire to existing conductive utilities.

Testing

All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the contractor, engineer and facility owner as applicable, prior to acceptance of ownership.

This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.

Continuity testing in lieu of actual line tracing shall be not accepted.

Products

The following products have been deemed acceptable and appropriate. These products are a guide only to help in choosing the correct applications for a trace wire project.

- Copper Clad Steel (CCS) Trace Wire
 - Open Trench – Copperhead #12 High Strength Part #1230-HS
 - Directional Drilling/Boring – Copperhead Extra High Strength Part #1245*EHS
 - Pipe Bursting/Slip Lining – Copperhead SoloShot Extreme Strength 7x7 Stranded Part #PBX-50
- Connectors
 - Copperhead 3-way Locking Connector Part #LSC1230*
 - DryConn 3-way Direct Bury Lug: Copperhead Part #3WB-01
- Termination/Access
 - Fire Hydrant and Non-Roadway access box applications: Trace wire access boxes grade level Copperhead adjustable lite duty Part #LD14*TP
 - Concrete/Driveway access box applications: Trace wire access boxes grade level Copperhead Part #CD14*TP 14”.

- Grounding
 - Drive-in Magnesium Anode: Copperhead Part #ANO-1005 (1.5 lbs.)

Manufacturers Product Options

The information provided by Copperhead Industries gives project options to help in choosing the correct wire, termination/access points, connectors and grounding products. Other manufacturers provide these products as well. This information is only a guide.

6.08 ACCESS

The contractor shall work within the designated Right of Way. Access to the work site shall be acceptable to all governing agencies.

6.09 INSTALLATION

Laying Pipe - Pipe shall not be laid in water or under unsuitable weather or trench conditions, and shall be protected against entry of foreign matter.

During cold weather, particular care shall be taken in handling and laying pipe to prevent damage by impact.

Whenever pipe laying is stopped, the open end of the line shall be closed with a tight-fitting end board to keep out sand and earth. The end board shall have several perforations near its center to permit water into the pipe, thus preventing flotation in the event that the trench is flooded. Standing water in the trench shall be removed before the end board is removed.

Pipe shall be protected from exposure to sunlight, shall be kept as cool as possible during installation, and shall be covered with backfill immediately after installation.

Cleaning - The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until work has been accepted.

Directional Tolerance - The pilot hole shall be drilled along the path shown on the drawings to the tolerances listed below:

- a. Alignment - Plus or minus 5 feet.
- b. Entry Point Location - The pilot hole shall initially penetrate the ground surface at the exact location shown on the drawings. The contractor shall determine the entry side of the pilot hole drilling depending on the pipe grade, availability of right-of-way, room to string the pipeline, and other factors.
- c. Exit Point Location - The pilot hole shall finally exit the ground surface at the exact location shown on the drawings.

In all cases, right-of-way restrictions shall take precedence over the listed tolerances. Regardless of the tolerance achieved, no pilot hole will be accepted if it will result in any or all of the pipeline being installed in violation of right-of-way restrictions. In all cases, concern for adjacent utilities and/or structures shall take precedence over the listed tolerances. Listing of tolerances does not relieve the contractor from responsibility for safe operations or damage to adjacent utilities and structures.

Cutting Pipe - Cutting shall comply with the pipe manufacturer's recommendations. Cuts shall be smooth, straight, and at a right angle to the pipe axis. After cutting, the end of the pipe shall be dressed to remove all roughness and sharp corners and shall be beveled in accordance with the manufacturer's instructions.

Joining - Joining shall conform to the instructions and recommendations of the pipe manufacturer. Sections of HDPE pipe shall be joined into continuous lengths above ground by the thermal butt fusion method in accordance with the pipe manufacturer's recommendations for the specified service. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but shall not be limited to, temperature requirements of 400°F, alignment, and 75 psi interfacial fusion pressure. Butt fusion joining shall be 100 percent efficient offering a joint weld strength equal to or greater than the tensile strength of the pipe.

Socket fusion and extrusion welding or hot gas welding will not be acceptable.

All joining procedures shall be acceptable to the engineer.

Inspection - Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation, with special attention to pipe ends. All defective pipe and fittings shall be removed from the site of the work.

Connections with Other Piping - Connections between HDPE pipe and other piping shall be made using suitable fittings. Each connection with other piping shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by the City. The pipe shall remain in the drilled hole at least 24 hours before any connections or cutting of pipe shall be made. Facilities shall be provided for proper dewatering and for disposal of all water removed from the dewatered lines and excavations without damage to adjacent property.

Special care shall be taken to prevent contamination of potable water lines when dewatering, cutting into, and making connections with other pipe. No trench water, mud, or other contaminating substances shall be permitted to get into the lines. The interior of all pipe, fittings, and valves installed in such connections shall be thoroughly cleaned and then swabbed with, or dipped in, a 200 mg/L chlorine solution.

Reaction Anchorage and Blocking - All tees and plugs installed in piping subject to internal hydrostatic heads in excess of 30 feet shall be provided with suitable reaction blocking, anchors,

joint harnesses, or other acceptable means of preventing movement of the pipe caused by internal pressure.

Concrete blocking shall extend from the fitting to solid undisturbed earth and shall be installed so that all joints are accessible for repair. The dimensions of concrete reaction blocking shall be as indicated on the drawings or as directed by the engineer.

Reaction blocking, anchorages, or other supports for fittings installed in fill or other unstable ground shall be provided as indicated on the drawings or as directed by the engineer.

Protective Coating - All steel clamps, rods, bolts, and other metal components of tapping saddles or reaction anchorages subject to submergence, or in contact with earth or other fill material, and not encased in concrete, shall be protected from corrosion. The first coat shall be dry and hard before the second coat is applied.

