

**CITY OF FARGO SPECIFICATIONS  
WATER MAINS**

**PART 1  
DESCRIPTION OF WORK**

The work to be done under this section of the Specifications and the accompanying plans consists of the furnishing of all labor, material, accessories and equipment necessary to construct water mains in the City of Fargo. The work includes excavation, removal and replacement of paving where encountered; furnishing, laying and jointing pipe; making connections to existing water mains as necessary; installing new valves, valve boxes, or valve manholes; installing hydrants; protecting existing utilities and public and private property; backfilling trenches and other work as may be necessary to in order that the work may be completed in accordance with these Specifications and the plans accompanying them.

**PART 2**  
**MATERIALS**

All products (treatment chemicals and material) that may come into contact with water intended for use in a public water system shall meet American National Standards Institute (ANSI)/National Sanitation Foundation (NSF) International Standards 60 & 61, as appropriate. A product will be considered as meeting these standards if so certified by NSF, The Underwriters Laboratories, or other organizations accredited by ANSI to test and certify such products.

2.1. POLYVINYLCHLORIDE (PVC) PRESSURE PIPE

*2.1.1. MATERIAL*

The PVC material shall conform to the requirements of ASTM D-1784, Class 12454-B.

*2.1.2. PIPE MANUFACTURE*

The pipe shall be marked to indicate compliance with NSF 61, Factory Mutual (FM) and either be marked or tagged with the Underwriter Laboratory (UL) approval. 12" and smaller PVC pressure pipe shall be manufactured in accordance with the latest revision of AWWA Standard C-900. The pipe shall be Class 150, DR 18. PVC pipe larger than 12" diameter shall be manufactured in accordance with the latest revision of AWWA Standard C-905. The pipe shall be Class 150, DR 18.

*2.1.3. PIPE JOINTS*

PVC pipe joints shall be rubber gasketed conforming to the requirements of ASTM D-3139-98 or the latest revision.

2.2. DUCTILE IRON PIPE

*2.2.1. MATERIAL*

Ductile iron pipe shall conform to AWWA C-151 Standards.

### 2.2.2. *PIPE MANUFACTURE*

Ductile iron pipe shall be American made and conform to a Class 53 standard thickness class unless otherwise specified.

### 2.2.3. *PIPE JOINTS*

Ductile iron pipe joints shall be slip joints with rubber gaskets and meet AWWA C-111 Standards.

### 2.2.4. *LINING*

The ductile iron pipe shall be lined with cement mortar in accordance with AWWA C104. Cement for mortar shall be Portland Cement conforming to current ASTM specifications. The thickness of the lining shall not be less than the following:

1/16" for 3 to 12 inch pipe

3/32" for 14 to 24 inch pipe

1/8" for pipe larger than 30 inches

### 2.2.5. *PIPE COATINGS*

Ductile iron pipe shall be coated with a 1 mil asphaltic coating.

### 2.2.6. *POLYETHYLENE WRAP*

All ductile pipe shall be wrapped with polyethylene plastic film having a minimum thickness of 8 mils or with a cross woven polyethylene plastic film having a minimum thickness of 4 mils. All water service taps shall be wrapped for a minimum distance of 3 feet from the watermain.

### 2.3. FITTINGS

All fittings shall be PVC or Ductile Iron, and shall be “push-on” or “slip-joint” unless specified otherwise in the plans or special instructions to bidders. Cast iron fittings will be used only when approved by the Engineer.

#### *2.3.1. PVC FITTINGS*

PVC fittings shall be injection molded conforming to the requirements of AWWA C-907 and carry a working pressure of at least 150 psi.

#### *2.3.2. DUCTILE IRON FITTINGS*

Ductile Iron fittings shall conform to AWWA C153, and shall be cement mortar lined on the interior and bituminous coated on the exterior. Cement lining shall conform to AWWA C104, and joints shall conform to AWWA C111. All ductile iron fittings shall be wrapped with polyethylene plastic film as specified for the ductile iron pipe, which must be securely fastened to the pipe on each side of the fitting. Mechanical joint fittings, where allowed by the Engineer, shall be bid complete with gaskets, glands, and stainless steel bolts (if necessary).

#### *2.3.3. COUPLINGS*

All pipe couplings up to and including 12” in diameter shall be epoxy coated ductile iron meeting or exceeding the requirements of ASTM A 536, grade 65-45-12. Couplings shall meet the requirements of AWWA Standard C219. The coupling shall carry a minimum working pressure of 150 psi, having end rings that are segmented and joined with a pinless hinge, gaskets formed from virgin Nitrile Butadiene Rubber (NBR) compounded for water and sewer service in accordance with ASTM D2000, and 304 stainless steel armor. Fasteners shall be 304 stainless steel.

### 2.4. GATE VALVES

#### *2.4.1. GENERAL*

Cast iron resilient-seated gate valves and tapping valves shall conform to the latest requirements of AWWA C509. Ductile iron resilient-seated gate valves and tapping

valves shall conform to the latest requirements of AWWA C515. The valve seats shall be able to withstand 200 psi and the body shall withstand 400 psi.

#### *2.4.2. CONSTRUCTION*

Size: 4" to 36"

Joints: Joints shall be provided with AWWA standard bell ends, flanged ends or mechanical joint bell ends as required for the type of pipe being used.

Gaskets: Rubber.

Operation: Open left (counter clockwise) w/ 2 inch operating nut.

Bolting: All body bolts shall be stainless steel.

Stem & seals: The stem shall be made of bronze and shall have two "O" rings to provide sealing.

Coating: All valves shall be coated inside and out in accordance with the latest revision of AWWA C-550.

Acceptable manufacturers are American Flow, Clow, Mueller, U.S. Pipe or Waterous.

16" and larger valves shall be installed horizontally with bevel gear actuators.

### 2.5. BUTTERFLY VALVES

#### *2.5.1. GENERAL*

Butterfly valves will be allowed only with the Engineer's approval. If allowed, butterfly valves shall conform to the latest requirements of AWWA C-504. They shall be Class 150B long body type with operating nut.

#### *2.5.2. CONSTRUCTION*

Size: 12" and larger.

Joints: Joints shall be provided with AWWA standard bell ends, flanged ends or mechanical joint bell ends as required for the type of pipe being used.

Bolting: All body and operator bolts shall be stainless steel.

Coating: Epoxy coating shall be applied to all surfaces of the valve body and vane to an average film thickness of 10 mils, conforming to the latest revision of AWWA C-550.

Acceptable manufacturers are Clow, Mueller/Pratt, CMB (Keystone) or DeZurik.

## 2.6. VALVE BOXES

### *2.6.1. GENERAL*

Valve boxes are required on all valves. All valve boxes shall be heavy-duty cast or ductile iron in accordance with ASTM A 48 30B material specification with a minimum tensile strength of 30,000 psi, have screw type adjustment, 5 1/4" shaft, and be furnished with heavy-duty cast or ductile iron bases and covers. Covers shall be cast with "WATER" on them. Valve boxes shall be three-piece type, adjustable from 62 to 82 inches in height, except that they shall in all cases be supplied and installed with a sufficient quantity of additional intermediate section(s) to allow the top of the installed box to be set at finished grade at mid-height of adjustment.

### *2.6.2. VALVE BOX ADAPTOR*

Rubber valve box adaptors shall be installed for all valve boxes on all gate valves and butterfly valves. The adaptor shall be the Valve Box Adaptor II as manufactured by Adaptor, Inc. or as approved by the Engineer.

## 2.7. TAPPING SLEEVES AND VALVES

Valves shall be in accordance with the latest revision of AWWA C-509. The sleeves shall be mechanical joint with stainless steel bolts or stainless steel tapping sleeves with a stainless steel flange.

## 2.8. HYDRANTS

### *2.8.1. GENERAL*

Hydrants shall be non-jacket types meeting the latest revision of AWWA C-502. All hydrants shall be equipped with a break-off traffic flange and shall be capable of being extended in 6" increments.

