

**CITY OF LAKEVILLE  
STANDARD SPECIFICATIONS  
FOR ALL UNDERGROUND CONSTRUCTION  
FOR PUBLIC IMPROVEMENTS  
TO BE MAINTAINED BY THE CITY**

**SECTION 3**

## **UNDERGROUND CONSTRUCTION INDEX**

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**CITY OF LAKEVILLE STANDARD SPECIFICATIONS FOR  
UNDERGROUND CONSTRUCTION**

- 1.00 **SCOPE:** This work shall consist of the construction of watermain, forcemain, sanitary and storm sewer, draintile, and building service pipelines utilizing plan fabricated pipe and other appurtenant materials installed for conveyance of potable water, sewage, industrial wastes or storm water. The work includes the relocation or adjustment of existing facilities as may be specified in these specifications.
- 2.00 **SPECIFICATION REFERENCE:** The Standard Utilities Specifications prepared by the City Engineers Association of Minnesota, 2018 Edition, shall govern underground construction except as modified or altered herein by these specifications.

Measurement for payment of work performed shall be in accordance with Mn/DOT specifications or C.E.A.M. specifications unless modified by Special Provision Specifications.

In the above-referenced state specifications, any words referring to the State of Minnesota or the Department of Transportation shall mean the Owner.

- 3.00 **MATERIALS:** All materials required for this work shall be new, USA made materials conforming to requirements of the referenced specifications for the class, kind, type, size, grade and other details indicated in the Contract Documents. Unless otherwise indicated, all required materials shall be furnished by the Contractor. If any options are provided for, as to type, grade or design of the material, the choice shall be limited as may be stipulated in the Contract Documents.
- 3.01 **Shop Drawings:** All manufactured products shall conform in detail to such standard design drawings as may be referenced or furnished in the Contract Documents. Otherwise, the Owner may require advance approval of material suppliers, product design, or other unspecified details as it deems desirable for maintaining adopted standards.
- 3.02 **Sanitary Sewer Poly-vinyl Chloride (PVC) Pipe and Fittings:** Sanitary Sewer poly-vinyl chloride (PVC) pipe and fittings shall conform with the following specifications:

4" through 6"	ASTM D3034, SDR 26 with rubber gasket joints
8" through 15"	ASTM D3034, SDR 35 with rubber gasket joints
18" through 48"	ASTM F679 with rubber gasket joints

PVC pipe shall conform to the following specifications for various trench depths computed from invert of pipe to finished centerline grade.

SDR-35	Up to 18 v.f.
SDR-26	Up to 28 v.f.
SDR-18, AWWA C-900, C-905	28 v.f. to 32 v.f.
Polybond Lined DIP, ASTM A746	32 v.f. and over

Sanitary Sewer wyes shall be molded SDR-26 or Schedule 40 material. Epoxy lined DIP TEE fittings for sanitary application shall be used in the depth range from 18vf to 28vf.

No sanitary sewer services will be allowed over 28 v.f. in depth at the main. Alternate designs must be submitted to the City Engineer for approval. One alternate design can be achieved by using sanitary sewer manholes of various inside diameters with inside drops as per detail plate No. LV-SS-10.

A...PVC – Storm Sewer: Poly-Vinyl Chloride pipe with rubber gasket joints may only be used outside of paved area (in green areas). The pipe material and class specification for depth is the same as for sanitary sewer. A-2000 pipe meeting ASTM F949 standards and installed in accordance with ASTM D2321 is an acceptable alternative. The minimum allowable pipe diameter is 12” and a manhole must be installed at the end of the line. Use of HDPE storm sewer pipe is not permitted, unless approved by the City Engineer.

3.03 Reinforced Concrete Pipe and Fittings: All branch fittings such as tee and wye sections shall be cast as an integral part of the pipe conforming to the same strength class as the pipe to which it is attached. The pipe shall conform to the type, size and strength class specified. Reinforced concrete pipe, fittings and special appurtenances shall conform to the following specifications:

A...Reinforced Circular Pipe: Reinforced circular pipe shall conform to ASTM C-76 for wall B pipe.

1...Confined Rubber O-Ring Gasket Joint: Unless otherwise specified, the confined rubber O-ring gasket joint shall conform to the Bureau of Reclamation R-4 joint specification.

2...Rubber Gasket Joint: The alternate rubber gasket joint, when specified, shall conform to ASTM C-361 pressure watertight gasket. Use ASTM C-443 gravity watertight joint.

3...Reinforced Concrete D-Load Pipe: Reinforced concrete D-load pipe shall conform to the requirements of ASTM C-655 and shall be furnished when the D-load is shown on the plans or when the D-load exceeds the D-load for Class V pipe as described in ASTM C-76.

B...Reinforced Arch Pipe: Reinforced arch pipe shall conform to ASTM C-506. The joint sealant shall conform to Federal Specification 55-5-00210. All joints shall be sealed with Gator Wrap brand butyl wrap, or approved equal, at least 12” wide. All joints on reinforced arch pipe must be tied.

C...Precast Concrete Box Culvert: Precast concrete box culverts shall conform to ASTM C-789 for HS-20 live load and depth of cover as shown on the plans. The joint sealant shall conform to Federal Specification 55-5-00210. All joints shall be sealed with Gator Wrap brand butyl wrap, or approved equal, at least 12” wide. All joints on precast concrete box culverts must be tied.

D...Reinforced Concrete Low-Head Pipe: Reinforced concrete low head pressure pipe conforming to ASTM C-361 shall be furnished when specified. Unless otherwise specified, the minimum class shall be D-125.

E...Unrestrained culverts: All joints on unrestrained culverts must be tied.

3.04 Precast Concrete Manhole and Catch Basin Sections: Precast concrete barrel, riser sections and appurtenant units (grade rings, top and base slabs, special sections, etc.) used in the construction

of manhole and catch basin structures shall conform with the requirements of ASTM-C-478, subject to the following supplementary provisions:

A...The precast sections and appurtenant units shall conform to all requirements as shown on the plans or in the Standard Plates.

B...Air-entrained concrete shall be used in the production of all units. Air content shall be maintained within the range of 5 to 7 percent.

C... Doghouses and voids to be filled with concrete block or brick no sand mix block or brick will be allowed.

D...Non-shrinking grout mix designed for underground utility construction shall be used for all structures to provide a waterproof barrier.

E...Sanitary sewer manhole sections shall conform to the following additional requirements:

1...The base of the manhole shall be cast integral with the bottom section of the manholes unless noted otherwise.

2...The pipes with an outside diameter of 21-inches or less, the inlet and outlet joint shall be with a watertight joint consisting of a rubber boot with a non-magnetic, corrosion resistant steel coupling band or equal. For pipes with an outside diameter larger than 21 inches, the bell and spigot inlet and outlet shall be cast integral with the bottom section of the manhole unless noted otherwise.

3...Sanitary sewer manholes to have Infi-shield or engineer approved equivalent external manhole chimney seal.

F...Press-Seal Gasket corporation's EZ-Stik Butyl Joint Sealant (or approved equal) shall be applied on outside edge, each joint of manhole section.

G...All exterior joints (base to cone) shall be sealed with Gator Wrap brand butyl wrap, or approved equal at least 12 -inches wide.

H. RCP connections to structures remove spigot end /bell (see notes from 2017).

3.05 Ductile Iron Pipe and Fittings: The pipe and fittings furnished shall be manufactured in the USA and shall be of the Ductile Iron type as specified for each particular installation. Unless as noted otherwise in the plans and/or Special Provisions, pipe shall be Class 52.

Ductile iron pipe shall conform to the requirements of ANSI A-21.51 (AWWA C-151). In addition, the pipe shall comply with the following supplementary provisions:

A...Fittings:

1...Fittings shall conform to the requirements of ANSI -21.10 (AWWA C-110) or ANSI A-21.53 (AWWA C-153), and manufactured by Tyler, American Cast Iron Pipe Company, U.S.

Pipe or approved by the City Engineer. When the pay item on the contract is by the pound, C-153 weights will be used.

2...Pressure Rating: All ductile fittings 3-inches to 12-inches shall be pressure rated at 250 psi, 14 inch and larger fittings shall be pressure rated at 150 psi.

3...All fittings shall be installed utilizing Stainless steel bolts that are manufactured in the USA.

**B...Joints:**

1...Slip-on and Mechanical Joint Fittings: The rubber gasket shall conform to ANSI A-21.11 (AWWA C-111).

2...Flange Fittings: Flange fittings shall conform with ANSI A-21.15 (AWWA C-115). Flange fittings shall not be used below ground except with the approval of the Engineer. Flange fittings may be used within wet wells, manholes and other appurtenances.