6.10 REAMING AND PULL BACK

Pre-reaming - Pre-reaming operations shall be conducted at the discretion of the contractor. The contractor shall insure that a hole sufficient to accommodate the pull section has been produced. Any damage to the pipe resulting from inadequate pre-reaming shall be the responsibility of the contractor. All provisions of this specification relating to simultaneous reaming and pulling back operations shall also pertain to pre-reaming operations.

Pulling Loads - The maximum allowable tensile load imposed on the pipe section shall be equal to 50 percent (50%) of the product of the HDPE pipe's specified tensile yield strength and the area of the pipe section.

Torsional Stress - A swivel shall be used to connect the pull section to the reaming assembly to minimize torsional stress imposed on the section.

Pull Section Support - The pull section shall be supported as it proceeds during pull back so that it moves freely and the pipe is not damaged.

External Collapse Pressure - The pull section shall be installed in the reamed hole in such a manner that external pressures are minimized and an appropriate counter-balancing internal pressure is maintained. Any damage to the pipe resulting from external pressure during installation shall be the responsibility of the contractor.

Buoyancy Modification - Buoyancy modification shall be used at the discretion of the contractor. Any buoyancy modification procedure proposed for use shall be submitted to the engineer for approval. No procedure shall be used which has not been reviewed and approved by the engineer. The contractor is responsible for any damage to the pull section resulting from buoyancy modification.

6.11 DRILLING FLUIDS

Composition - The composition of all drilling fluids proposed for use shall be submitted to the engineer for review and approval. No fluid will be approved or utilized that does not comply with permit requirements or environmental regulations.

Water - The contractor is responsible for obtaining, transporting, and storing any water required for drilling fluids. Connecting to fire hydrants is not acceptable. Contact the City to determine acceptable water locations.

Recirculation - The contractor shall maximize recirculation of drilling fluid surface returns. The contractor shall provide solids control and fluid cleaning equipment of a configuration and capacity that can process surface returns and produce drilling fluid suitable for reuse. A description of solids control and cleaning equipment proposed for use shall be submitted to the engineer.

Disposal - Disposal of excess drilling fluids is the responsibility of the contractor and shall be conducted in compliance with all environmental regulations, right-of-way and workspace agreements, and permit requirements. Drilling fluid disposal procedures proposed for use shall be submitted to the engineer.

Control of drilling fluids on the site is very critical. Spills of drilling fluids will not be allowed or permitted.

Inadvertent Returns - The contractor shall employ his best efforts to maintain full annular circulation of drilling fluids. Drilling fluid returns at locations other than the entry and exit points shall be minimized. In the event that annular circulation is lost, the contractor shall take steps to restore circulation. If inadvertent surface returns of drilling fluids occur, they shall be immediately contained with hand placed barriers (i.e. hay bales, sand bags, silt fences, etc.) and collected using pumps and other suitable equipment. If the amount of the surface return exceeds that which can be contained with hand placed barriers, small collection sumps, drilling operations shall be suspended until surface return volumes can be brought under control.

6.12 FIELD QUALITY CONTROL

Instrumentation - The contractor shall at all times provide and maintain instrumentation which will accurately locate the pilot hole, measure drill string axial and torsional loads, and measure the drilling fluid discharge rate and pressure. The engineer will have access to these instruments and their readings at all times. A log of all recorded readings shall be maintained and will become part of the "As Constructed" information to be supplied by the contractor.

Cleaning and Disinfection - Cleaning and disinfection is described in Section 10.00 of the Water main Specifications.

Testing - After installation the pipe will be subjected to a Hydrostatic Pressure Test and a Trace Wire Test. These tests are described in Section 10.00 of the Water main Specifications. Additional testing may be required at the discretion of the engineer.

All HDPE piping shall be watertight and free from leaks. Each leak that is discovered within the correction period specified in the General Conditions shall be repaired by and at the expense of the contractor.

SECTION 7.00 - EXCAVATION AND TRENCH PREPARATION

7.01 GENERAL

The trench shall be so dug that the pipe can be laid to the alignment and depth required and shall be excavated only so far in advance of pipe laying as the engineer shall specify. The trench shall be so braced and drained that the workmen may work therein safely and efficiently. All trenches shall be sheeted and braced as per Chapter 66: Trench bracing of the Minnesota Regulations Relating to Industrial Safety to a safe angle of repose. Such angle of repose shall be no less than the repose required by the Accident Prevention Division of the Minnesota State Industrial Commission or the requirements of the Occupational Safety and Health Act (OSHA), whichever is more restrictive.

It is essential that the discharge of any required trench dewatering pumps be conducted to natural public drainage channels, drains or storm sewers.

All trenches shall be excavated so that the pipe may be laid accurately to grade with a minimum of 7½ feet of earth cover over the top of the water mains, unless otherwise noted on the drawings.

All utility installations under existing “collector” roads or newly constructed (less than 5 years old) residential streets must be jacked or directional bored as appropriate. No open trenching will be allowed.

7.02 TRENCH WIDTH AND DESCRIPTION

The trench width, at the top of the trench, may vary depending on the depth of the excavation and the nature of excavated material encountered. All trenches shall be constructed in strict accordance with requirements prescribed by the Occupational Safety and Health Act (OSHA).

The trench width at pipe grade shall be ample to permit the proper laying and jointing of the pipe and fittings and for proper backfilling and compaction. The maximum width of trench at the top of the pipe shall be not greater than the outside diameter of the pipe plus four feet.

The trench shall have a bottom conforming to the grade to which the pipe is to be laid. The pipe shall be laid upon sound soil, cut true and even so that the barrel of the pipe will have a bearing for its full length. If the excavation is inadvertently made below the bottom conforming to grade, it shall be backfilled with well tamped pit run sand or fine gravel or other material as approved by the engineer at no additional expense to the owner.

Bell holes shall be dug at the ends of each length of pipe to permit proper jointing. Excavations for manholes and other structures shall have one foot minimum clearance on all sides.

The trench shall be kept free from water until the joints have been completed.