*2.8.2. CONSTRUCTION*

Main valve opening: 5" minimum.  
 Hydrant barrel: 7 3/8" minimum inside diameter.  
 Type of shut-off: Compression.  
 Inlet connection: 6" size- bell or mechanical joint type.  
 Nozzles: 2-2 1/2" hose nozzles; 1-4 1/2" pumper nozzle.  
 Nozzle threads: National Standard threads.  
 Bury depth: 8 feet 6 inches.  
 Operating & cap nuts: City of Fargo Standard (NST).  
 Direction to open: To the left (counter-clockwise).  
 Paint: City of Fargo Standard Red above ground line.  
 Bolts: All bolts below ground shall be stainless steel.  
 Hydrants shall be wrapped with polyethylene plastic film as per section 2.2.6.  
*POLYETHYLENE WRAP.*  
 Acceptable manufacturers are Waterous WB67 Pacer and American Darling B62B-1.

*2.9. HYDRANT MARKERS**2.9.1. GENERAL*

Hydrant markers shall be mounted on both sides of the post to face traffic (perpendicular to the curb) and shall be installed with each hydrant.

POST: Green U-channel- 2 lb. per foot & 9 feet long with 2 foot bury.

SIGN: 4" by 7" by 0.063" aluminum covered with Engineer Grade reflective sheeting,  
 Red hydrant symbol on white background.

*2.10. SERVICE CONNECTIONS*

All service connections to PVC pipe shall be stainless steel, double bolt (minimum) service saddles. Service saddles shall have stainless steel washers between the nut and the plastic washer to equalize tightening stress. Rubber tapered gaskets shall be required to resist circumferential and longitudinal forces along with O-ring or flat gaskets for hydraulic seal. Saddle bolts shall be tightened to the manufacturers recommended tightness and verified with a torque wrench. Bolt tightness shall be rechecked with a torque wrench after the pipe tap is complete. All services shall be pressure tested with the main.

Approved saddle types:  
Romac style 304  
Ford style FS 303  
Powerseal 3412AS  
Cascade CSC-1 and CSC-2

## 2.11. YARD HYDRANTS

### *2.11.1. GENERAL*

Yard hydrants, where allowed by the Engineer, shall be brass ¾" frost proof type equipped with a brass vacuum breaker. The valve stem and plunger assembly shall be removable for inspection and repair without the need for digging up of the hydrant.

### *2.11.2. CONSTRUCTION*

Hydrant barrel: 1" brass.  
Inlet connection: ¾" NPT in brass casting.  
Nozzle: heavy duty ¾" brass hose thread.  
Bury depth: 7 feet.  
Paint: Standard Red above ground line.  
Acceptable manufacturers are Merrill Any Flow Brass Frost Proof or equal.

## 2.12. TRACER WIRE

### *2.12.1. GENERAL*

Tracer wire shall be installed along all PVC pipe unless noted otherwise. The tracer wire shall be considered incidental to watermain construction.

### *2.12.2. TRACER WIRE FOR DUCTILE IRON*

Electrical Conductivity: Cooper Straps shall be welded or otherwise permanently affixed to each pipe or appurtenance to provide a positive means of conveying electricity from pipe or fitting, to pipe or fitting. Conductive pipe gaskets may be used on pipe to pipe connections if approved by Engineer. Size and method of affixing strap shall be subject



to approval of the Engineer and shall be sufficient to meet or exceed the criteria for conductivity testing set forth in this specification.

### *2.12.3. TRACER WIRE FOR PVC*

Tracer wire to be used for direct bury and boring applications shall be 10 gage copper clad carbon steel core, with blue HDPE coating (45 mil thickness). It is required that the tracer wire carry a radio signal to aid in locating buried watermain. Tracer wire shall be in accordance with ASTM B170 for copper, ASTM B869 for wire, and ASTM D1238 for polyethylene. The wire shall be identified by surface marking indicating manufacturer's identification, conductor size, and other appropriate information.

In-line splices shall be made with "DryConn Direct Bury Lug Aqua" or approved equal. Wire nut splices will not be allowed.

At hydrants, to protect tracer wire from weed whips, mowers, etc., tracer wire shall be run through a 2-foot long min. piece of ¾" HDPE heavy-wall innerduct with angle-cut end. Hydrant connections shall be made with an aluminum angle iron 1.5" x 2.0" x 1.5" wide having two 5/8" diameter holes (one for mounting to the hydrant; one for tracer wire split bolt) and a 5/8" diameter x 1" long No. 2-H split bolt made from high strength corrosion resistant copper alloy.

### 2.13. INSULATION

Insulation shall be in accordance with Section 1200 of these Specifications.

**PART 3**  
**CONSTRUCTION**

3.1. GENERAL

Excavation, trenching, and backfill shall be done in accordance with Section 1000. Pipe and fittings shall be handled and laid in accordance with AWWA Standard C600-77. Pipe and fittings shall be laid in the location shown on the plans, the exact location being designated by the Engineer during construction. Before laying any pipe, it shall be cleaned of all foreign matter and kept clean thereafter. Open ends shall be protected at all times to prevent the entrance of dirt, trench water, animals or foreign material into the pipe. The bell and spigot shall be wiped clean and sufficient lubrication placed on the gasket and spigot before the pipe is pushed fully into the bell. Field cut spigot ends of push-on joints shall be beveled prior to being pushed into the bell. Every part of the pipe shall be bedded uniformly throughout its length. All handling, field cuts, polyethylene wrapping, and jointing shall be done as per the manufacturer's recommendation.

3.2. ALIGNMENT

The Engineering Department will provide line and grade for all watermain. All water mains shall have a minimum cover of 7.5'. Grade shall be maintained with batter boards or electronic grade control equipment. Water mains installed parallel to sanitary sewer shall be laid 10 feet apart, distance shall be measured edge to edge. Where a water main crosses a sanitary sewer line, a minimum vertical distance of 18 inches shall be maintained between the outside of the water main and the outside of the sewer. Deflections from a straight line or grade, where permitted by the Engineer, shall not exceed the pipe manufacturer's recommendation.

3.3. THRUST BLOCKS

All fittings shall be braced by means of poured concrete or concrete thrust blocks. No wood thrust blocks will be allowed. Poured concrete shall be 3000 psi concrete poured against undisturbed earth. Care shall be taken not to cover up joints, bolts, flanges, and the fittings with concrete.

Thrust restraint at the joints may be used in lieu of concrete thrust blocking with the permission of the Engineer. Restraint devices for PVC pipe shall meet or exceed the requirements of ASTM F 1674-96 or the latest revision, Standard Test Method for Joint Restraint Products for Use with PVC Pipe.

#### 3.4. SETTING HYDRANTS

All hydrants shall be vertically plumb and shall have their pumper nozzle facing and at right angles to the street. Each hydrant shall be set on a concrete block and blocked behind with concrete block(s) of sufficient size to prevent settling and horizontal movement. Hydrant bases shall be backfilled with at least 1/3 cubic yard of crushed rock to facilitate drainage. The crushed rock shall extend to 6" above the weep hole. After backfilling the hydrant markers shall be installed 18 inches behind the hydrant.

#### 3.5. CONNECTIONS TO EXISTING WATER MAINS

Connections between new and existing pipes shall use proper specials and fittings to suit the actual conditions encountered. Suitable facilities shall be provided for proper de-watering, drainage, and disposal of all water removed from the excavation or pipe without damage to adjacent property. Prior to the closure of existing water mains, the Contractor shall notify all affected water users.

#### 3.6. WATER MAIN SHUTDOWNS

The Contractor shall coordinate watermain shutdowns with the Engineer and the Mains and Hydrants Department. The Contractor is responsible for gate valve locations and property notification. The Mains and Hydrants Department will assist with cleaning and operating the valves if required.

Shutdowns in residential areas may not occur prior to 9:00 AM. Residential water users shall be notified of the outage by 7:00 PM the night before the planned shutdown.

The Contractor shall schedule outages to non-residential water users in such a manner as to minimize the impact of the outage to the user. Outage notifications to non-residential water users shall be per the direction of the Engineer, but in no case shall be given less than 2 working days prior to the shutdown.

Notifications shall be in writing and shall indicate the estimated duration of the shutdown. A sample shutoff notification form can be found on the City's website. If actual shutdown varies from the stated time by more than one hour, a second verbal notification is required.

The Contractor shall turn on all valves after the necessary water main connections have been made.