3...Conductivity:

a...Appropriate means for electrical conductivity shall be provided at each gasket joint.

b...Conductivity straps shall bridge epoxy fittings.

C...Anchoring of Watermain Fittings: Restrained joints shall be provided on all bends having a deflection of 11.25 degrees or greater, tees, crosses, plugs, caps and hydrants. Hydrants shall be restrained to the lateral watermain tee. Plugs shall also have poured concrete thrust blocking in accordance with Lakeville Detail Plate No. LV-WM-6. In addition to restraining joints at fittings with mechanical joint restraints, the pipes in each direction from **all** fittings shall be restrained for a length equal to or greater than that shown in the table below:

<b>Pipe Diameter</b>	<b>90 Degree Bends, Tees and Crosses</b>	<b>45 Degree Bends</b>	<b>22.5 and 11.25 Degree Bends</b>	<b>Dead Ends</b>
6 inch				40 feet
8 inch				40 feet
12 inch	27 feet	12 feet	10 feet	66 feet
16 inch	35 feet	15 feet	10 feet	86 feet
20 inch	42 feet	18 feet	10 feet	101 feet
24 inch/30 inch	50 feet	21 feet	10 feet	119 feet

1...Mechanical Joint Restraints: Mechanical joint restraints for ductile iron pipe shall be manufactured in the USA by Ebba iron-megalugs, or as approved by the City Engineer. On PVC pipe, the joint restraints shall be manufactured in the USA by Ebba iron-megalugs or approved equal. Trumbull "Tie-Lugs" shall be used to offset threaded rods from the flange connection.

2...Mechanical Restrained Joints: Mechanical restrained joints for 16 inch and larger watermain shall be restrained with rods and Ebba iron-megalugs or as approved by Engineer.

3...Restrained Joint Gaskets: Gaskets for 6 inch, 8 inch and 12 inch watermain shall be “Fast Grip” by American Cast Iron Pipe Company, “Field Lock” by Griffon Pipe and “Field Lock” by U.S. Pipe.

4...Restrained Joints may be installed using the following method: Place D.I.P Flange behind the bell end of the pipe, place a mechanical joint restraint on the spigot end and install ¾ inch threaded rod between flanges. Apply corrosion protection material.

6” D.I.P. Watermain	2 Rods
8” D.I.P. Watermain	4 Rods
12” D.I.P. Watermain	6 Rods
16” D.I.P. Watermain	8 Rods
20” D.I.P. Watermain	10 Rods
24” D.I.P. Watermain	12 Rods
30” D.I.P. Watermain	15 Rods

This method of restrained joints must also be approved by the pipe manufacturer.

D...DIP: All pipe and fittings used for watermain shall be furnished with cement mortar lining meeting the requirements of ANSI A-21.4 (AWWA C-104) for standard thickness lining. All pipe and fittings used with sanitary sewer shall be furnished with an Interior Lining Protecto 401 by U.S. Pipe, Protecto 401 by American Pipe, Sewper Coat by Griffin Pipe, or an approved equal. All interior and exterior surfaces of the pipe and fittings shall have a tar or bituminous seal coating at least one mil thick. Spotty or thin seal coating or poor coating adhesion shall be cause for rejection.

Ductile Iron Fittings: All fittings shall be ductile iron Class 350 compact fittings in accordance with ANSI/AWWA C153/A21.53-84. All fittings shall be fusion-bonded epoxy coated, conforming to ANSI/AWWA C550 and C116/A21.16 requirements. The thickness of the coating shall be 6-8 mils.

All restraints shall be fusion bonded epoxy coated on the inside and outside according to ANSI/AWWA C550 and C116/A21.16. The thickness of the coating shall be 6-8 mils. All bolts and fasteners are to be stainless steel and manufactured in the USA.

**All water main bolts and restraining rods are to be stainless steel and manufactured in the USA. Anti-seize lubricant shall be used on all stainless-steel bolts and restraining rods at connection points.**

Retainer Glands: Retainer glands shall be ductile iron designed to withstand pressures shown in Table No. 9-6 of American Cast Iron Pipe Company’s catalog. Retainer glands shall be by American, US Pipe or Mega-Lug type and shall be used at all changes in direction and at all fittings and valves in addition to reaction blocking. This shall be considered incidental to water main pipe.

All pipe shall be cast and lined at the same manufacturing plant before shipping of the finished product.

- 3.06 Water Main Polyvinyl Chloride Pipe: All PVC water main pipe shall conform to AWWA Standard C-900-97 (DR 18). The bell shall consist of an integral wall section with a factory-installed, solid cross-section elastomeric ring that meets the requirements of ASTM F-477. Tracer wire shall be laid with all PVC water mains. Tracer wire shall be installed in accordance with the Minnesota Rural Water Association “Sewer/Water Utility – Trace Wire Specification” as modified by the City of Lakeville (Paragraph 8 of this specification). **Water service taps shall not be made directly to PVC water main pipe. Service taps shall be made only to epoxy coated ductile iron or stainless steel fittings (saddles).**

All hydrant lead piping (hydrant assembly) shall conform to AWWA Standard C-900-97 (DR 18).

Fitting: All fittings used with PVC water main pipe shall be epoxy coated ductile iron, meeting the requirements outlined in Section 3.05.D.

- 3.07 Polyethylene Encasement Material: Polyethylene encasement material shall conform to the requirements of ANSI A-21.5 (AWWA C-105) for tube type installation and a minimum 8-mil nominal film thickness, and shall be used on all watermain.

- 3.08 Fire Hydrants: All fire hydrants shall be American Flow Control Model Pacer Fire Hydrant as manufactured by the Waterous Company, South St. Paul, MN. All hydrants shall conform to AWWA C-502 latest revision unless otherwise specified in the Contract Documents. Hydrants shall be furnished in compliance with the following supplementary requirements:

A...Hydrants shall be dry barrel compression fire hydrants that opens against the water pressure and shall have a five and a quarter inch (nominal diameter) main valve opening.

B...Hydrant traffic section and lower barrel shall be ductile iron. The traffic section shall be 16 inches to allow for a nozzle elevation of 24 inches from the centerline of the steamer connection to the final grade. The allowable distance between the ground flange and the final grade shall be 2 to 4-inches. All hydrant extensions, if required, shall be furnished by the Contractor and be manufactured by American Flow Control. No after market hydrant extensions will be accepted.

C...Hydrant nozzle section shall have two 2-1/2 inch (I.D.) hoze nozzles and one 4-1/2 inch (I.D.) steam nozzle. All nozzles shall be National Standard Threads.

D...Hydrant bury depth shall be as shown in the Standard Plate.

E...Hydrant operating nut shall be two piece 1-1/2 inch pentagon. Operating nuts with weathershield will not be accepted. Hydrant operating threads shall be factory lubricated and o-ring sealed from water, moisture and foreign debris.

F...No drain hydrants shall be provided in areas where the hydrant is installed below the water table. Hydrant drains shall be plugged by the manufacturer. A bronze tag shall be attached to hydrant with “NO DRAIN, PUMP AFTER USE” embossed on the plate and the hydrant steamer nozzle cap shall be painted black.



G...The hydrant bottom shall be ductile iron, 6” mechanical joint, epoxy coated unless otherwise noted. The bottom bolts shall be grade 304 stainless steel.

H...If a hydrant extension is allowed, the Contractor will be required to remove the lower operating rod and install a new rod to the vertical height to include the extension being used.

- 3.09 Hydrant Locator and Out of Service Sign: Each hydrant shall be provided with a 60” Hydrfinder Marker (no ball on top), as manufactured by Rodon Corporation, or approved equal. One marker replacement shall be provided to the Owner for every six hydrants installed or a minimum of one per project.

A hydrant out of service sign tag shall be installed on all hydrants when not in service as manufactured by Hydra-Schild, HSGN-4.5 or equal, at the contractor’s expense.

- 3.10 Hydrant Wrenches: One hydrant wrench shall be supplied to the Owner for every six hydrants installed or a minimum of one per project.

- 3.11 Hydrant Extensions: One 6-inch hydrant extension shall be supplied to the Owner for every six hydrants installed or a minimum of one per project. The hydrant extensions shall be Waterous K562.

- 3.12 Gate Valves: Valves shall be ductile iron resilient-wedge gate valves as manufactured by the Clow Corporation, Mueller, Waterous or approved equal. The valves shall meet all applicable requirements of AWWA C509 with mechanical joint ends and the following supplementary requirements:

A...Buried service gate valves shall have a 2 inch operating nut opening counter-clockwise.