7.03 PIPE BEDDING

When using ductile iron pipe and existing soil conditions are not acceptable for backfill and/or compaction in the pipe zone, pipe bedding and backfill shall be used as shown on standard detail plate no. 2201. Otherwise, backfill as shown on standard detail plate no. 2202 may be used. When using PVC pressure pipe bedding and backfill shall be accomplished as per Section 7.02 of the sanitary sewer specifications and standard detail plate no. 2203.

7.04 PIPE FOUNDATION IN POOR SOIL

When the bottom at subgrade is soft and in the opinion of the engineer cannot adequately support the pipe, a further depth and/or width shall be excavated and refilled to pipe foundation grade with approved material and thoroughly compacted as shown on standard detail plate nos. 2203 and 2203A; or other approved means, such as piling, shall be adopted to assure a firm foundation for the pipe with extra compensation allowed the contractor as provided elsewhere in these specifications.

The contractor shall furnish, drive, and place piling if ordered by the engineer. Piles shall be driven in exact position at locations determined by the engineer. The contractor at his/her own expense must replace piles not correctly positioned at the completion of driving.

7.05 PIPE CLEARANCE IN ROCK

Large stones shall be removed to provide a clearance of at least twelve inches (12") below outside barrel of the pipe, valves, or fittings, and to a clear width of 12" on each side of all pipe and appurtenances for pipe 16" or less in diameter; for pipes larger than 16", a clearance of 18" below and clear width of 9" on each side of pipe shall be provided. Adequate clearance for properly jointing pipe laid in rock trenches shall be provided at bell holes.

7.06 BRACED AND SHEETED TRENCHES

The contractor shall adequately brace and sheet excavations wherever necessary to prevent caving or damage to nearby property. The cost of this temporary sheeting and bracing, unless provided for otherwise, shall be considered as part of the excavation costs without additional compensation to the contractor. Trench sheeting shall remain in place until pipe has been laid, tested for defects and repaired if necessary, and the earth around it compacted to a depth of one foot over the top of the pipe. Sheeting, bracing, etc. placed in the "pipe zone" (that part of the trench below a distance of one foot [1'] above the top of the pipe) shall not be removed without the written permission or written order of the engineer; that sheeting thereby left in place shall be paid for at the unit price bid. Sheeting ordered left in place by the engineer in writing shall be paid for at the unit price bid. The contractor may also leave in place, at his/her own expense, to be embedded in the backfill of the trench any sheeting or bracing in addition to that ordered left in place by the engineer for the purpose of preventing injury or damage to persons, corporations, or property whether public or private, for which the contractor under the terms of this contract is liable.

7.07 PILING OF EXCAVATED MATERIAL

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street drainage.

7.08 BARRICADES, GUARDS AND SAFETY PROVISIONS

To protect persons from injury and to avoid property damage, adequate barricades, construction signs, flashing lights, and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the highway. All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor. The rules and regulations of the local authorities respecting safety provisions shall be observed.

7.09 TRAFFIC AND UTILITY CONTROLS

Excavations for pipe laying operations shall be conducted in a manner to cause the least interruption to traffic. Where traffic must cross open trenches, the contractor shall provide suitable bridges at street intersections and driveways. The contractor shall post, where directed by the engineer, suitable signs indicating that a street is closed and necessary detour signs for the proper maintenance of traffic. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, or other utility controls shall be left unobstructed and accessible during the construction period.

7.10 PRIVATE PROPERTY PROTECTION

Trees, fences, poles and all other private property shall be protected unless their removal is authorized; and any property damage shall be satisfactorily restored by the contractor, or adequate compensation therefore shall be the responsibility of the contractor.

7.11 TUNNELING, JACKING, BORING OR EXCAVATION OTHER THAN OPEN TRENCH

Where pipe cannot be placed by open trench excavation, the method for placing and payment therefore shall be stated in the special provisions.

7.12 RAILROAD AND HIGHWAY CROSSINGS

When any railroad is crossed, all precautionary construction measures required by the railroad shall be followed. See Special Provisions or Detail Drawings. The contractor shall be responsible for securing necessary crossing permits.

Before any construction is started, the successful bidder shall meet with the Minnesota Department of Transportation, County Highway Department, Railroad Maintenance Engineer, and the Consulting Engineers where applicable to determine the construction procedure to be followed, methods of rerouting traffic, placing of barricades, flares, signs, flagmen, etc., and methods of

preventing damage to the highway or railroad. If required by the railroad or highway department, the contractor shall deposit with them a certified check in an amount sufficient to cover the required repair work.

7.13 INTERRUPTION OF WATER SERVICE

No interruption of water service will be allowed unless approved by the city engineer. The contractor will be required to provide temporary water service whenever possible. If an interruption in water service is approved, all consumers affected by the operation shall be notified by the contractor at least 48 hours before the operation and be advised of the probable time when service will be restored. All valves and hydrants that are required to be opened or closed shall be operated only by the Chanhassen Utility Department. The contractor shall notify the Chanhassen Utility Superintendent 48 hours in advance to request opening or closing of all gate valves and hydrants.

SECTION 8.00 - PIPE LAYING

8.01 INSTALLATION OF WATER MAIN AND APPURTENANCES

Proper implements, tools and facilities satisfactory to the engineer shall be provided and used by the contractor for the safe and convenient prosecution of the work.

Pipe and other materials shall be unloaded and distributed on the job in a manner approved by the engineer. In no case shall materials be thrown or dumped from the truck. All materials unloaded in an unsatisfactory manner shall be rejected and work shall be stopped until such materials have been examined by the inspector and approved. The contractor shall furnish the necessary assistance in such examination of materials.

Water main materials shall be carefully lowered into trench piece by piece by means of a derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to materials and protective coatings and lining. Under no circumstances shall water main materials be dumped into the trench.