### 3.7. TEMPORARY WATER SERVICES

If the water to a property is to be out for more than 12 hours, the Contractor will be responsible for providing a temporary water service to the affected water users. All piping shall be rated for potable water use. Minimum pipe size shall be 1" diameter for up to 3 service connections, 2" diameter for 4 or more connections. The Contractor shall use larger pipes where necessary to provide adequate domestic service throughout the duration of the temporary connection. Valves shall be provided on temporary piping at intervals not to exceed 500 feet. The method of providing the temporary water service (which hydrant to use, direction to feed, etc.) shall be an option of the Contractor subject to the approval of the Engineer.

All temporary water mains and services shall be disinfected in accordance with section 1300.3.9. One water sample per block at the end of a service connection will be taken after the temporary water line is flushed. The sample shall show the absence of bacteria before connections are allowed. No additional contract time will be allowed for failure to pass bacteria test.

### 3.8. SETTING VALVES

Valves will be installed where shown on the plans or as directed by the Engineer. Before installing the valve, care should be taken to ensure that all foreign material has been removed. The stuffing boxes shall be tightened and the valve opened and closed to see that all parts are in first class working order. The body of the valve shall be wrapped with polyethylene wrap, securely fastened to the pipe on both sides of the valve, as per ANSI/AWWA C105/A21.5. Valve and valve boxes must be plumb. The valve box adapter shall be installed on the valve and the valve box shall be placed directly over the operating nut, and the top of the box being brought to grade flush with the surface of the ground. The Valve box shall be wrapped with polyethylene plastic film as per section 2.2.6. *POLYETHYLENE WRAP*. The box shall be backfilled and thoroughly tamped around the box. After backfilling a wrench shall be dropped on the valve to ensure that it is operable. Prior to acceptance, the City Water Department will verify that each valve is easily operable.

### 3.9. DISINFECTION

All water mains shall be chlorinated as set forth by the latest revision of AWWA Standard C651. Sufficient chlorine tablets or powder shall be placed in each pipe to furnish a resultant solution of

50 to 100 parts per million of available chlorine. Generally required dosage to meet this standard is as follows:

<u>WATER MAIN SIZE</u>	<u>REQUIRED DOSAGE</u>
2"	1 LB. PER 10,000 FEET
4"	1 LB. PER 2,500 FEET
6"	1 LB. PER 1,100 FEET
8"	1 LB. PER 700 FEET
10"	1 LB. PER 350 FEET
12"	1 LB. PER 280 FEET
16"	1 LB. PER 160 FEET

The chlorinated water shall remain in the pipe line for at least 24 hours and shall have a residual chlorine content of at least 5 parts per million at that time. A water sample will be taken after the main is flushed and shall show the absence of bacteria before connections are allowed to the water main. Chlorine disinfection shall be included in the unit bid price for the pipe.

### 3.10. PRESSURE AND LEAKAGE TESTING

All watermain shall be subjected to pressure and leakage testing. The Contractor shall furnish all pumping equipment, labor and gauges required for these tests and if any section of pipe does not meet these tests, the Contractor shall at his own expense locate and repair the defects and retest the line until it meets the requirements. The pipe shall be subjected to a hydrostatic test of 125 psi for a period of two hours. The pressure shall be held within 5 psi of this test pressure for the entire time and leakage shall not exceed the rate established by the following formula:

$$Q = (LD\sqrt{P})/148,000$$

In which:

Q= maximum permissible leakage rate in gallons per hour for the length of line being tested.

L= length of the line being tested in feet.

D= internal diameter of the pipe in inches.

P= average test pressure in psig.

In the event that the line contains more than one size of pipe, the allowable leakage for each size shall be calculated separately and then added to obtain the total allowable leakage allowed for the lines being tested. Repairs shall be made by replacing the defective pipe or dismantling the faulty joint, cleaning, realigning the gland or gasket and reassembling the joint as per the original

specification. Repair sleeves may only be used if approved by the Engineer and shall have all stainless steel parts. All cost of locating and repairing the leaks shall be borne by the Contractor.

### 3.11. BACTERIOLOGICAL TESTING

Bacteriological testing is required on all new and replaced watermain before the watermain is placed in service. The tests ensure that the water being introduced into the system has been properly disinfected and is free of contamination. Only the City inspector may do the testing procedure. Records are kept of the litmus test, the bacteriological tests, and the chain of custody during the sample submittal process.

After final flushing and before the new watermain is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the new main. At least one set of samples shall be collected from every 1,200 feet of new watermain. All samples shall be tested for bacteriological quality in accordance with *Standard Methods for the Examination of Water and Wastewater*, and show the absence of coliform organisms and the presence of a chlorine residual.

The basic procedure is as follows:

1. Insert litmus paper test strip in the discharge stream of the hydrant while it is being flushed. The color change will indicate that there is residual chlorine content.
2. Before the valves are opened, obtain a sterile sample of the disinfected main. This water sample will be taken after the completion of the pressure test. 100-ml samples will be taken with a chlorine neutralizer tablet in the container. The sample must be taken to the water plant immediately for testing. If this is not possible, the sample must be kept in a refrigerated container, however, the test must begin within 24 hours. Results will be available approximately 24 hours from the time the test is admitted.
3. A second sample is obtained from the same location at least 24 hours after the first sample. This sample indicates that the residual chlorine content is such that verification is obtained that the pipe, newly introduced water, and any debris are disinfected. As such, the sample must be obtained from water that has remained in the new pipe for at least 24 hours. Both samples must pass the test before the new watermain may be opened and put in use in the distribution system.
4. When flushing the mains, care must be taken to ensure that flow is away from the existing mains. This may involve flushing ½ block in one direction until the water is

clear, and then closing that valve and flushing from the other end of the block for a mid-block hydrant.

If the initial disinfecting fails to produce satisfactory results, the main shall be reflashed and re-sampled. If check samples also fail, the main shall be rechlorinated by the continuous feed or slug method until satisfactory results are obtained.

The Contractor should note that the testing tank may require sterilization in order to avoid contamination of the mains during the testing process. The pipe installation crews will need to ensure that the pipes are free of dirt, debris and other matter. It must be remembered that the final water quality test is not the primary means for certifying the sanitary condition of the main. The sanitary handling of materials, the construction practices, and the continual inspection of the work are the primary means for ensuring the sanitary condition of the water main.

The Contractor shall assist the inspector as necessary to obtain the samples. There is no direct charge to the Contractor for the testing procedure.

### 3.12. TRACER WIRE FOR PVC

#### *3.12.1. TRACER WIRE*

The tracer wire shall be installed no more than 6" above and centered along the top of the pipe during the initial backfilling operations. Two wires shall be used on all bores. Care shall be taken to not damage the wire. Splices shall be made using approved splice kits. Splices shall not occur more frequently than one per 250 feet of pipe.

At each hydrant, the tracer wire shall be routed up the side of the hydrant, through the approved tracer wire protection, and securely fastened to the hydrant flange using approved clips. Where indicated on the plans, tracer wire shall be routed to the top of gate valve boxes per the Standard Detail - the Contractor shall wind at least 2' of excess wire into a loop and place it in the top of the valve box where it can be accessed when necessary.

It is recommended that during construction, the Contractor periodically test the tracer wire being installed, to ensure continuity. Upon completion of the project the Contractor shall test the tracer wire in accordance with Section 1300.3.12.4 Electrical Conductivity Testing for PVC.

### 3.12.2. *TRACER WIRE ACCESS BOX*

The maximum spacing between tracer wire and connection points shall be 600 feet. Tracer wires on lengths of pipe without hydrants or valves or that cannot meet the 600' spacing requirement shall have wire terminal connection points through the use of an access box. The access box shall be placed on the pipe in accordance with the manufacture's recommendations. The tracer wire shall be routed up through the access box and securely fastened to the terminal connections on the bottom side of the lid.

When located outside of a paved surface, the Contractor shall be required to mark each tracer wire riser with a hydrant marker U-channel post with two 4"x6" steel blue reflectors attached to it. The reflectors shall be marked "WM". All material and installation costs regarding the tracer wire risers shall be considered incidental to the pipe installation.

### 3.12.3. *ELECTRICAL CONDUCTIVITY TEST FOR DUCTILE IRON*

The Contractor shall perform a conductivity test one week after completion of pressure testing of the watermain on all ductile iron pipe watermain. This shall be performed in a timely manner to ensure acceptable conductivity prior to further construction.