B...All gate valves shall be furnished with O-ring stem seals.

C...Bolts used for connection shall be Stainless steel bolts manufactured in the USA.

D...Epoxy-coated valves shall be bridged with a conductivity strap.

E...16” and larger gate valves to be furnished with beveled gears for easier operation.

F...No butterfly gate valves shall be allowed, with the exception of a raw watermain unless approved by the City Engineer.

- 3.13 Valve Boxes: Valve boxes shall be manufactured in the U.S., screw-type, three piece Tyler 6860, Bingham & Taylor V-626, Size “G” or equal and adjust to 8 ½ feet fully extended and to provide 6” of adjustment above and below finished grade. Valve box shall have a 3 ½ inch drop lid with the word “WATER” on the lid. Prior to acceptance of a valve box during the Public Works inspection a 4-inch PVC pipe or approved equal must be placed in each valve box to demonstrate proper alignment with the valve box sections and operating nut on the gate valve.

A...Provide valve box extensions as required to meet finished grades. Valve box extensions shall be screw type.

B...Provide valve box aligner Power Seal Model 5000 or approved equal per each gate valve installed.

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

3.14 Water Service Pipe and Fittings: Water service pipe of 3 inches or larger inside diameter shall conform to the requirements specified in Section 3.05 of these specifications.

3.15 Copper Water Service Pipe: Water service pipe of 2 ½ inches or less in inside diameter shall conform to the requirements of ASTM B-88 for seamless copper water tube, Type K, soft annealed temper. Unless specified otherwise, all service pipe shall be copper water service pipe.

No compression fittings except Ford will be allowed. Flare type joints or silver solder methods must be approved by the City Engineer.

3.16 Water Service Pipe Fittings: All fittings for copper tubing shall be cast brass, having uniformity in wall thickness and strength and shall be free of defects affecting serviceability. All copper pipe fittings 1 inch and smaller shall be flared. All threaded service line fittings shall conform to the requirements of AWWA C-800. Each fitting shall be permanently and plainly marked with the name or trademark of the manufacturer.

3.17 Corporation Stop: Corporation stop shall be the ball valve type in accordance with the following schedule:

Size

Manufacturer and Model Number

1 inch through 2 inches

Mueller B-2500, Ford 1" FB600-4, 1-1/2" FB600-6, 2" FB600-7 or A.Y. McDonald 4704-B

1 inch corporations shall be 1 inch by 1 inch

Saddles shall be used for all connections to 6-inch or smaller watermains, on all PVC watermain and for all other connections where the watermain cannot support 3 full threads for the size of corporation stop installed. Saddles shall be PowerSeal 3412AS all stainless steel double stud bolt design or approved equal.

All services are to be tapped with the watermain under working pressure.

3.18 Curb Stop: Curb stop shall be Minneapolis pattern for copper service pipe inlet and outlet in accordance with the following schedule:

SIZE	MANUFACTURER AND MODEL NUMBER
1 inch	Mueller (Oriseal Mark II) H-15154, Ford B22-444M or A.Y. McDonald 6104
1 ½ inches	Mueller (Oriseal Mark II) H-15154, Ford B22-666M or A.Y. McDonald 6104
2 inches	Mueller (Oriseal Mark II) H-15154, Ford B22-777M or A.Y. McDonald 6104

3.19 Curb Box:

A...Curb stop service boxes shall be gray iron castings conforming to the requirements of ASTM A-48 for Class 20 or higher tensile strength. The curb stop service assembly shall have a one foot adjustment range and shall extend to 8 feet when fully extended.

B...Curb box shall be an extension type with stationary rod, Minneapolis pattern base and 1 ¼ inch upper section.

C...Pig tails shall be plugged with copper plug and pressure tested to the plug.

D...Curb stops installed in paved areas shall have a meter box cover as manufactured by Ford or approved equal. The meter box cover shall be incidental to the curb stop unit price.

E...Curb boxes shall be ball valve type in accordance with the following schedule:

SIZE	MANUFACTURER AND MODEL NUMBER
1 inch	Mueller H-10300, Ford EM2-80-46-72R or A.Y. McDonald 5614L
1 ½ to 2 inches	Mueller H-10300 with H-10344 Adapter, Ford EM2-80-47-72R or A.Y. McDonald 5615

3.20 Piling: Piling shall be constructed in accordance with the provisions of Mn/DOT 2452. Piles for pipelines shall be treated timber unless specified otherwise.

3.21 Insulation: Wrap around insulation shall conform to ASTM C-552-91 and cover the entire pipe, pipe joints and bends for those areas designated on the plans or directed by the Engineer. The insulation shall be installed with bands as per the manufacturer's specification and four inches in thickness.

Sheet insulation board (polystyrene) shall conform to ASTM C-578-95. Sheets shall be installed above the pipe a minimum of 2 feet each way of pipe centerline. The insulation shall be of a waterproof type and installed to four inch thickness.

3.22 Manhole Steps: Manhole steps shall be made with an approved plastic such as copolymer polypropylene meeting with the requirements of ASTM 2146, Type II, Grade 49108, reinforced with a deformed 3/8 inch diameter reinforcing bar which conforms to the requirements of ASTM A-615, Grade 60. All manhole steps shall conform to the dimensions shown in the Standard Plate(s). Manholes less than 4' deep shall have one step located 16" down from top of casting.

4.00 CONSTRUCTION REQUIREMENTS:

4.01 Establishing Line and Grade: The primary line and grade will be established by the Engineer in accordance with the General Conditions and the Supplementary Conditions and with the following. For trench installation, line and grade stakes will be set parallel to the proposed pipeline at an appropriate offset therefrom as will best serve the Contractor's operations wherever practical.

The Contractor shall arrange his operation to avoid unnecessary interference with the establishment of the primary line and grade stakes, and shall render whatever assistance may be required by the Engineer to accomplish the staking.

The Contractor shall be responsible for preservation of the primary stakes, and shall bear the full cost of any re-staking necessitated by his negligence.

Cut sheets will be required for all staking operations. Stationing will be required to show exact locations of all service wyes, fitting locations, and laterals. See Section 4.07 for locating procedures.

- 4.02 Staking Notice: The Contractor shall give the Engineer 48 hour notice of a need for stakes on the project.
- 4.03 Tunnel Installation: For tunnel installation, line and grade stakes will be set directly above the proposed pipeline setting. Grade and line stakes will be set at 25 foot intervals along the pipeline, at each change in line or grade and as needed for pipeline appurtenances and service lines.
- 4.04 Laser Beam Grade Control: When the Contractor uses laser beam control for grade and alignment, the Contractor shall check into the grade stakes provided. Any discrepancies found between the laser beam elevation and grade stake elevation shall be immediately brought to the Engineer's attention before continuing pipe installation. Failure to check into grade stakes provided or to notify the Engineer of discrepancies shall put the full responsibility on the Contractor for any removal and reinstallation of pipe necessary to conform to the line and grade shown on the plans.
- 4.05 Contractor's Responsibility: The Contractor shall be solely responsible for the correct transfer of the primary line and grade to all working points and for construction of the work to the prescribed lines and grades as established by the Engineer.
- 4.06 Location of Underground Utilities: The location of underground utilities is based on available information. The Contractor shall be solely responsible for investigating and locating the existing underground utilities (such as electric, telephone, gas, water and sewer service mains, cable, etc.). Relocation of existing utilities shall be coordinated with the Owner of the specific utility by the Contractor. Where the utility owner elects to perform the utility relocation work, the Contractor shall schedule his work to comply with the utilities schedule. No additional compensation shall be allowed for delays caused by the utility company's schedule, nor for delays caused by the utilities relocation efforts. It shall be a construction priority for the Contractor to contact Gopher State One Call 651-454-0002 for utility locations before doing any underground excavation.
- 4.07 Field Location of Newly Constructed Utilities. The contractor shall assist the inspector/engineer in locating all horizontal bends, corporation stops, wyes, curb stops, valves, fittings and all other appurtenances required for MNOPS requirements. This may require leaving areas open to allow for survey location or for assisting in gathering swing ties for these items to an above grade permanent structure prior to backfilling the trench. If items are backfilled prior to the field information being documented, the contractor has the sole responsibility of exposing the item

and assisting in its location. No additional compensation will be given to contractor for this work.

- 4.08 Extra Work: Wherever alterations are required as a result of unforeseen underground interferences not due to any fault or negligence of the Contractor, the Engineer will issue a written order covering any additional or extra work involved and specifying the revised basis of payment, if any. Any alterations made strictly for the convenience of the Contractor shall be at the Contractor's expense. No additional compensation shall be allowed for notification and relocation of gas, electric, etc. utilities.