8.02 LAYING OF PIPE AND FITTINGS

Before lowering and while suspended, the pipe and fittings shall be inspected for defects to detect any cracks. Any defective, damaged or unsound material shall be rejected.

All foreign matter or dirt shall be removed from the inside of the pipe and fittings before it is lowered into its position in the trench, and shall be kept clean by approved means during and after laying. All openings along the line of the main shall be securely closed as directed, and in the suspension of work at any time, suitable stoppers shall be placed to prevent earth or other substances from entering the main.

No pipe shall be laid in water or when the trench conditions are unsuitable for such work, except by written permission of the engineers.

8.03 JOINTING OF PIPE AND FITTINGS

Ductile Iron - Jointing of mechanical joint pipe, push-on joint pipe, and fittings shall be done in accordance with A.W.W.A. Section 9b and 9c of A.W.W.A. Specification C600, latest revision. Mega-lugs shall be used to secure all mechanical joint pipe and fittings.

When pipes are cut in the field, the cut or straight end shall have all sharp or rough edges removed before assembly.

PVC - The bell shall consist of an integral wall section with a factory-installed, solid cross-section elastomeric ring which meets the requirements of ASTM F-477. The bell section shall be designed to be at least as hydrostatically strong as the pipe wall and meet the requirements of A.W.W.A.

C900 for sizes 4" to 12". The pipe shall be manufactured to cast iron or ductile iron outside dimensions in accordance with A.W.W.A. C900.

Fittings shall be ductile iron, having a minimum working pressure rating of 150 PSI and shall conform to the requirements of A.W.W.A. C110 (ANSI A21.10) or A.W.W.A. C153 (ANSI 21.53) Ductile Iron Compact Fittings. Valves, tees, crosses, hydrant barrels or any other ductile iron fitting shall be furnished with Cor-Blue nuts and bolts and shall be wrapped with a flat sheet or split length polyethylene tube by passing the sheet under the appurtenance and bringing it up around the body. Make seams by bringing the edges of the polyethylene sheet together, folding over twice and taping down.

Restraints for C900 PVC pipe shall, per Section 2.15, be Ebba Iron Mega-Lug Series 2000 PV or approved equal.

8.04 SETTING HYDRANTS

Hydrants shall be placed in locations as staked by the engineer.

All hydrants shall be supported on an 18" x 18" x 4" solid concrete block or equal concrete base. Each hydrant shall be tied as shown on the detail drawings. After each hydrant has been set, there shall be placed around the base of the hydrant, not less than one (1) cubic yard of gravel or crushed rock from which all fine material has been removed. A layer of polyethylene, minimum 4 mil thickness, shall be carefully placed over the rock to prevent the backfill from entering the voids in the drain rock. All hydrants must be maintained in a plumb position during the backfilling operation.

8.05 CONDUCTIVITY

When using D.I.P. conductivity shall be provided throughout the water system by use of copper straps or approved conductive gaskets with copper inserts. All mechanical joint fittings shall be equipped with copper straps. Lead tipped gaskets will not be approved for conductivity.

Copper jumper straps between sections of pipe shall be not less than 1/16" x 3/4" strap bolted to shop welded pipe straps of the same size. Bolts shall be 5/16" diameter bronze. For all locations where shop welded straps are not available, field welds shall be made using the Cadweld method with size 32 cartridge. Each field weld shall be properly made after filing the surface of the pipe to a clean bare metal over the entire area of the weld. Straps bolted to mechanical joint fittings shall be not less than 1/16" x 1-1/2". All straps shall be securely fastened and backfill placed so as to not damage the conductivity.

8.06 SEWER CROSSINGS

Water mains crossing sanitary sewers shall be laid to provide a separation of at least 18" between the bottom of the water main and the top of the sewer. When local conditions prevent a vertical separation as described, the following construction shall be used:

- (a) Sewers passing over or under water mains shall be constructed of materials equal to water main standards of construction.
- (b) A length of water pipe shall be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

8.07 VALVES, BOXES, MANHOLES, VAULTS AND FITTINGS

Valves and fittings shall be placed where shown on the plans or as designated by the engineer. Jointing shall be done as previously specified herein.

Unless otherwise specified or shown on the drawings, cast iron valve boxes shall be installed with all gate valves eighteen inches (18") or smaller and all butterfly valves. Valve boxes shall be firmly supported with a valve box adapter to maintain centered and plumb alignment over the wrench nut of the valve, with box cover one-quarter to one-half inch (1/4" - 1/2") below the surface of the finished pavement or at such other level as may be directed by the engineer.

All bends, tees, hydrants and plugs shall be securely braced against undisturbed soil using pre-cast concrete block or poured-in-place concrete thrust blocks. The method of anchorage must be reviewed and approved by the engineer prior to backfilling. In addition, Mega-lugs shall be installed at all bends.

8.08 BUILDING SERVICES

Curb stops and boxes shall be installed as shown on the standard plates. The curb stop and box shall be located 9' inside of the property, unless specified otherwise.

Ties to water services must be provided at the lateral, all vertical and horizontal bends and at right-of-way.

Corporation stops shall be tapped into the main only when full of water under pressure. No taps shall be made into a dry pipe. Corporation stops shall be turned into the pipe until tight and shall not be turned back to facilitate having the operating nut on the top.

The copper service lines as placed between the water mains and the curb boxes shall have a minimum of 7.5 feet of cover except at the goose neck which shall have 6½-foot minimum cover. Therefore, service lines must be placed (incidental to the project) beneath any obstruction which would prohibit the required cover if the service line was placed on top of said obstruction. The method of tunneling under an obstruction shall be approved by the engineer.

Each curb box shall be marked by a steel fence posts located two feet behind the curb box cover. The top 6 inches of the steel fence post shall be painted blue.

SECTION 9.00 - BACKFILLING

9.01 GENERAL

All excavation in trenches shall be backfilled to the original ground surface or to such grades as specified or shown on the plans. The backfilling shall begin as soon as practicable after the pipe has been placed. Prior to any backfilling, the excavation shall be cleaned of all trash, debris, organic material, and other undesirable material.