On watermain reconstruction projects, the Contractor shall perform the conductivity test prior to service line reconnections to ensure main line isolation from house services.

The Engineer and Owner may require a Contractor to test the first section of pipe installed to demonstrate the Contractors ability to install the pipe in an acceptable manner. When the connection to the existing system is not made with a valve, the Contractor shall test the existing section to the first available valve(s) to determine the condition of the existing system, or the Contractor may make provisions to test his work separately, prior to connection to the existing system, in a manner acceptable to the Engineer.

The system (pipeline, valves, fittings and hydrants) shall be tested for electrical continuity and current capacity. The electrical test shall be made after the hydrostatic test and while the line is at normal operating pressure. Backfilling shall have been completed. The line may be tested in sections of convenient length as approved by Engineer.



Direct current of 350 amperes plus or minus 10%, shall be passed through the pipeline for 5 minutes. Current flow through the pipe shall be measured continuously on a suitable ammeter and shall remain steady without interruption or fluctuation throughout the 5-minute test period.

Insufficient current or intermittent current or arcing, indicated by large fluctuation of the ammeter needle, shall be evidence of defective contact in the pipeline. The cause shall be isolated and corrected. Thereafter, the section in which the defective test occurred shall be retested as a unit and shall meet the requirements.

Sources of D.C. for these tests may be motor generators, arc welding machines, or other approved sources. All such equipment shall be furnished by the Contractor.

Cables from the power source to the section of system under test should be a sufficient size to carry the test current without overheating or excessive voltage drop.

After the test, the hydrant shall be shut off and cap loosened to allow hydrant drainage. Tighten cap after drainage.

#### *3.12.4. ELECTRICAL CONDUCTIVITY TEST FOR PVC*

Upon completion of the project the Contractor shall furnish a locator and using a low voltage circuit, test the entire tracer wire system in the presence of the Engineer. The test shall consist of a continuous above ground trace of the piping and appurtenances installed. All areas failing the location test shall be corrected at the Contractor's expense. The wire shall be tested in accordance with the requirements of ASTM B-1, B-3, B-8 and D-1248.

### 3.13. FINAL INSPECTION

The Contractor and the City of Fargo representative will operate all main valves and inspect all stop boxes for access. This procedure will be accomplished after all clean up, etc. has been completed. This inspection will be made prior to the final payment for work performed. Any defects shall be promptly repaired by the Contractor at his cost.

**PART 4**  
**GUARANTEE, MEASUREMENT & PAYMENT**

4.1. GUARANTEE

The guarantee shall be per the contract.

4.2. MEASUREMENT AND PAYMENT

*4.2.1. GENERAL*

The cost of excavation and trenching shall be included as part of this specification.

*4.2.2. WATERMAIN PIPE*

Pipe will be measured by customary and conventional methods and paid for on a unit price basis for the actual length installed.

Measurement will be from the center of the fitting or valve to the center of the next fitting or valve. The unit price shall include the cost of the pipe, jointing material, concrete thrust blocking or joint restraint and all other appurtenance costs except valves, hydrants, and fittings, completely installed in accordance with the Specifications.

*4.2.3. FITTINGS*

All types of fittings shall be paid for on a unit price per pound of fitting basis. The weight of the fittings shall be determined using AWWA C110 published body weights for cast iron mechanical joint fittings including accessories and cement lining. No additional weight will be added for accessories and/or cement lining.

#### 4.2.4. VALVES

Valves will be paid for under the unit price bid per each complete in place. The unit price will include the valve, jointing material, valve box, valve box adaptor, concrete blocking, necessary extensions, and all other work necessary for a complete and workable valve installation.

#### 4.2.5. HYDRANTS AND YARD HYDRANTS

Hydrants will be paid for under the unit price bid per each complete in place. The unit price will include the hydrant with hydrant marker, rock bedding, blocking, excess excavation and all other work necessary for a complete and workable hydrant installation.

#### 4.2.6. POLYETHYLENE WRAP

Polyethylene wrap shall be included in the unit bid price for ductile iron pipe, fittings, hydrants, and valves. All material, labor, equipment and incidental costs necessary to install the plastic wrap shall be included.

#### 4.2.7. DISINFECTION AND TESTING WATER MAINS

Disinfection and testing of water mains shall be incidental to the bid price for the water main. Payment will not be made for watermain until such time as it has been successfully tested.

#### 4.2.8. TAPPING SLEEVES AND VALVES

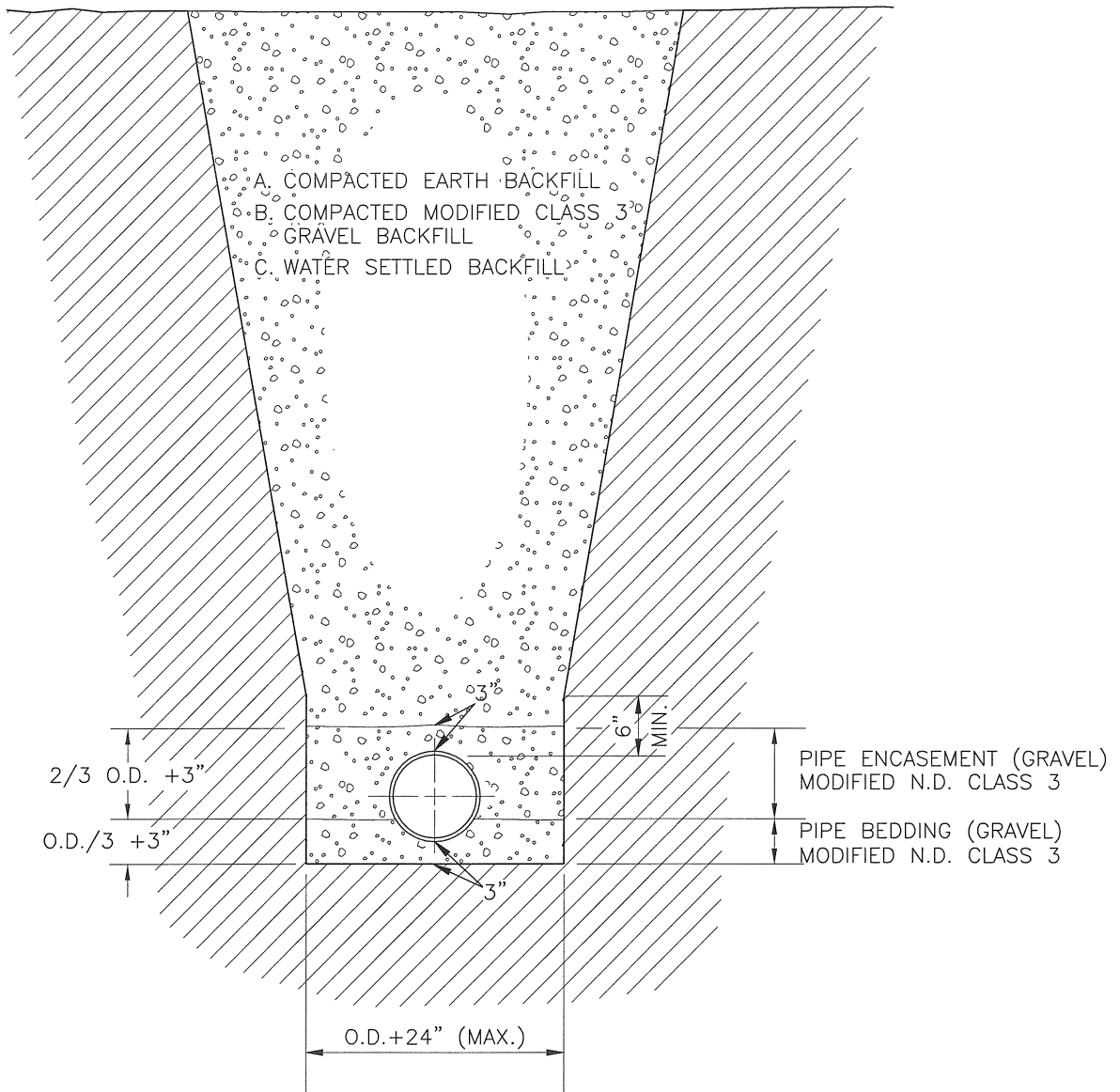
The unit bid price shall include the cost of furnishing and installing the tapping sleeve and valve. The City of Fargo Water Department will make the tap on 12" and smaller taps and bill the Contractor for those costs. On taps larger than 12", the Contractor shall make arrangements with other entities to make the tap.