No extra compensation will be allowed for delays caused by the interference of underground structures.

- 4.09 Sanitary Sewer and Watermain Crossing Conflicts: Watermains crossing sanitary sewers shall be laid to provide a vertical separation of at least 18 inches between the outside of the watermain and the outside of the sewer. When conditions prevent a vertical separation as described, the following construction shall be used:

Sewers passing over or under watermain shall be constructed of materials equal to watermain standards of construction for a distance of 10 feet from the watermain as measured perpendicular to the watermain.

A length of the watermain pipe shall be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

- 4.10 Removal of Surface Improvements: Removal of surface improvements in connection with trench excavation shall be limited to actual needs for installation of the pipeline and appurtenances, based on the trench widths and any other controls imposed in connection with the work. Removal operations shall be coordinated with the excavation and installation operations in such a manner as will cause the least practical disruption of traffic or inconvenience to the public. Removed debris shall not be deposited at locations that will block access to fire hydrants, private driveways or other essential service areas. Removal and final disposal of debris shall be accomplished as a single operation wherever possible, and in any event, the debris shall be removed from the site before starting the excavating operations.

- 4.11 Interruption of Water Service: The Contractor shall be responsible for providing water to affected homes and businesses during the course of the project.

The Contractor shall be responsible for furnishing a temporary water supply to areas affected by the Contractor's construction process.

The Contractor shall supply temporary water service by furnishing and delivering bottled water for cooking and drinking, and bulk water by temporary hosed connections for other uses. Plans for providing temporary water service shall be submitted by the Contractor to the City Engineer for review and approval.

Interruption of water service to businesses or in commercial areas must be approved by the City prior to each interruption of service. The City will determine the time and duration of the service interruption.

All items related to furnishing, installing, operating, maintaining and removal of temporary water service shall be considered incidental to the project.

4.12 Jacking Steel Casing Pipe: The Contractor shall jack-bore steel casing pipe in place as shown on the plans.

The most recently published Mn/DOT Specifications for Construction shall govern except as modified herein.

The steel casing shall have a minimum wall thickness of 0.50". The casing may consist of salvaged material, but deviation from plan diameter and plan wall thickness will not be allowed. The casing may also be comprised of both salvaged and new materials. The casing shall have two coats of copper bismastic and two 17-pound anode packs attached for corrosion protection.

Jacking requirements:

A 1 ½ inch pipe shall be forced along the top of the casing pipe. Bentonite grout under pressure shall be forced through this pipe at **ALL** times during the jacking operation to fill any voids that might develop above the casing. The 1 ½ inch pipe shall be 18 inches back from the lead edge of the jacking pipe.

- There shall be a shield, with a method to control the flow of materials.
- No jacking of pipe will be allowed below water table until it has been dewatered.
- If a void develops, the jacking shall stop until the void has been filled by an approved method.
- Any dewatering shall have prior approval in writing by the office of the City Engineer.
- Shields shall conform to the size and shape of the pipe.
- The lead cutting edge of the machine shall be approved by the Engineer.
- When augers are used, the type of head shall be approved by the Engineer, and the auger shall be located 6 inches back from the lead edge of the jacking pipe.
- The machine shall be capable of controlling line and grade, and the flow of materials.
- The machine shall conform to the size and shape of the pipe.

The Contractor shall provide skids and blocking as necessary to install gravity flow pipe to proper grade and alignment within the casing pipe.

Upon completion of the carrier pipe installation, the annular space between the carrier and casing shall be densely filled with sand and the ends sealed with cement grout. The sand shall be blown into the annular space or installed by other approved methods.

Backfilling of jacking pit excavation shall be in accordance with Mn/DOT 2106 and be completed without undue delay.

The Contractor shall be responsible for obtaining all permits, bonds, etc. required.

- 4.13 Jacking Concrete Pipe: The Contractor shall jack-bore concrete pipe in place as shown on the plans.

The most recently published Mn/DOT Specifications for Construction shall govern except as modified herein.

RCP Pipe requirements: The RCP pipe shall consist of Class V jacking pipe with R-4 joints. Pipe shall be manufactured in accordance with ASTM C-76 specifications.

Jacking Requirements:

A 1 ½ inch pipe shall be forced along the top of the casing pipe. Bentonite grout under pressure shall be forced through this pipe at **ALL** times during the jacking operation to fill any voids that might develop above the casing. The 1 ½ inch pipe shall be 18 inches back from the lead edge of the jacking pipe.

- There shall be a shield, with a method to control the flow of materials.
- No jacking of pipe will be allowed below water table until it has been dewatered.
- If a void develops, the jacking shall stop until the void has been filled by an approved method.
- Any dewatering shall have prior approval in writing by the office of the City Engineer.
- Shields shall conform to the size and shape of the pipe.
- The lead cutting edge of the machine shall be approved by the Engineer.
- When augers are used, the type of head shall be approved by the Engineer, and the auger shall be located 6 inches back from the lead edge of the jacking pipe.
- The machine shall be capable of controlling line and grade, and the flow of materials.
- The machine shall conform to the size and shape of the pipe.

Backfilling of jacking pit excavation shall be in accordance with Mn/DOT 2106 and be completed without undue delay.

The Contractor shall be responsible for obtaining all permits, bonds, etc. required.

- 4.14 Classification and Disposition of Materials: Excavated material will be classified for payment only to the extent that the removal of materials classified by the Engineer as rock will be paid for separately from other unclassified materials, either as a separate contract item or as an extra work item when no bid price is applicable. All other materials encountered in the excavations, with the exception of items classified for payment as structure removals, will be considered as unclassified excavation unless specified otherwise. Unclassified materials shall include muck, rubble, wood debris and boulder, stone, masonry or concrete fragments less than 1 cubic yard in volume, together with miscellaneous matter than can be removed effectively with power-operated excavators without resorting to drilling and blasting.
- 4.15 Rock Excavation Defined: Rock excavation shall be defined to include all hard, solid rock in ledge formation, bedded deposits and unstratified masses; all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; and any boulder, stone, masonry or concrete fragments exceeding 1 cubic yard in volume. Materials such as shale, hard

pan, soft or disintegrated rock which can be dislodged with a hand pick or removed with a power-operated excavator will not be classified as rock excavation.

- 4.16 Rock Excavation: When rock foundation materials are encountered at the established grade, additional materials shall be removed as directed by the Engineer to produce an acceptable foundation. Unless directed otherwise, rock shall be removed to an elevation 12 inches below the lowest projection of pipe bells. Excavation below grade shall be to a minimum width equal to the outside pipe diameter plus 2 feet. Rock shall be removed to such additional horizontal dimensions that will provide a clearance of 12 inches on all sides of appurtenant structures such as valves, housings, manholes, access structures, etc.
- 4.17 Excavation for Granular Foundation: When unstable foundation materials are encountered at the established grade, additional materials shall be removed as directed by the Engineer to produce an acceptable foundation.
- 4.18 Pipe Bedding Requirements: Pipe bedding shall be in accordance with the manufacturer's recommendations for the type of pipe installed. Concrete pipe must be bedded to a minimum of the Class B bedding requirements. D.I.P. and Thermoplastic Pipe for sewers and watermains must follow the requirements of the CEAM Specification 2600.2A1 under bedding and encasement materials. Sanitary sewer and water services shall be bedded from a point 6" below the bottom of the pipe to 12" above and around the sides of the pipe being installed. Extreme care must be taken in the bedding and the backfilling of individual services. Compaction of this material shall be to 95 percent of maximum density (ASTM N698). Furnishing, installing and compaction of granular materials around pipe shall be considered incidental to the installation of the pipe with no additional compensation allowed therefore. The trench shall be excavated and prepared to allow placement of the bedding materials specified. The trench width at ground level shall be kept as narrow as practicable without causing sluffing or cave in accordance with OSHA standards.
- 4.19 Over-Excavation: Care shall be taken during final subgrade shaping to prevent any over-excavation. Should any low spots develop, they shall only be filled with suitable material which shall have optimum moisture content and be thoroughly compacted. The finished subgrade shall be maintained free of water, and shall not be disturbed during pipe lowering operations except as necessary to remove pipe slings. The discharge of trench dewatering pumps shall be directed to natural drainage channels or storm water drains.
- 4.20 Extra Work: All costs of excavating below grade and placing foundation or bedding aggregates shall be included in bid prices for pipe items to the extent that the need for such work is indicated in the Contract Documents, and the Proposal does not provide for payment under separate contract items. Any excavation below grade and any foundation or bedding aggregates required by order of the Engineer in the absence of contract requirements in the Contract's Documents will be compensated for separately as extra work items.