9.02 BACKFILL PROCEDURE AT PIPE ZONE

Backfilling and compacting shall be done as thoroughly as possible so as to prevent after settlement. Depositing of the backfill shall be done so the shock of falling material will not injure the pipe or structures. Grading over and around all parts of the work shall be done as directed by the engineer.

All water main pipe shall be installed in accordance with Standard Detail Plate No. 2203A and bedded in a granular material meeting the requirements of MnDOT specification 3140.2A Granular Borrow in which all shall pass a three-quarters inch (3/4") sieve and not more than 20% shall pass a #200 sieve. Embedment materials shall be compacted in six-inch (6") lifts to a point twelve inches (12") above the pipe and to a density of at least 95% of standard proctor density as described by ASTM methods D698. All embedment materials shall be tested for compliance with the above specification and test results shall be supplied to the Engineer. If materials are purchased, weight slips should also be provided.

9.03 BACKFILL PROCEDURE ABOVE THE PIPE ZONE

Unless otherwise specified, suitable backfill material shall be furnished and the following backfill procedures shall apply and be used above the "pipe zone" to either the existing surface elevation or design grade, as specified, with the cost of such considered incidental to the installation of the pipe unless specified for a particular section of the project by the special provisions and/or plans, or allowed in writing by the engineer, and a unit price has been established.

All trenches shall be backfilled to obtain the necessary compaction, with the lift thickness as required, dependent upon type of roller. The backfill material shall be compacted to 95% of the standard moisture density relationship of soils (ASTM D698-70) except the top three feet (3') of the trench which shall be compacted to 100% density. Moisture content of these soils shall be within a range of $\pm 3\%$ of optimum moisture content. If the existing moisture content of the backfill material below three feet of subgrade is greater than 3 percentage points above the optimum moisture content, the soil shall be compacted to a minimum density of 3 pounds per cubic feet less than the standard Proctor curve at that moisture content. At no time shall the density be less than 90 percent of the standard Proctor density. This modification of the compaction specification shall at no time be used or applied to the upper 3 feet of the subgrade or the aggregate base. In the event the contractor fails to meet these compaction requirements, corrective measures such as spreading/discing/farming, etc. shall be implemented or the contractor may elect to replace backfill

with a more suitable material taken from another source. All of these corrective measures shall be at the contractor's expense.

Any settlement greater than one inch (1") as measured with a string line from one edge of the settlement to the other within the warranty period of this contract shall be considered failure of the mechanical compaction and all street surfaces, driveways, boulevard and ditch areas shall be repaired by the contractor at no cost to the City.

Under state or county highways and road, the contractor shall obtain the necessary permits at his/her expense after commencing and type of work upon a state or county highway or roadway. All such work, especially backfilling, shall conform to state and county standards and specifications.

9.04 DISPOSAL OF EXCESS MATERIALS AND DEBRIS

Unless otherwise specified, excavated material either not suitable or not required for fill material shall be disposed of by the contractor outside of the right-of-way at his/her expense in any manner s/he may elect subject to the provisions of the following paragraph.

Before dumping such materials or debris on a private or public land, the contractor must obtain from the owner of such land written permission for such dumping and a waiver of all claims against the owner for any damage to such land which may result therefrom together with all permits required by law for such dumping. A copy of such permission, waiver of claims and permits shall be filed with the engineer before said disposal is made.

In addition, be advised City Ordinance may require the property owner apply and receive a grading permit prior to any earthwork activities commencing.

9.05 FILL MATERIAL

Normal, allowable "fill material" used in backfilling outside of the pipe encasement shall be sand, gravel, or clay, free from pieces of rock, concrete or clay lumps more than one-third cubic foot in volume, roots, stumps, organic soil, vegetation, tin cans, rubbish, frozen materials, and similar articles and substances whose presence in the backfill would cause excessive settlement. In that portion of the backfill which is within six inches (6") of a road subgrade, there shall be no stones which will be retained on a three-inch (3") sieve.

9.06 DENSITY TESTS

Density tests will be performed by an approved soils testing firm at various locations and depths throughout the project as directed by the engineer. The contractor shall cooperate fully and provide assistance as necessary to complete these tests with no additional compensation being made to the contractor. A minimum of one test at an elevation approximately two feet above the top of pipe, one test in the top three feet and one test at an intermediate elevation per 100 feet of pipe. A minimum of 50% of the individual water and sewer service trenches shall be tested at elevations listed above.

SECTION 10.00 - TESTING AND DISINFECTING MAINS

10.01 PRESSURE TESTING

All water main including fittings, valves, services and hydrants shall be tested in accordance with and shall meet the requirements set forth in American Water Works Association (A.W.W.A.) Specifications C600-10 and C605-13, latest revision.

The contractor shall have the option of using an alternative testing procedure as identified below:

After the pipe has been laid including fittings, valves, hydrants, and service and the line has been backfilled in accordance with these specifications, all newly laid pipe, or any valved section thereof, unless otherwise directed by the engineer, shall be subjected to a hydrostatic pressure of 150 pounds per square inch. The duration of each such test shall be two (2) hours. The allowable pressure drop shall not exceed one (1) PSI in the said two (2) hour period.

Each valved section of pipe shall be slowly filled with water and the specified test pressure, measured at the lowest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges and all necessary apparatus shall be furnished by the contractor. Gauges and measuring devices must meet with the approval of the engineer and the necessary pipe taps made as directed. Before applying the specified test pressure, all air shall be expelled from pipe. To accomplish this, taps shall be made, if necessary, at points of highest elevations, and afterward tightly plugged.