#### 4.2.9. TRACER WIRE

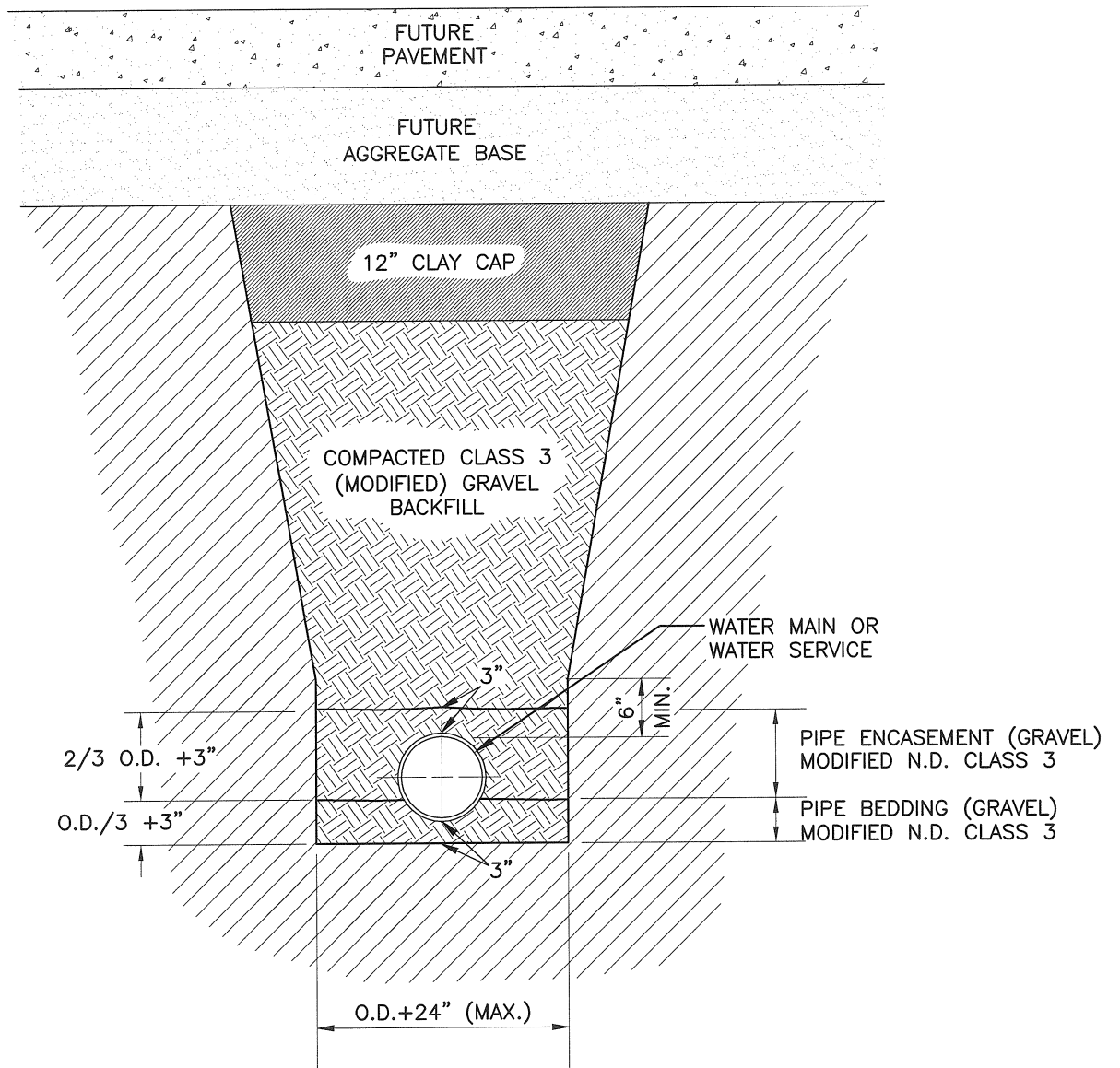
The tracer wire shall be considered incidental to watermain construction.

*4.2.10. OTHER COSTS*

All other costs for work necessary to properly complete the work specified herein shall not be bid items; the costs shall be charged to other items unless a bid item is specifically included on the bid sheet.



SECTION NO. 1300	DRAWING NO. 5.1
REV.D. 2012	
<b>WATER MAIN TRENCH BACKFILL</b>	
CITY OF FARGO ENGINEERING DEPARTMENT	
APPROVED <i>BEO</i>	DATE <i>2-21-2012</i>



**NOTE:**

THIS DETAIL APPLIES WHERE WATER MAIN IS INSTALLED UNDER FUTURE PAVING WITH EDGE DRAIN.

SECTION NO.	1300	DRAWING NO.	5.2
REV.D.			
<i><b>WATER MAIN TRENCH UNDER NEW PAVEMENT</b></i>			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	<i>BED</i>	DATE	<i>2-21-2012</i>

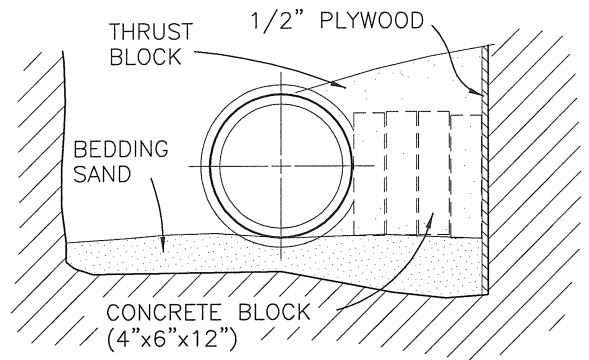
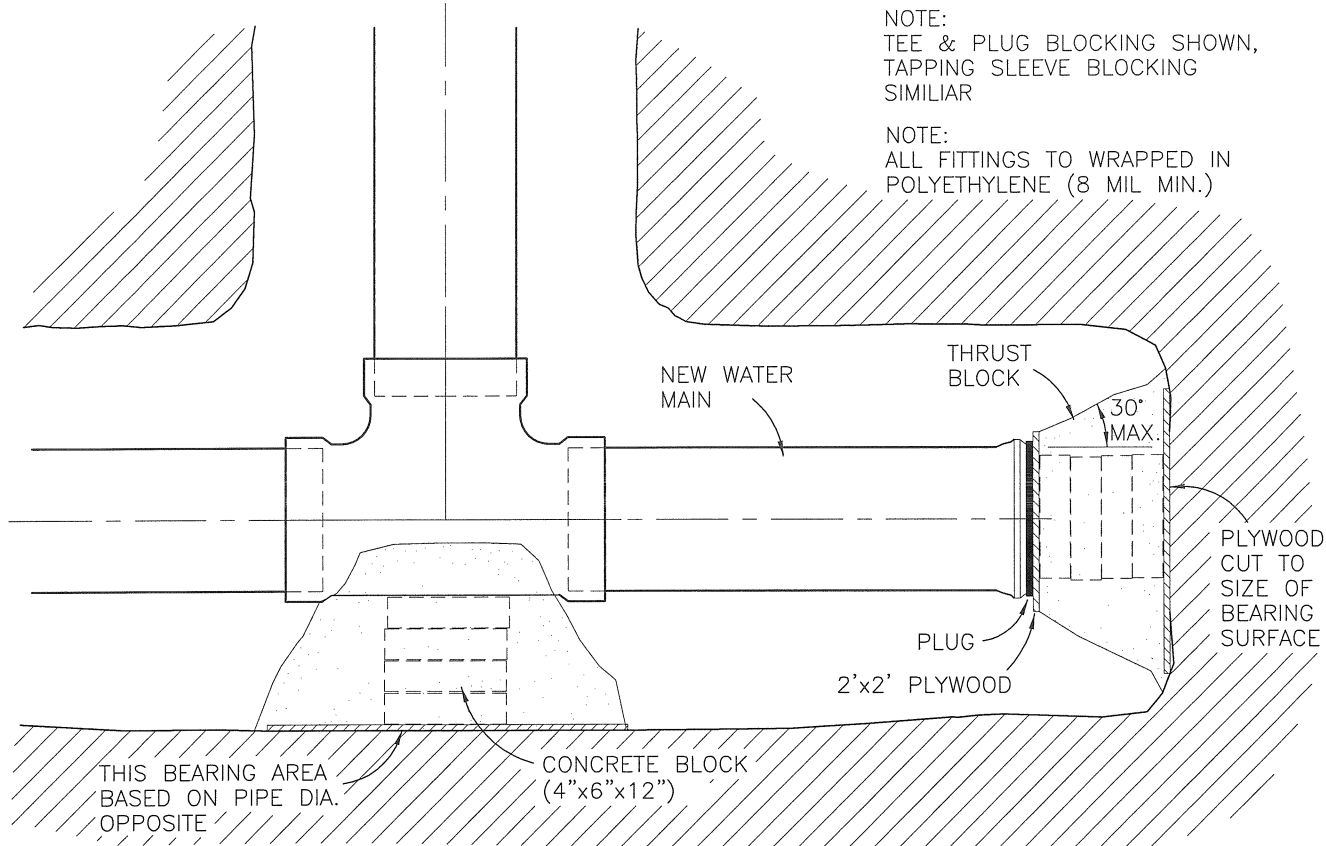
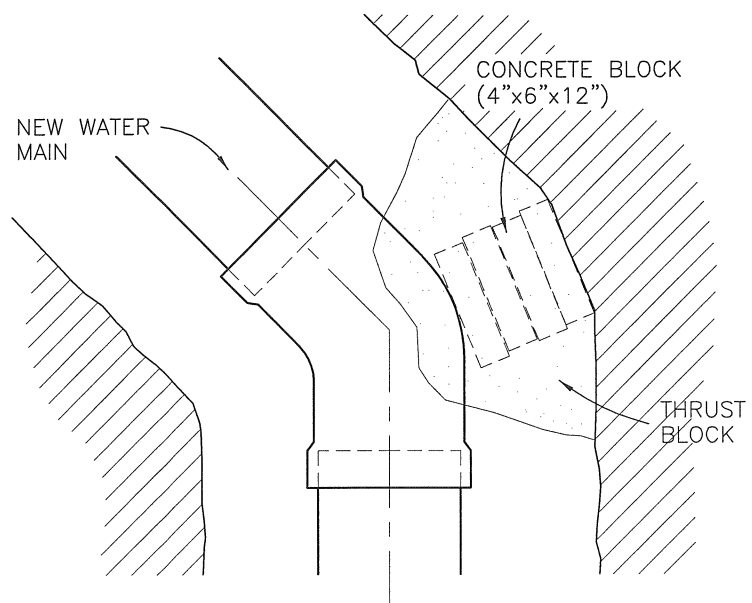