## 5.00 INSTALLATION OF PIPE AND FITTINGS

- 5.01 Sanitary Sewer Stubs and Cleanouts: The Contractor shall furnish and install PVC cleanouts at the end of all mainline sanitary sewer stubs which are installed for future connection. PVC cleanouts must be 6" diameter SDR 26 pipe and must have cast iron caps capable of being



located with a metal detector. Actual Horizontal Location and invert elevations at the end of the stub shall be taken and recorded prior to trench backfill.

- 5.02 Watermain Stub Markers: The Contractor shall furnish and set vertically 4" x 4" x 8' wooden markers extending 18 inches above the ground to mark the exact ends of all watermain stubs which are installed for future connections. The stubs must be field located both horizontally and vertically prior to backfill.
- 5.03 Storm Sewer and Drain Tile Stub Markers: The Contractor shall furnish and set vertically 4" x 4" wooden markers extending from the invert of the stub to 18 inches above the ground to mark the exact ends of all storm sewer stubs which are installed for future connection, and a clean out installed on the end of all drain tile services per LV-STM-10. Actual Horizontal Location and invert elevations at the end of the stub shall be taken and recorded prior to trench backfill.
- 5.04 Connection to Existing Sanitary and Storm Sewer: The Contractor will be required to core drill any connection to an existing sanitary sewer manhole which does not have an existing stub. See Spec. 3.04 for pipe connection to manhole. Service connections to existing concrete sanitary and storm sewer pipes shall be with an Inserta Tee or approved equal meeting ASTM D3034 and F477 standards.
- 5.05 Connection to Existing Watermain: The Contractor will be required to schedule shutdown of the watermain with the Owner 48 hours in advance of interruption of water service.

The Contractor shall arrange his work for a minimum number of shutdowns to the existing water service, and shall schedule the shutdowns so that the present water customers will have water service from 6 a.m. to 9 a.m., and from 4 p.m. to 9 p.m. everyday. When this is not possible, temporary service supplies may be ordered by the Engineer as per Section 4.11, Interruption of Water Service.

- 5.06 Pressure Connection to Existing Watermain: The Contractor may, at his option (unless specifically stated in the Contract Documents), make a pressure connection to existing watermain(s). The tapping of the watermain shall be made under pressure in accordance with the tapping equipment manufacturer's recommendations. The pressure tap shall expel cuttings from the existing watermain. The tap shall be completed through a valve to allow the tap to be shut off. After completion of the tapping operation, the system shall be inspected for leaks. The tap and tapping valve shall be the same nominal size as the planned watermain extension. A tapping saddle shall be used, of a size recommended by the manufacturer and approved by the Engineer.
- 5.07 Bulkheading Open Storm Sewer Pipe Ends: All pipe and fitting ends left open for future connection shall be bulkheaded with prefabricated plugs or caps.

Prefabricated plugs and caps shall be of the same material as the pipe material or an equivalent alternate material, and they shall be installed with watertight seal as required for the pipeline joints.

At all times when pipe laying is not in progress, including noon hour and overnight periods, all open ends of the pipeline shall be closed by watertight plugs or equivalent means. If water is present in the trench, the seals shall remain in place until the trench is pumped completely dry.

- 5.08 Sewer Service Location Record: The Contractor, with the assistance of the Project Representative, shall keep accurate records of all service installations as to the type, location, elevation, point of connection and termination, to the level required to meet MNOPS locating requirements, etc. This service record shall be maintained jointly by the Contractor and Project Representative on forms provided by the Engineer. The service installations shall not be backfilled until all required information has been obtained and recorded.
- 5.09 Bends: Building service pipelines shall generally be kept as deep as required to serve the building elevation and maintain the specified minimum pipe grades. Pipe bends shall be provided as necessary to bring the service lines to proper location and grade. Pipe bends shall not exceed 45 degrees without approval of the Engineer.
- 5.10 Sanitary Sewer Service Markers: Unless indicated otherwise, sanitary sewer services shall terminate at the utility easement line, at which point the Contractor shall furnish and set vertically a 2" x 2" x 12' wooden marker extending 18 inches above the ground to mark the exact end of the sewer service pipe, and a 4' minimum #6 steel post rebar at the invert of service. If sanitary sewer service only is to be provided to a property (i.e., no water service to be installed), an 8 foot galvanized steel post weighing not less than 2.75 pounds per foot, extending 4' above the ground, shall be set next to the 2" x 2" x 10' wooden marker. The horizontal and vertical location must be recorded prior to backfill (4.07).
- 5.11 Plugging Service Lines: All pipe and fitting openings at temporary terminal points shall be fitted with suitable plugs or shall be bulkheaded as required for air testing.
- 5.11A Abandoning Service Lines: All abandoned services shall be removed to the main unless otherwise approved by the engineer.
- 1...Sanitary sewer shall be removed to main and the wye shall be plugged with the appropriate size cap and be constructed with the same material type as the mainline sanitary sewer.
  - 2...Water services shall be removed to the main, and shall include removal of the corporation stop and plugging main with a brass plug.
- 5.12 Water Service Location Record: The Contractor, with the assistance of the Engineer, shall keep an accurate record of the location, depth and size of each service connection and other pertinent data such as the location of curb stops and pipe endings. Tap locations shall be recorded in reference to survey line stationing. Curb stops shall be tied to definable landmarks such as building corners, hydrants, manhole covers, and have x,y,z coordinates on the As-built plan. The service installations shall not be backfilled until all required information has been obtained and the inspector had visually seen water flowing from the end of the curb stop.
- 5.13 Water Service Markers: Water service shall terminate 15 feet past the right-of-way line, at which point the Contractor shall furnish and set vertically a 2" x 2" x 8' wooden marker extending 18 inches above the ground to mark the exact end of the water service pipe. Water service curb boxes shall be located within one foot of the utility easement line and marked with an 8 foot galvanized steel fence post weighing not less than 2.75 pounds per foot, extending 4 feet above the ground.

- 5.14 Depth of Cover: Unless specified otherwise, installation of water mainline and service lines shall be such as to provide for not less than 7 ½ feet of cover over the top of the pipe, and for not less than 18 inches of clearance between pipelines. Also, at least 18" inches of clearance shall be maintained in crossing over or under other structures. Where the service pipe may be exposed to freezing due to insufficient cover or exposure from other underground facilities, the water pipe shall be insulated.
- 6.00 TESTING: All testing shall be incidental unless specific bid items appear on the proposal form.
- 6.01 Cleaning Sanitary Sewer Lines: Sanitary sewer lines and manholes shall be cleaned prior to the performance of the air, deflection, and televising testing, and as needed prior to final acceptance for service hookups. The Contractor shall give the Project Representative a minimum of 24 hours notice prior to flushing. The Contractor shall flush a ball, sized for the full inside diameter of the pipe, through each section of the sewer line. All dirt and debris shall be prevented from entering the existing sewer system by means of watertight plugs and pumping of the flushing water from the existing sanitary sewer manhole into the storm sewer system, or by the use of 90 degree elbows in the downstream lines at the existing manholes. The invert of the sewer pipe and manholes shall be left clean and free from obstructions throughout the entire line.
- 6.02 Cleaning Storm Sewer Lines: Prior to final inspection of each section of the storm sewer, the Contractor shall clean and flush all dirt and debris from the lines, manholes and catchbasins.
- 6.03 Sanitary Sewer Air Test: A low pressure air test shall be performed on all PVC sanitary sewer pipe. The test shall be conducted in the presence of the Project Representative. The Contractor shall give the Project Representative a minimum of 48 hours notice prior to testing. Sanitary sewer testing shall conform to the procedures outlined in the 2018 C.E.A.M. Specifications.
- 6.04 Disinfection of Watermains: Before being placed in service, the completed watermain installation shall be disinfected and flushed. After the final flushing, the water shall be tested for bacteriological quality and for conformance with the standards prescribed by the State Department of Health. Disinfection materials and procedures and the collection and testing of water samples shall be in accordance with the provisions of AWWA C-651, and as will meet the health regulation requirements. The flushing operations shall be conducted in the presence of the Project Representative. Flushing of the hydrant should also consist of flushing through the pumper nozzle. Each hydrant needs flushing through all nozzle openings.
- Only the tablet method of chlorination shall be used, with placement of the tablets and filling of the watermain to be accomplished in accordance with Sections 5.1.2 and 5.1.3 of AWWA C-651.
- Unless otherwise indicated in the Contract Documents, the Contractor shall furnish all materials and perform the disinfecting, flushing and provide third party certified testing and collection as necessary for meeting the water quality requirements. The flushing operations shall be subject to review by the Engineer.
- 6.05 Electrical Conductivity Test: The Contractor shall perform a conductivity test within 1 week after completion of pressure testing of the main on all iron pipe watermains to establish that electrical thawing may be carried out in the future. The Contractor shall give the Project Representative a minimum of 48 hours notice prior to testing. The test shall be conducted in the

presence of the Project Representative. For testing procedure, refer to C.E.A.M. specifications, 2018 Edition, Section 2611.3F.