Each valved section shall be subjected to the pressure test and, if required, the leakage test prescribed herein. Testing for the two hour duration shall be with hydrants closed, and valves on hydrant leads and dead end water lines open. Once this portion of the test is completed, the valve on the hydrant leads and dead end water lines shall be closed, and hydrants opened. The specified test pressure shall be applied, and the test repeated for 15 minutes to establish the condition of the hydrant lead valves. This shall apply to both the pressure and leakage test.

When tying into existing water main system, the contractor shall be responsible for pressure testing from the point of starting the new water main and including all newly constructed pipe and valves. If the contractor elects to test the existing water main, the City will not be responsible for any testing costs if the existing water main is the cause of any failing tests.

Any cracked or defective pipes, fittings, valves or hydrants discovered in consequence of the pressure test shall be removed and replaced by the contractor with sound material in the manner provided and the shall be repeated until satisfactory to the engineer.

The pressure gauge for the tests shall be an Ashcroft Model 1082 with a 4½-inch dial face with one (1) psi increments or approved equal.

10.02 DISINFECTING MAINS AND TEMPORARY WATER SERVICES

All new and repaired water main will be chlorinated in accordance with A.W.W.A. Standard C651-14.

10.03 ELECTRICAL CONDUCTIVITY TEST

Conductivity test shall be performed on all D.I.P. mains after they have been pressure tested and are full of water at normal operating pressure. A direct current of 350 amps shall be passed through the line for five minutes. Current flow shall be measured continuously on a suitable ammeter and shall remain steady without interruption or excessive fluctuation throughout the period. Insufficient current or wide fluctuations of ammeter needle shall be evidence of defective conductivity which shall be isolated, corrected and retested. The connection for the conductivity shall be made either to a gate valve or to the hydrant barrel. Connections shall not be made to any operating mechanism of the hydrant.

Acceptable equipment for the test shall be arc welding machines with adequate sized cables to carry the test current without voltage drop or overheating. Conductivity test shall be carried out in the presence of the engineer or his/her duly authorized agent. Caution shall be exercised at all times when working with electrical equipment and wires during the conductivity test.

10.04 TRACE WIRE

Materials

General

All trace wire and trace wire products shall be domestically manufactured in the USA.

All trace wire shall have HDPE insulation intended for direct bury, color coated per APWA standard for the specific utility being marked.

Trace Wire

- **Open Trench** – Trace wire shall be #12 AWG Copper Clad Steel, High Strength with minimum 450 lb. break load, with minimum 30 mil HDPE insulation thickness.
- **Directional Drilling/Boring** – Trace wire shall be #12 AWG Copper Clad Steel, Extra High Strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.
- **Trace Wire – Pipe Bursting/Slip Lining** – Trace wire shall be 7x7 Stranded Copper Clad Steel, Extreme Strength with 4,700 lb. break load, with minimum 50 ml HDPE insulation thickness.

Connectors

- All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At crosses, the four wires shall be joined using a 4-way connector. Use of two, 3-way connectors with a short jumper wire between them is an acceptable alternative.
- **Direct Bury Wire Connectors** – Shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure.
- Non-locking friction fit, twist on or taped connectors are prohibited.

Termination/Access

- All trace wire termination points must utilize an approved trace wire access box (grade level/in-ground access box as applicable), specifically manufactured for this purpose.
- All grade level/in-ground boxes shall be appropriately identified with “sewer” or “water” cast into the cap and be color coded.
- A minimum of two feet of excess/slack wire is required in all trace wire access boxes after meeting final elevation.
- All trace wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection.
- Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.
- **Service Laterals on Public Property** – Trace wire must terminate at an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway.
- **Service Laterals on Private Property** – Trace wire must terminate at an approved above-ground trace wire access box, affixed to the building exterior directly above where the utility enters the building, at an elevation not greater than five vertical feet above finished grade, or terminate at an approved grade level/in-ground trace wire access box, located within two linear feet of the building being served by the utility.
- **Hydrants** – Trace wire must terminate at an approved grade level/in-ground trace wire access box, properly affixed to the hydrant grade flange. (Affixing with tape or plastic ties shall not be acceptable.)
- **Long-Runs, In Excess of 500 Linear Feet Without Hydrants** – Trace wire access must be provided utilizing an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway. The grade level/in-ground trace wire access box shall be delineated using a minimum 48” polyethylene marker post, color coded per APWA standard for the specific utility being marked.

Grounding

- Trace wire must be properly grounded at all dead ends/stubs.

- Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20 feet of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the utility.
- When grounding the trace wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.
- When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire nor the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.
- Where the anode wire will be connected to a trace wire access box, a minimum of two feet of excess/slack wire is required after meeting final elevation.

Installation

General

- Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, property locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.
- Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.
- Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.
- Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at five foot intervals.
- Trace wire must be properly grounded as specified.
- Trace wire on all service laterals/stubs must terminate at an approved trace wire access box located directly above the utility, at the edge of the road right-of-way, but out of the roadway. (See Trace Wire Termination/Access.)
- At all mainline dead-ends, trace wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the trace wire. (See Grounding.)
- Mainline trace wire shall not be connected to existing conductive pipes. Treat as a mainline dead-end ground using an approved waterproof connection to a grounding anode buried at the same depth as the trace wire.
- In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved splice connectors, and shall be properly grounded at the splice location as specified.

Sanitary Sewer System

- A mainline trace wire must be installed with directionally bored sewer lines with all service lateral trace wires properly connected to the drive-in magnesium grounding anode rod driven in at the “Y”.
- Lay mainline trace wire continuously, by-passing around the outside of manholes/structures on the north and east side.
- Trace wire on all sanitary service laterals must terminate at an approved trace wire access box color coded green and located directly above the service lateral at the edge of road right-of-way.

Water System

- A mainline trace wire must be installed, with all service lateral trace wires properly connected to the drive in at the “Y” and driven in at saddle connection point.
- Lay mainline trace wire continuously, by-passing around the outside of valves and fittings on the north and east side.
- Trace wire on all water service laterals must terminate at an approved trace wire access box color coded blue and located directly above the service lateral at the edge of road right-of-way.
- Grade level/in-ground trace wire access boxes will be installed on all fire hydrants.
- All conductive and non-conductive service lines shall include trace wire.