TABLE OF REQUIRED BEARING AREAS

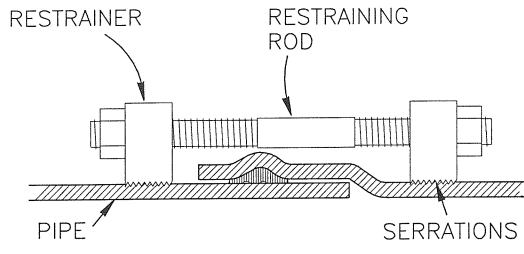
SIZE OF PIPE	90° BEND	45° BEND	22 1/2°	11 1/4°	TEE
4"	2' SQ.	2' SQ.	2' SQ.	2' SQ.	2' SQ.
6"	3' SQ.	2' SQ.	2' SQ.	2' SQ.	3' SQ.
8"	5' SQ.	3' SQ.	2' SQ.	2' SQ.	4' SQ.
10"	8' SQ.	4' SQ.	3' SQ.	2' SQ.	6' SQ.
12"	11' SQ.	6' SQ.	3' SQ.	2' SQ.	8' SQ.
16"	20' SQ.	11' SQ.	6' SQ.	4' SQ.	15' SQ.
18"	25' SQ.	14' SQ.	7' SQ.	4' SQ.	18' SQ.

NOTE:  
 CONCRETE BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH. BELLS AND BOLTS TO BE KEPT FREE OF CONCRETE. CONCRETE IN PLACE TO BE INCLUDED IN PRICE BID FOR WATER MAIN.

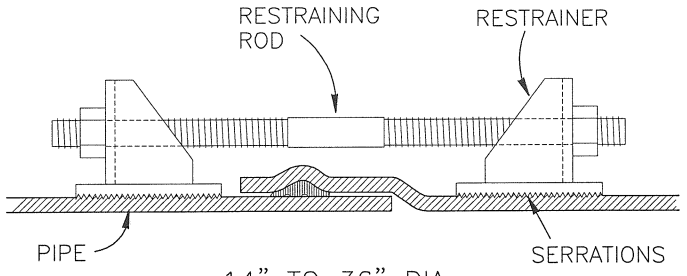
IF APPROVED BY THE ENGINEER, SOLID CONCRETE BLOCKS MAY BE USED FOR BLOCKING ON 8" DIA PIPE AND BELOW. 10" DIA. PIPE AND ABOVE WILL CONFORM TO CONCRETE POURED IN PLACE AREAS SHOWN ABOVE.



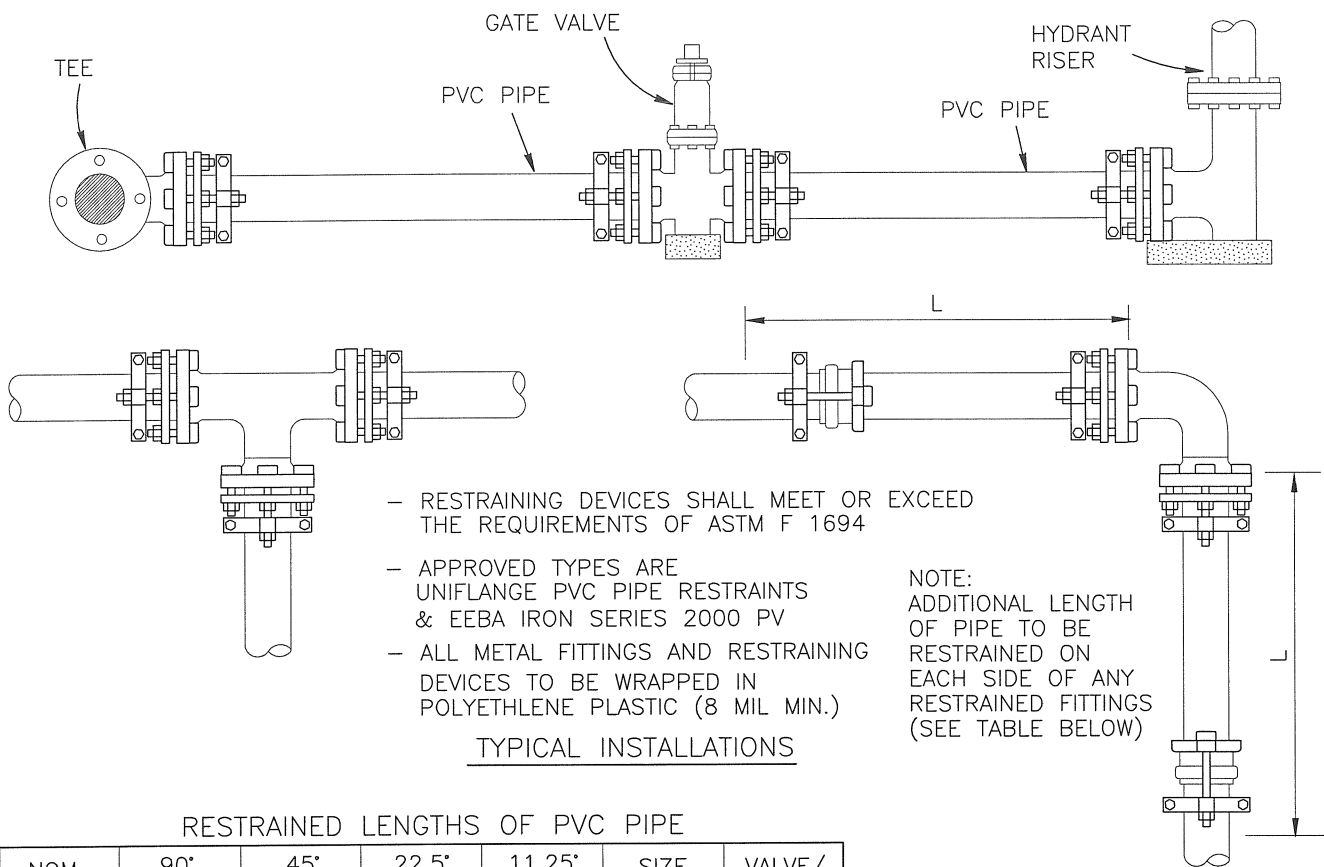
SECTION NO. 1300	DRAWING NO. 5.3
REV.D. March, 1999	
<b>WATER MAIN THRUST BLOCKING</b>	
CITY OF FARGO ENGINEERING DEPARTMENT	
APPROVED <i>BEO</i>	DATE <i>2-21-2012</i>



2" TO 12" DIA.