- 6.06 Hydrostatic Testing of Watermains: Each valved section shall be subjected to the pressure and/or leakage tests prescribed herein. The Contractor shall pre-test the watermain prior to scheduling the record test. The record test shall be conducted in the presence of the Project Representative.

The Contractor shall give the Project Representative a minimum of 48 hours notice prior to testing. The Contractor shall furnish the pump, pipe connections, gauges and measuring equipment, and shall perform the testing under the observation of the Engineer. Where permanent air vents are not provided, the Contractor shall provide and install corporation stops at the high points as needed for release of air as the line is filled with water.

A....Blocking Curing Time: Where concrete reaction blocking is placed, the water main shall not be subjected to hydrostatic pressure until at least 5 days have elapsed after the concrete casting, with the exception that this period may be reduced to 2 days where high early strength concrete is used.

B....Closed Trench Hydrostatic Test: Only closed trench hydrostatic testing shall be allowed. The closed trench test shall be performed with the piping completely backfilled. Hydrants shall be in the closed position.

1...Pressure Test: A hydrostatic pressure test of 150 pounds per square inch shall be applied to each consecutive valved section of pipe. The test shall be applied by means of a suitable pumping apparatus connected to a service line or testing tap on the water main test section.

The pressure gauge for the test shall be an Ashcroft Model 1082 with a 4 ½ inch dial face with 1 psi increment or equal. The test shall be applied for a period of two hours, and the pressure drop at the end of that period shall be recorded. A four pound drop in pressure will be allowed.

- 6.07 Hydrostatic Testing of Forcemains: Testing of forcemains shall conform to the 2018 C.E.A.M. Specifications and be the same as testing of watermains except that the maximum test pressure shall be equal to twice the maximum design pressure or a minimum hydrostatic pressure of 100 psi for 1-hour, whichever is greater. (See also Section 6.06 of these specifications)

- 6.08 Television Inspection: After completion of all utility construction and base bituminous has been completed, the Contractor shall clean and televise the sanitary and storm sewers. The pipe sidewalls must be substantially dry after cleaning before television inspection is initiated. A nominal flow through the pipe should be established during televising to indicate the presence of dips in the pipe flowline.

Television inspection of storm sewer shall be conducted no more than three months prior to paving wear course; if wear course is not installed within three months of the television inspection, the inspection shall be performed again prior to paving. No television inspection shall be performed during or immediately after a rain event.

The television camera shall be mounted on a skid so that it is centered in the pipe. The camera shall have a cross-hair to maintain a constant reference on the image. The camera shall be

equipped with sufficient lights to completely illuminate the interior of the pipe with the range of the camera. The camera operator shall manipulate the camera to fully inspect any potential damage within the pipe and all joints that appear to be damaged or have a visible gap.

A monitor shall be provided with seating facilities to allow three or more persons to view the picture continuously. The television camera, transmitting equipment and monitoring equipment shall combine to provide a picture on the monitor screen which is free from distortion and clear enough to distinguish between hairline cracks, "pipe marks", etc. The exact distance to each wye must be recorded from downstream manhole.

Digital video files shall be made of the entire footage of pipe televised. The linear footage of pipe televised shall be integrated into the video for ease of identification of pipe being viewed. A diagram of the project with all televising indexed on it shall be provided in triplicate within five working days following the last day of televising on the project. If televising is interrupted for more than five days, an interim index diagram shall be furnished. The Owner will be given a USB flash drive containing the video files and all reports and/or diagrams upon completion of the televising. The Owner will review the television inspection videos and provide any comments or requests for reinspection within two weeks of receipt of the digital video files.

- 6.9 Flexible Pipe Deflection Test: A deflection test shall be performed on all flexible pipe. The test shall be conducted in the presence of the Project Representative a minimum of 30 days after final backfilling of the pipe trench. The Contractor shall give the Project Representative a minimum of 48 hours notice prior to testing.

The deflection test shall be run using a rigid ball or mandrel with a diameter equal to 95 percent of the inside diameter of the pipe, allowing for manufacturing tolerances. The test shall be performed without mechanical pulling devices.

Sections failing the test shall be repaired and re-tested a minimum of 30 days after the repairs are made and prior to acceptance.

- 6.10 Final Inspection of Sanitary Sewer: If conditions permit, the sanitary sewer lines and manholes will be inspected by the Project Representative on the same day(s) that the mandrel testing is performed. If not, the inspection will be done as soon as possible thereafter. All sewers and appurtenances will be carefully inspected. Any unsatisfactory work shall be removed and replaced in a proper manner. The invert of the sewer lines and manholes shall be left clean and free from dirt, sand, gravel or other obstructions throughout the entire line.

In the event that the inspection is performed prior to construction of the first lift of bituminous pavement, all manholes and, if necessary, all sewer lines will be reinspected by the Project Representative after construction of the bituminous pavement. Any unsatisfactory work shall be removed and replaced in a proper manner. The invert of the sewer lines and manholes shall be left clean and free from dirt, sand, gravel or other obstructions throughout the entire line.

- 6.11 Final Inspection of Storm Sewer: Upon completion of all street construction and restoration of boulevards, stormwater ponding areas and drainage swales, the Project Representative will carefully inspect all storm sewer lines and appurtenances. Any unsatisfactory work will be removed and replaced in a proper manner. The invert of the storm sewer lines, manholes and

catch basins shall be left clean and free from dirt, sand, gravel or other obstructions throughout the entire line.

## 7.00 BACKFILLING PROCEDURES

Compaction Requirements: Compaction requirements for all embankments and trench backfill constructed under this contract shall be in accordance to MnDOT 2106.3F except modified as follows:

A...Areas Outside Street Right-of-Way: Areas outside the street right-of-way shall be compacted to 95% of Standard Proctor Density (T-99) ASTM D-698 or 90% Modified Proctor Density (T-180) ASTM D-1557. Side yards shall be compacted to 100% of Standard Proctor Density (T-99) ASTM D-698 within drainage and utility easement areas.

B...Areas Within Street Right-of-Way: Trench backfilling or embankment construction shall meet the following requirements:

1...Below Upper 3 Feet: The zone from bottom of embankment or trench to within 3 feet of top of subgrade shall be compacted to 95% of Standard Proctor Density (T-99) ASTM D 698 or 90% Modified Proctor Density (T-180).

2...Upper 3 Feet: The zone from 3 feet below top of subgrade to top of subgrade together with those portions of embankment or trench backfill below the upper 3 feet adjacent to structures shall be compacted to 100% of Standard Proctor Density (T-99) ASTM D-698 or 95% Modified Proctor Density (T-180).

C...Pipeline Backfilling Operations: Refer to Standard Utilities Specifications (C.E.A.M.) 2018 Edition, Section 2600.3E.

D...Compact area in pipe bedding and encasement zone (generally known as that area from the bottom of the trench to 1 foot above the top of pipe) shall be mechanically tamped in accordance to the pipe manufacturer's specifications and recommendations for the various soil types. The contractor shall not utilize any frozen backfill materials. The contractor shall make a special effort to compact around manholes and gate valves during construction and adjustment.

E...Maximum lift thickness of backfill for all trench compaction shall be as follows:

1...Cohesive Soils: 1 foot maximum

2...Cohesionless Soils: 2 foot maximum

F...When the sanitary sewer services and water services have a separation exceeding 18 inches, the sanitary service will have to be compacted first prior to installing the water service, or the water service may be lowered under the roadway to within 1 foot separation to the sanitary service to insure proper compaction requirements as listed above.

8.00 TRACER WIRE SPECIFICATIONS: The following special provisions shall be required with the installation of PVC water main and storm sewer:

## **Materials**

### **General**

All trace wire and trace wire products shall be domestically manufactured in the U.S.A.