Storm Sewer System

- All PVC draintile must have trace wire as shown in Standard Detail Plate Nos. 5232 and 5233.

Prohibited Products and Methods

The following products and methods shall not be allowed or acceptable:

- Uninsulated trace wire.
- Trace wire insulations other than HDPE.
- Trace wires not domestically manufactured.
- Non-locking, friction fit, twist-on or taped connectors.
- Brass or copper ground rods.
- Wire connections utilizing taping or spray-on waterproofing.
- Looped wire or continuous wire installations that have multiple wires laid side-by-side or in close proximity to one another.
- Trace wire wrapped around the corresponding utility.
- Brass fittings with trace wire connection lugs.
- Wire terminations within the roadway, i.e. in valve boxes, cleanouts, manholes, etc.
- Connecting trace wire to existing conductive utilities.

Testing

All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the contractor, engineer and facility owner as applicable, prior to acceptance of ownership.

This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.

Continuity testing in lieu of actual line tracing shall be not accepted.

Products

The following products have been deemed acceptable and appropriate. These products are a guide only to help in choosing the correct applications for a trace wire project.

- Copper Clad Steel (CCS) Trace Wire
 - Open Trench – Copperhead #12 High Strength Part #1230-HS
 - Directional Drilling/Boring – Copperhead Extra High Strength Part #1245*EHS
 - Pipe Bursting/Slip Lining – Copperhead SoloShot Extreme Strength 7x7 Stranded Part #PBX-50
- Connectors
 - Copperhead 3-way Locking Connector Part #LSC1230*
 - DryConn 3-way Direct Bury Lug: Copperhead Part #3WB-01
- Termination/Access
 - Fire Hydrant and Non-Roadway access box applications: Trace wire access boxes grade level Copperhead adjustable lite duty Part #LD14*TP
 - Concrete/Driveway access box applications: Trace wire access boxes grade level Copperhead Part #CD14*TP 14”.
- Grounding
 - Drive-in Magnesium Anode: Copperhead Part #ANO-1005 (1.5 lbs.)

Manufacturers Product Options

The information provided by Copperhead Industries gives project options to help in choosing the correct wire, termination/access points, connectors and grounding products. Other manufacturers provide these products as well. This information is only a guide.

SECTION 11.00 - SURFACE RESTORATION, CLEANUP AND GUARANTEE

11.01 RESTORATION OF SURFACE

All surfaces disturbed during the construction period including adjacent streets used to access the site, whether caused by actual excavation, deposition of excavated material, or by the construction equipment, shall be returned to its original conditions or better. Exceptions to the above, if any, or special instructions pertaining to any particular section of the project will be outlined in the "Special Provisions". Any excess dirt shall be removed by the contractor in accordance with Section 9.04 of these specifications.

11.02 DUST CONTROL DURING CONSTRUCTION

The contractor shall at his/her own expense maintain dust control as necessary and in a manner satisfactory to the engineer until final acceptance of the project or until restoration has been completed.

11.03 MAILBOX RESTORATION

The contractor, at his/her expense, shall replace and restore mailboxes disturbed by the work.

11.04 MAINTENANCE OF STREETS UNTIL SURFACED

After backfilling according to the above specifications, the contractor shall maintain the streets as required and blade as necessary to provide a passable surface for traffic until the surfacing is completed or to the date of final acceptance.

11.05 CLEAN UP

Surplus pipe material, tools, and temporary structures shall be removed by the contractor and all dirt and/or rubbish caused by his/her operations and excess earth from excavations shall be hauled to a dump provided by the contractor, and the construction site shall be left in a condition satisfactory to the engineer.

11.06 GUARANTEE

The contractor shall be held responsible for any and all defects in workmanship and materials which may develop in any part of the entire installation furnished by him and upon written notice from the engineer shall immediately replace and make good, without expense to the owner, any such faulty part or parts and damage done by reason of same, during the warranty period as prescribed by the conditions of the contract.

11.07 FAILURE TO REPLACE DEFECTIVE PARTS

Should the contractor fail to make good the defective parts within a period of thirty (30) days of such notification, after written notice has been given him, the owner may replace these parts, charging the expense of the same to the contractor.

SECTION 12.00 - TURF ESTABLISHMENT

12.01 GENERAL

All turf establishment shall be in accordance with Section 4.14, Turf Establishment, of the street specifications which is included as part of this standard specification.

SECTION 13.00 - METHOD OF PAYMENT

The work shall be measured and the compensation determined in the following manner:

13.01 WATER MAIN PIPE

Water main pipe will be paid for at the contract price per lineal foot for each diameter of pipe furnished, which shall include the cost of furnishing the pipe, rubber gasket, joints, insulation and other material and of delivering, handling, laying, trenching, backfilling, testing, disinfecting, and all material or work necessary to install the pipe complete in place at the depth above specified.

The length of the pipe for which payment is made shall be the actual overall length measured along the axis of the pipe without regard to intervening valves or specials.

Lengths of branches will be measured from the centers of connecting pipes to center of valves or hydrants. All lengths will be measured in a horizontal plain unless the grade of the pipe is more than 15%.

13.02 COMPACT DUCTILE IRON FITTINGS

Ductile iron fittings shall be class 350 for sizes up to and including twelve inches (12") in diameter and shall conform to AWWA Specification C153 covering compact fitting. Ductile iron fittings shall be measured by weight in pounds (kilograms) according to the published weights of mechanical joint fittings as listed in the following table. Retainer glands shall be incidental to the fitting installation.