14" TO 36" DIA.



- RESTRAINING DEVICES SHALL MEET OR EXCEED THE REQUIREMENTS OF ASTM F 1694
- APPROVED TYPES ARE UNIFLANGE PVC PIPE RESTRAINTS & EEBA IRON SERIES 2000 PV
- ALL METAL FITTINGS AND RESTRAINING DEVICES TO BE WRAPPED IN POLYETHYLENE PLASTIC (8 MIL MIN.)

NOTE:  
ADDITIONAL LENGTH OF PIPE TO BE RESTRAINED ON EACH SIDE OF ANY RESTRAINED FITTINGS (SEE TABLE BELOW)

TYPICAL INSTALLATIONS

RESTRAINED LENGTHS OF PVC PIPE

NOM. PIPE SIZE	90° BEND (L)	45° BEND (L)	22.5° BEND (L)	11.25° BEND (L)	SIZE ON SIZE TEE(L)*	VALVE/ DEAD-END(L)
6"	19'	8'	4'	2'	2'	35'
8"	25'	11'	5'	3'	13'	45'
10"	31'	13'	6'	3'	23'	55'
12"	36'	15'	8'	4'	33'	65'
16"	47'	20'	10'	5'	52'	84'

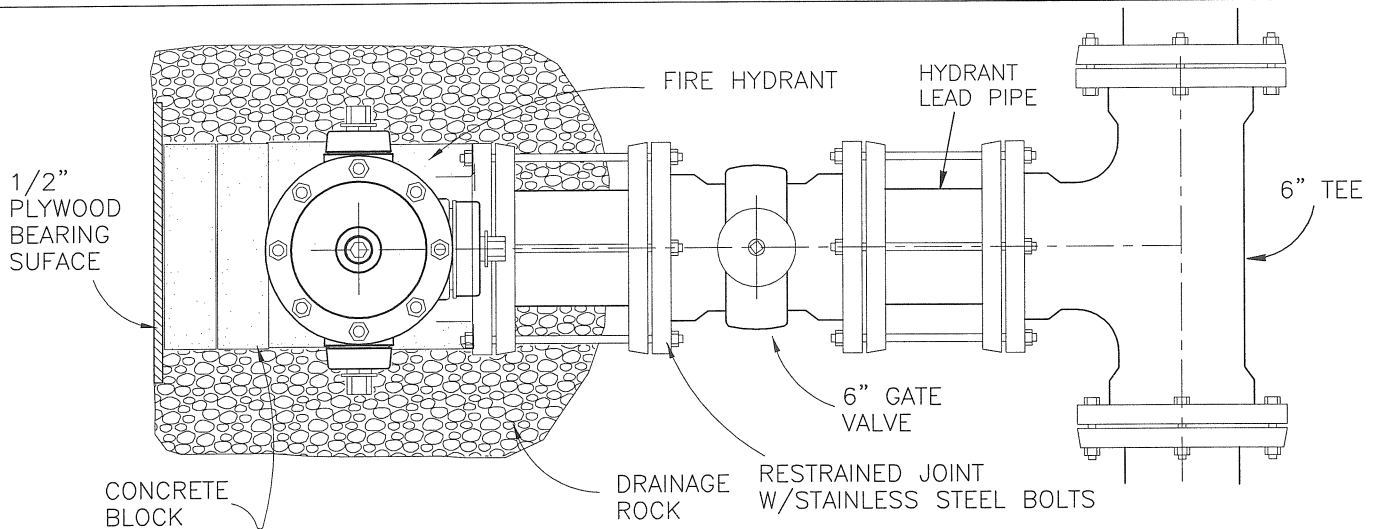
\* RECOMMENDED RESTRAINED LENGTHS FOR TEES ARE FOR THE BRANCH OUTLET AND ASSUME A MINIMUM 10 FT. SECTION OF PIPE ATTACHED TO EACH SIDE OF THE RUN. RESTRAINT DEVICES ARE ALSO REQUIRED ON BOTH RUN JOINTS OF THE TEE ITSELF.

SIZE	45° VERT. OFFSET* (L)	22½° VERT. OFFSET* (L)
6"	15'8"	7'4"
8"	19'11"	9'5"
10"	23'13"	11'6"
12"	27'15"	13'8"
16"	35'20"	17'10"

\* FIRST NUMBER IS THE RECOMMENDED RESTRAINED LENGTH ON EACH SIDE OF THE DOWN BEND, THE SECOND NUMBER IS THE LENGTH FOR EACH SIDE OF THE UP BEND.

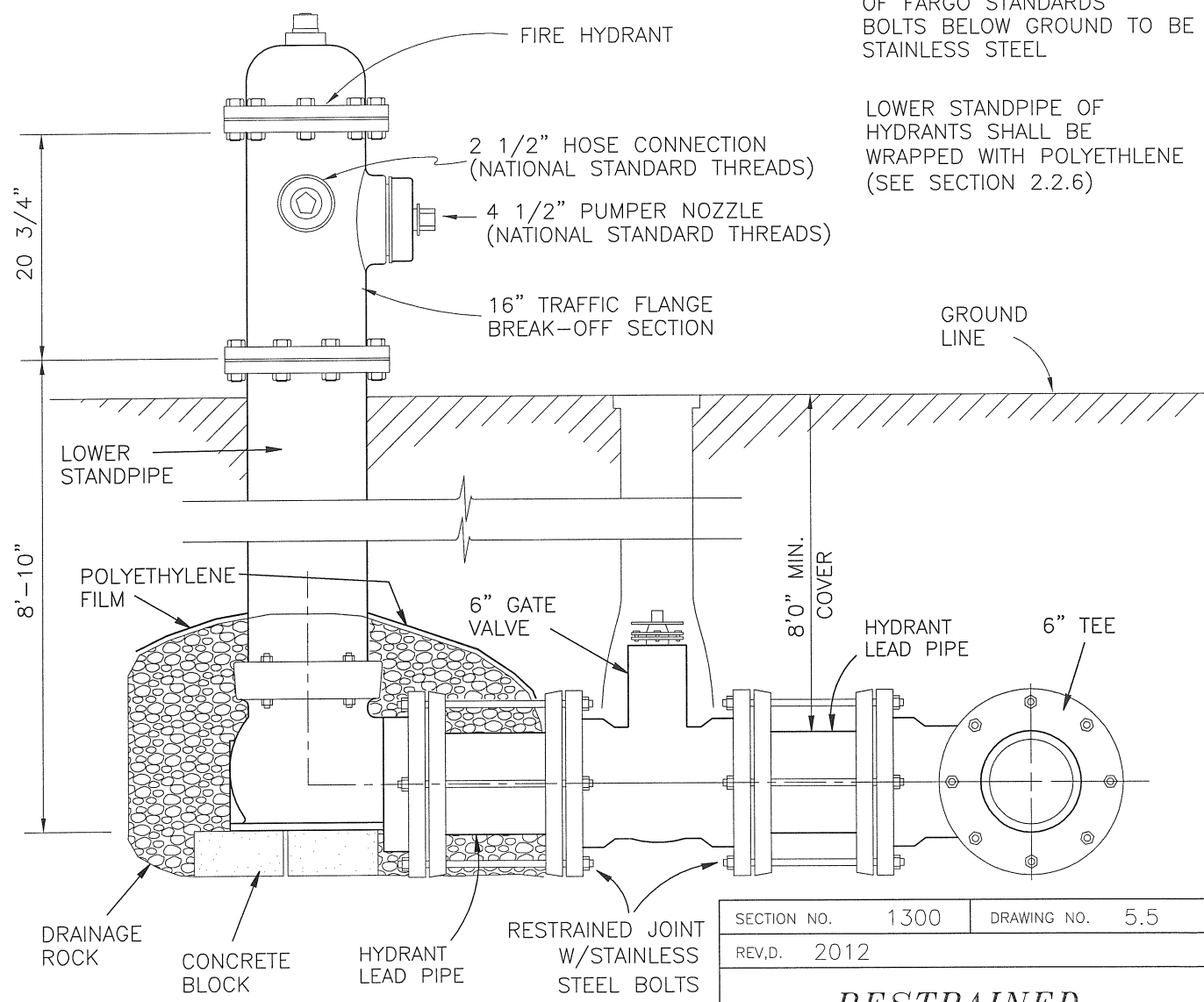
SECTION NO. 1300	DRAWING NO. 5.4
REV.D. March, 1999	
<b>RESTRAINT DEVICE FOR PVC PIPE BELL JOINTS</b>	
CITY OF FARGO ENGINEERING DEPARTMENT	
APPROVED <i>BEO</i>	DATE <i>2-21-2012</i>