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 7 x 7 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 (above ground access box or grade level/in-ground access box as applicable), specifically manufactured for this purpose.
- All grade level/in-ground access boxes shall be appropriately identified with “sewer” or “water” cast into the cap and be color coded.
- A minimum of 2 ft. of excess/slack wire is required in all trace wire access boxes after

**Sewer/Water Utility - Trace Wire Specification Modified by City of Lakeville January, 2020**

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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 5 vertical feet above finished grade, or terminate at an approved grade level/in-ground trace wire access box, located within 2 linear feet of the building being served by the utility.
- **Hydrants** – Trace wire must terminate at an approved above-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 service laterals or 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 20ft of #12 red HDPE insulated copper clad steel wire connected to anode (minimum 1.5 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 or 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 2 ft. of excess/slack wire is required after meeting final elevation.

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## **Installation**

### **General**

- Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper 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 5' 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 for new PVC watermain being connected to existing ductile iron pipe (DIP) watermain shall be connected to the existing DIP via exothermic welding.
- All service lateral trace wires shall be a single wire, connected to the mainline trace wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline 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.

### **Water System**

- A mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.
- Lay mainline trace wire continuously, by-passing around the outside of valves and fittings on the North or East side.
- Trace wire on all water service laterals must terminate at an approved trace wire access

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box color coded blue and located directly above the service lateral at the edge of road right of way.

- Above-ground tracer wire access boxes will be installed on all fire hydrants.
- All conductive and non-conductive service lines shall include tracer wire.

### **Storm Sewer System**

- A mainline trace wire must be installed on all draintile, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.
- Lay draintile trace wire continuously, by-passing around the outside of manholes/structures on the North or East side.
- Trace wire on all draintile 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.

### **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 has 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.

### **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.

The owner will perform a conductivity test prior to accepting the utilities. Any deficiencies found during testing shall be replaced or repaired by the contractor.

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

#### **Sewer/Water Utility - Trace Wire Specification Modified by City of Lakeville January, 2020**

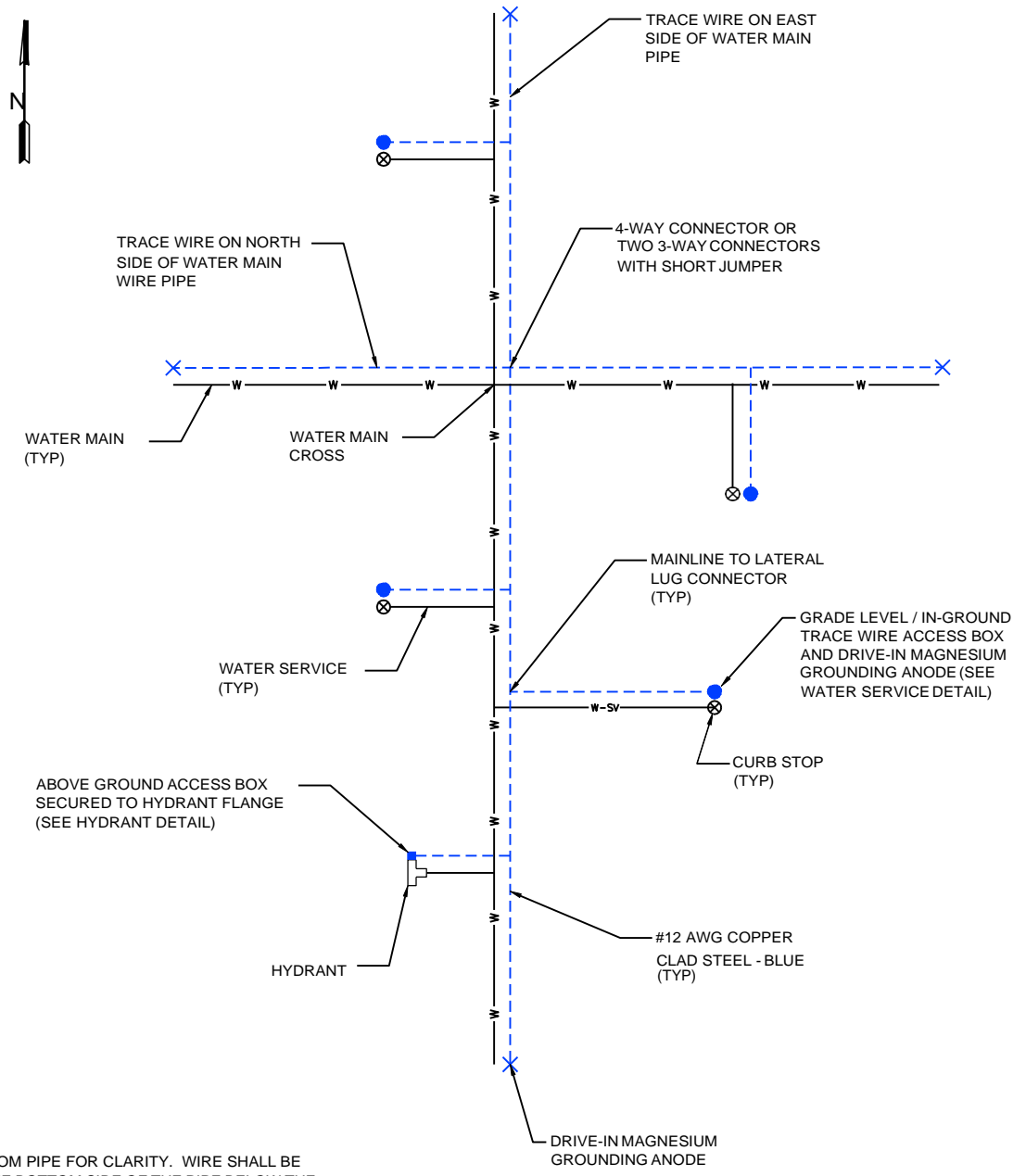
*This Standard specification was prepared by Joe Rubbelke ([joe.rubbelke@gmail.com](mailto:joe.rubbelke@gmail.com)), Jeff Dale ([jeff.dale@mrwa.com](mailto:jeff.dale@mrwa.com)) and Frank Stuemke ([frank.stuemke@mrwa.com](mailto:frank.stuemke@mrwa.com)), and is a work-in-progress, intended for redistribution, modification and immediate use by any municipality (March 2014). The end user must accept all liabilities and hold harmless the contributors of this information.*

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

## **Products**


The following products have been deemed acceptable and appropriate. Alternate products may be submitted to the City Engineer for approval on a project-by-project basis.

- 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 7 x 7 Stranded part # PBX-50\*-\*\*
    - \* Denotes color: B=Blue, G=Green, P=Purple
    - \*\*Denotes spool size. 500’ 1000’ 2500’
- Connector
  - s
    - Copperhead 3-way locking connector part # LSC1230\*
    - DryConn 3- way Direct Bury Lug: Copperhead Part # 3WB-01
- Termination/Access
  - Non-Roadway access boxes 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”
  - Fire hydrant trace wire access box applications: Above ground two terminal Cobra Test Station, denoting “F” includes hydrant mounting flange. Copperhead part # T2\*-FLPKG-5/8 to fit hydrants with 5/8” bolts and T2\*-FLPKG-3/4 to fit hydrants with 3/4” bolts.
- Grounding
  - Drive in Magnesium Anode: Copperhead Part # ANO-12 (1.5 lb)



**NOTES:**  
 1. WIRE SHOWN AWAY FROM PIPE FOR CLARITY. WIRE SHALL BE (TYP) INSTALLED ON THE BOTTOM SIDE OF THE PIPE BELOW THE SPRING LINE. THE WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 5' INTERVALS.