COMPACT MECHANICAL JOINT DUCTILE IRON FITTINGS							
MJ TEES			MJ-MJ REDUCERS			MJ PLUGS	
Run*	Branch*	Weight-Lb/Kg	Size*	Weight-Lb/Kg	Size*	Weight-Lb/Kg	
4	4	32/14.5	6 x 4	24/10.9	4	15/6.8	
6	4	46/20.9	8 x 4	32/14.5	6	25/11.3	
	6	56/25.4	8 x 6	36/16.3	8	45/20.4	
8	4	60/27.2	10 x 4	46/20.9	10	65/29.5	
	6	72/32.7	10 x 6	47/21.3	12	85/38.6	
	8	86/39.0	10 x 8	50/22.7	16	150/68.0	
10	4	78/35.4	12 x 4	58/26.3	20	215/97.5	
	6	90/40.8	12 x 6	60/27.2	24	350/158.8	
	8	105/47.6	12 x 8	60/27.2	MJ CROSSES		
	10	120/54.4	12 x 10	64/29.0	Size*	Weight-Lb/Kg	
12	4	94/42.6	16 x 6	124/56.2	4 x 4	40/18.1	
	6	110/49.9	16 x 8	124/56.2	6 x 4	62/28.1	
	8	125/56.7	16 x 10	124/56.2	6 x 6	80/36.3	
	10	140/63.5	16 x 12	124/56.2	8 x 6	108/49.0	
	12	160/72.6	20 x 10	220/99.8	8 x 8	105/47.6	
16	6	228/103.4	20 x 12	205/93.0	12 x 8	162/73.5	
	8	248/112.5	20 x 16	200/90.7	12 x 12	215/97.5	
	10	264/119.7	24 x 12	305/138.3	16 x 16	385/174.6	
	12	280/127.0	24 x 16	320/145.1			
	14	316/143.3	24 x 20	300/136.1			
	16	322/146.1	MJ-MJ BENDS				
20	6	315/142.9	Size*	Weight-Lb/Kg			
20	8	345/156.5		90E	45E	222E	113E
	10	370/167.8	4	27/12.2	23/10.4	18/8.2	16/7.3
20	12	395/179.2	6	39/17.7	32/14.5	32/14.5	30/13.6
	16	465/210.9	8	57/25.9	46/20.9	46/20.9	42/19.1
	20	535/242.7	10	89/40.4	70/31.8	64/29.0	58/26.3
24	6	415/188.2	12	408/49.0	86/39.0	84/38.1	74/33.6
	8	445/201.8	16	264/119.7	202/91.6	178/80.7	158/71.7
	10	470/213.2	20	400/181.4	305/138.3	310/140.6	245/111.1
	12	500/226.8	24	565/256.3	405/183.7	412/186.9	315/142.9

COMPACT MECHANICAL JOINT DUCTILE IRON FITTINGS (cont.)		
MJ TEES		
Run*	Branch*	Weight-Lb/Kg
	16	580/263.1
	20	660/299.4
	24	720/326.6
MJ SLEEVES		
	Weight-Lb/Kg	
Size*	Short	Long
4	17/7.7	20/9.1
6	28/12.7	36/16.3
8	38/17.2	46/20.9
10	49/22.2	61/28.1
12	56/25.4	76/34.5
16	130/59.0	172/78.0
20	195/88.4	255/115.7
24	255/115.7	335/152.0
*Multiply by 25 to convert to millimeters		

13.03 HYDRANTS

Hydrants will be paid for at the contract unit price per hydrant installed complete with drainage pit, gravel, concrete base, and bracing. Hydrant extensions will be paid for at the contract unit price per lineal foot, where specified by the engineer. The unit price for the hydrant does not include the auxiliary hydrant valve which shall be paid for under another item of these specifications, unless they are combined in the bid proposal.

13.04 VALVES AND BOXES

Valves, boxes, and valve adapters (including extensions or valve stem risers) will be paid for at the contract unit price bid for each size valve and box furnished and installed complete.

13.05 COPPER WATER SERVICE PIPE

Copper water service pipe will be paid for at the contract unit price per lineal foot, for each diameter of pipe furnished, measured from the centerline of pipe to the centerline of curb box. The unit price shall include all pipe, fittings, laying, excavation, backfilling, insulating and testing.

13.06 CORPORATION COCKS

Corporation cocks will be paid for at the contract unit price for each size furnished and installed and shall include the saddle where required and the tap or connection to the water main.

13.07 SERVICE SADDLES

Service saddles shall be considered incidental to the corporation cocks as per section 14.06.

13.08 CURB STOPS AND BOXES

Curb stops, boxes and extensions will be paid for at the contract unit price for each size furnished and installed and shall include necessary fill when required.

13.09 AIR RELIEF MANHOLES

Air relief manholes will be paid for at the contract unit price per manhole installed complete as detailed including corporation cock.

13.10 PILING

Piling up to 20 feet long including caps shall be paid for at the contract unit price for each single pile bent in place. No additional payment will be made for cradles.

Any piling required over 20 feet in length shall be paid for as excess length of piling. Cut off lengths will not be paid.

Double pile bents shall be paid for according to the length of each individual pile. There shall be no additional compensation for lumber or hardware used to tie the piles together.

13.11 SPECIAL CONDITIONS

Material used for refilling to pipe foundation grade to assure firm foundation for pipe shall be paid for at the contract unit price per ton in place. No foundation material will be paid for that is installed without the knowledge or consent of the engineer nor will payment be made for rock installed only for dewatering purposes. Payment shall include cost of excavation and placement.

13.12 SPECIAL SECTIONS

Special sections will be paid for at the contract price on a lump sum basis for all work and material necessary for the complete installation of construction.

13.13 SHEETING ORDERED LEFT IN PLACE

Sheeting ordered left in place shall be paid for at the contract unit price per 1000 board feet.

13.14 JACKING

Payment for jacking will be paid for at the contract unit price per lineal foot. Water main used in jacking will be paid separately at bid unit prices for that diameter water main.