**TRACE WIRE PLAN (WATER)**  
 NO SCALE

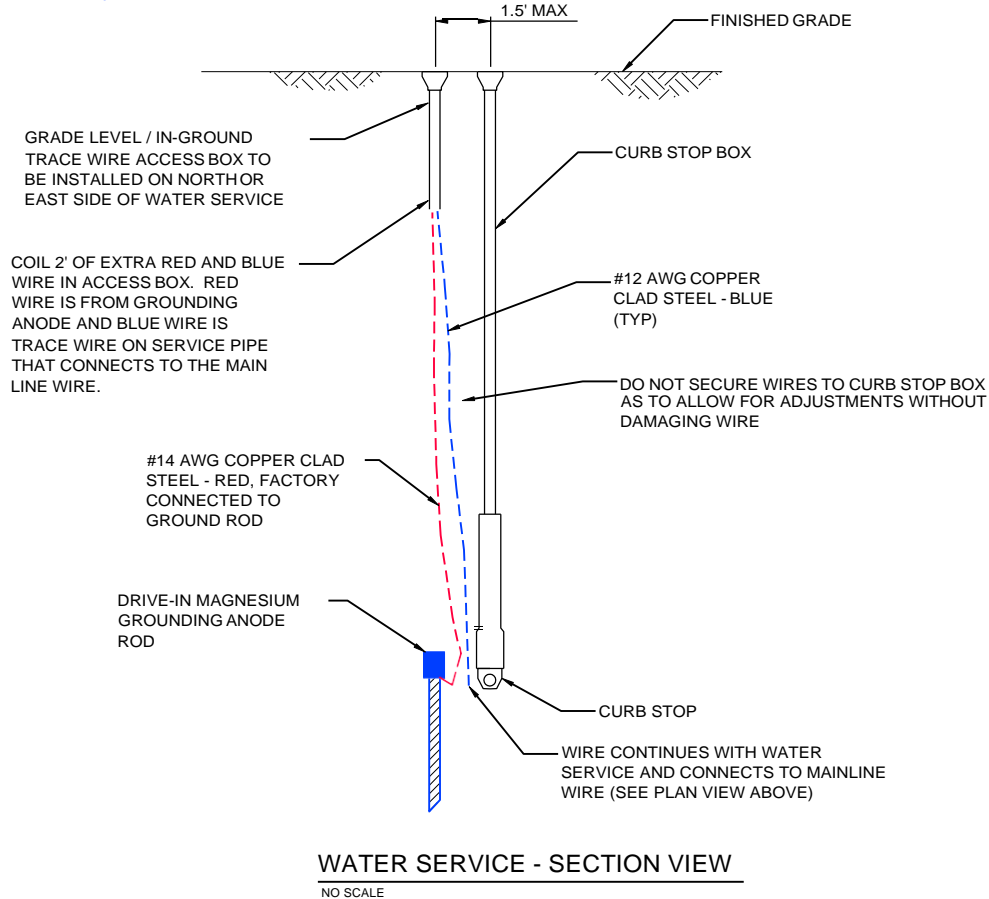
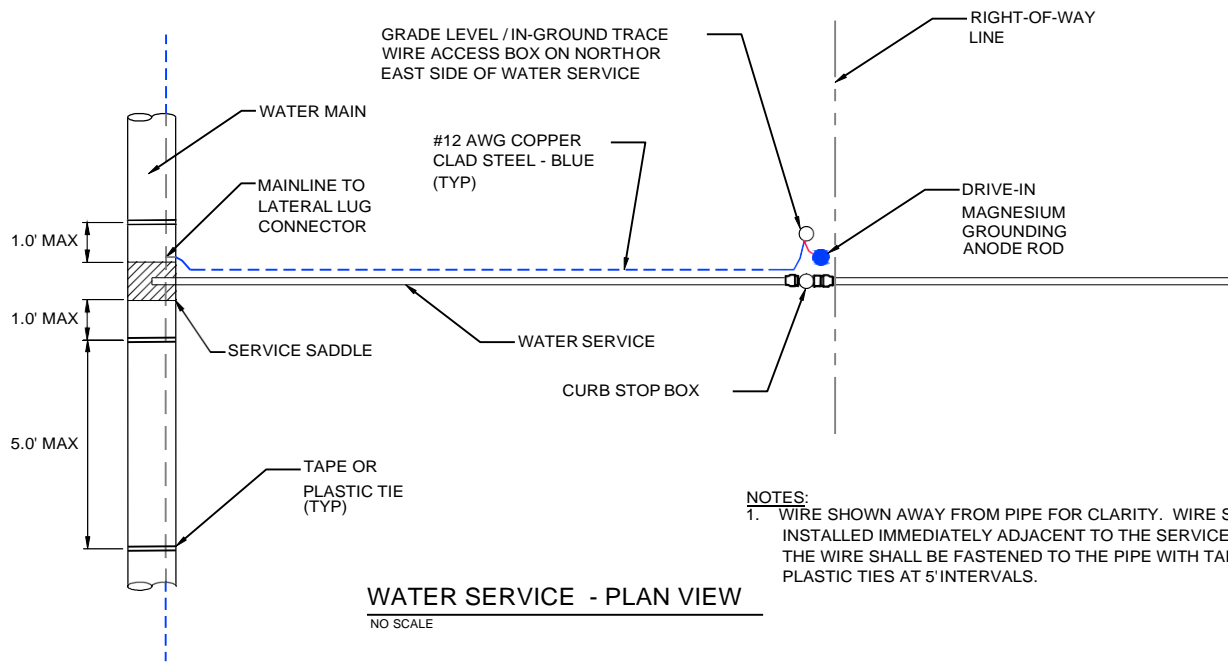


**MINNESOTA RURAL WATER ASSOCIATION  
 STANDARD DETAIL**

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**TRACE WIRE  
 SAMPLE WATER PLAN**

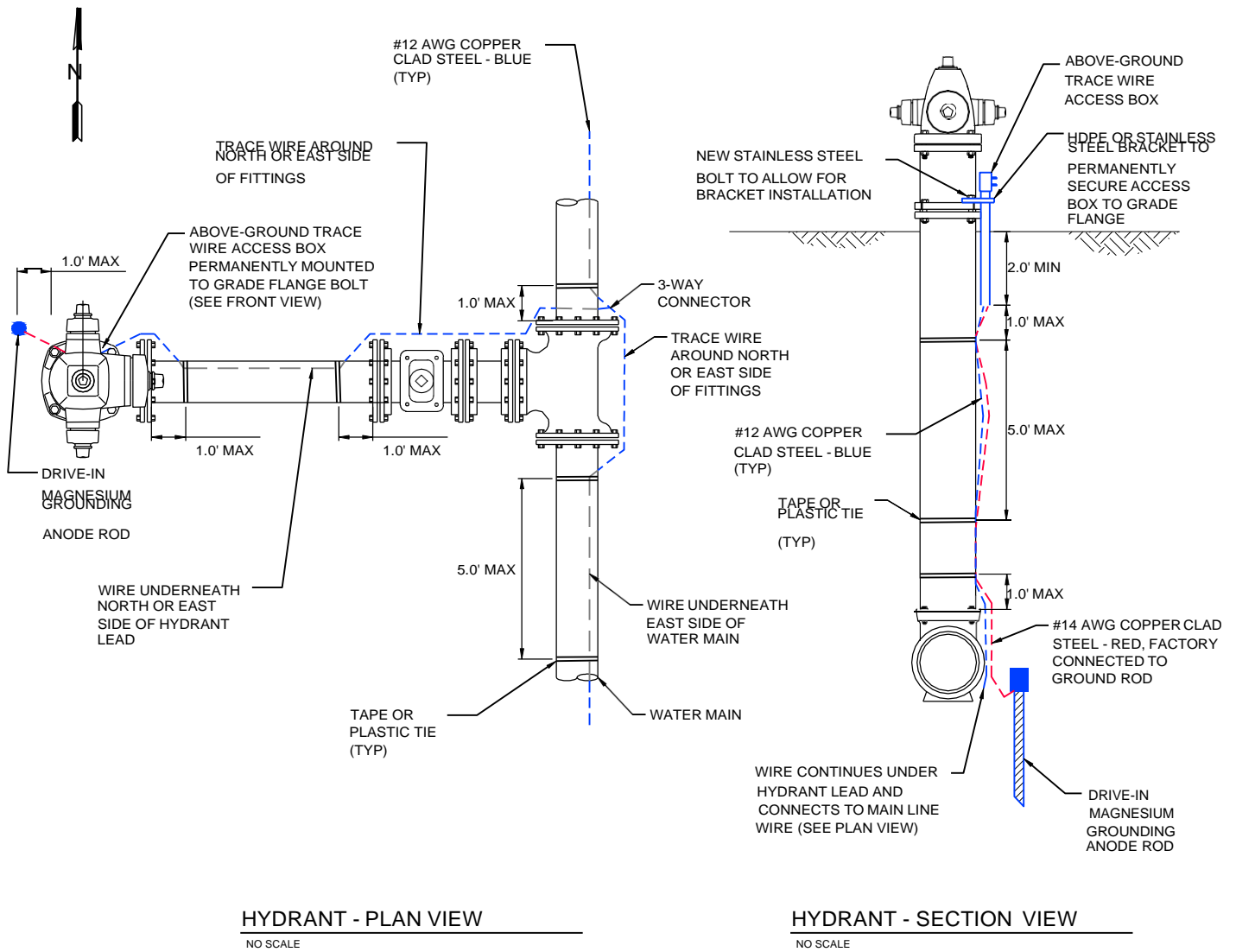
May 28, 2014



MINNESOTA RURAL WATER ASSOCIATION  
STANDARD DETAIL

TRACE WIRE  
WATER SERVICE DETAIL

May 28, 2014



MINNESOTA RURAL WATER ASSOCIATION  
STANDARD DETAIL

TRACE WIRE  
HYDRANT DETAIL

May 28, 2014