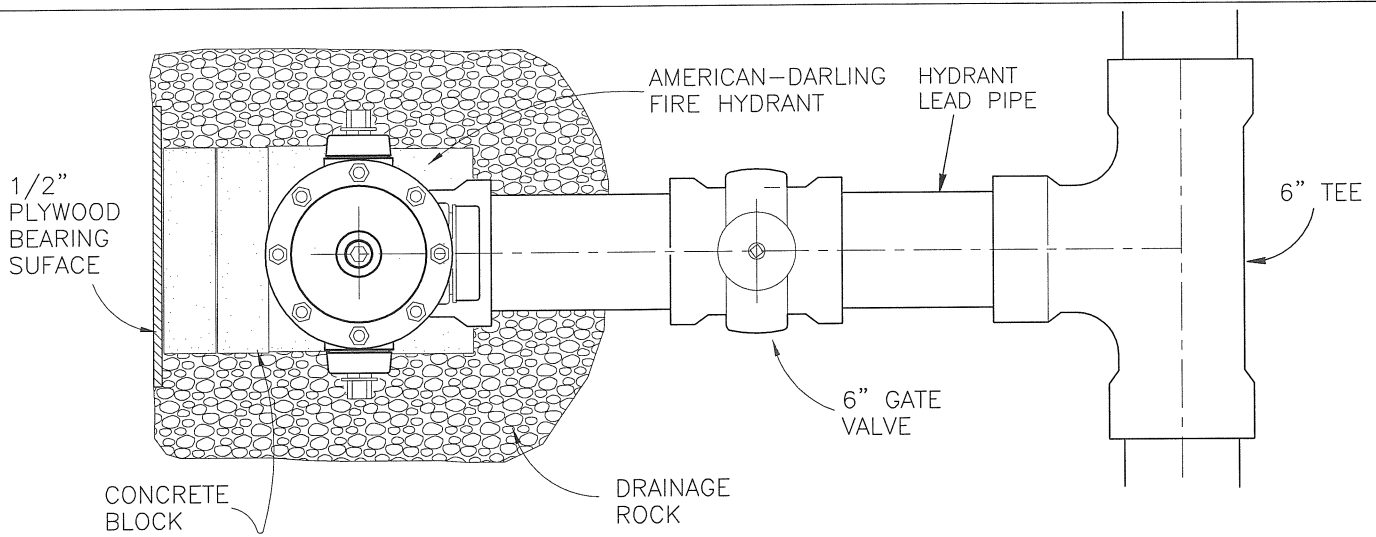


NOTE:  
 OPERATING & CAP NUTS: CITY OF FARGO STANDARDS  
 BOLTS BELOW GROUND TO BE STAINLESS STEEL

LOWER STANDPIPE OF HYDRANTS SHALL BE WRAPPED WITH POLYETHYLENE (SEE SECTION 2.2.6)

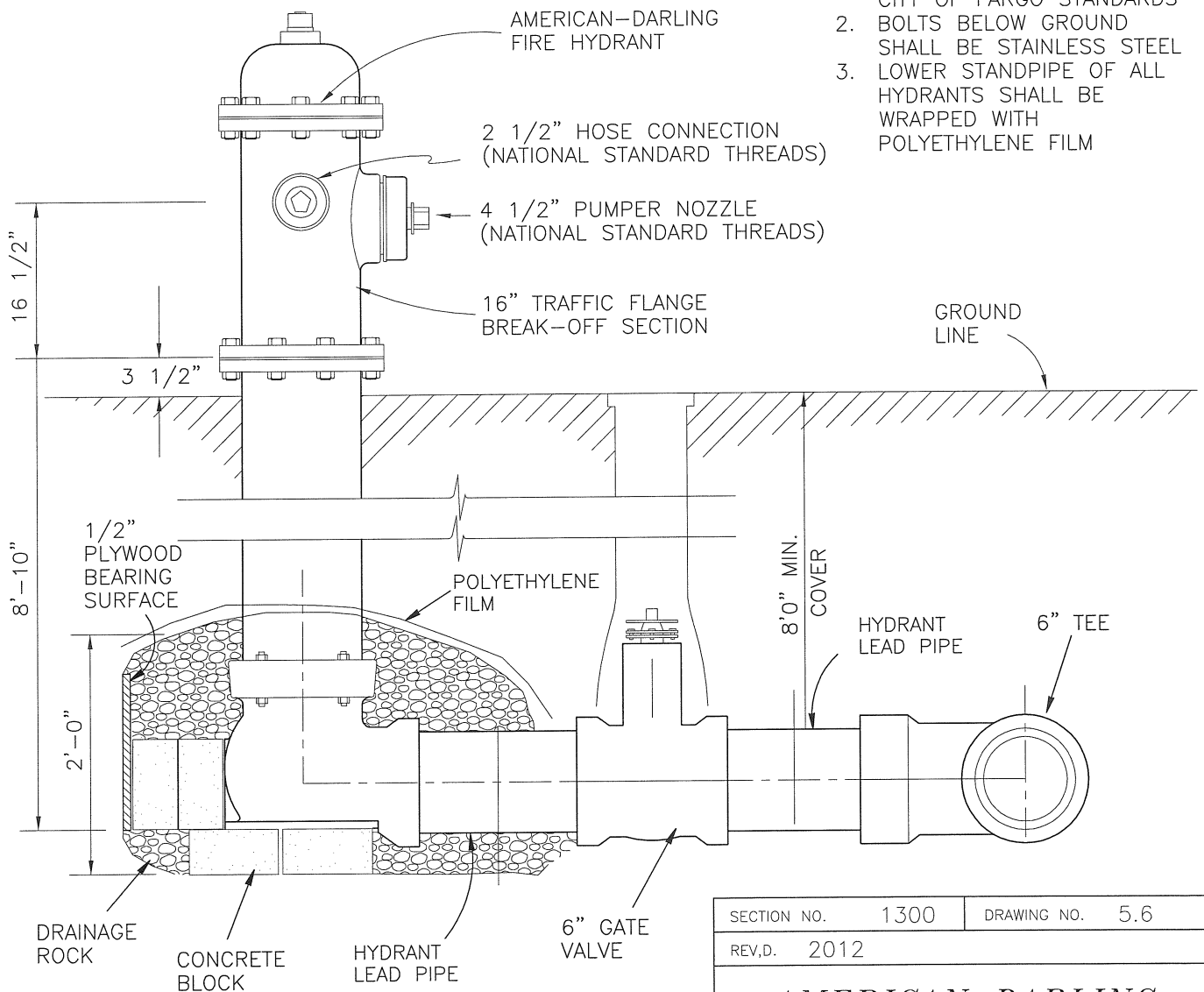


SECTION NO.	1300	DRAWING NO.	5.5
REV.D.	2012		
<b>RESTRAINED MECHANICAL JOINT</b>			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	<i>BEO</i>	DATE	<i>2-21-2012</i>

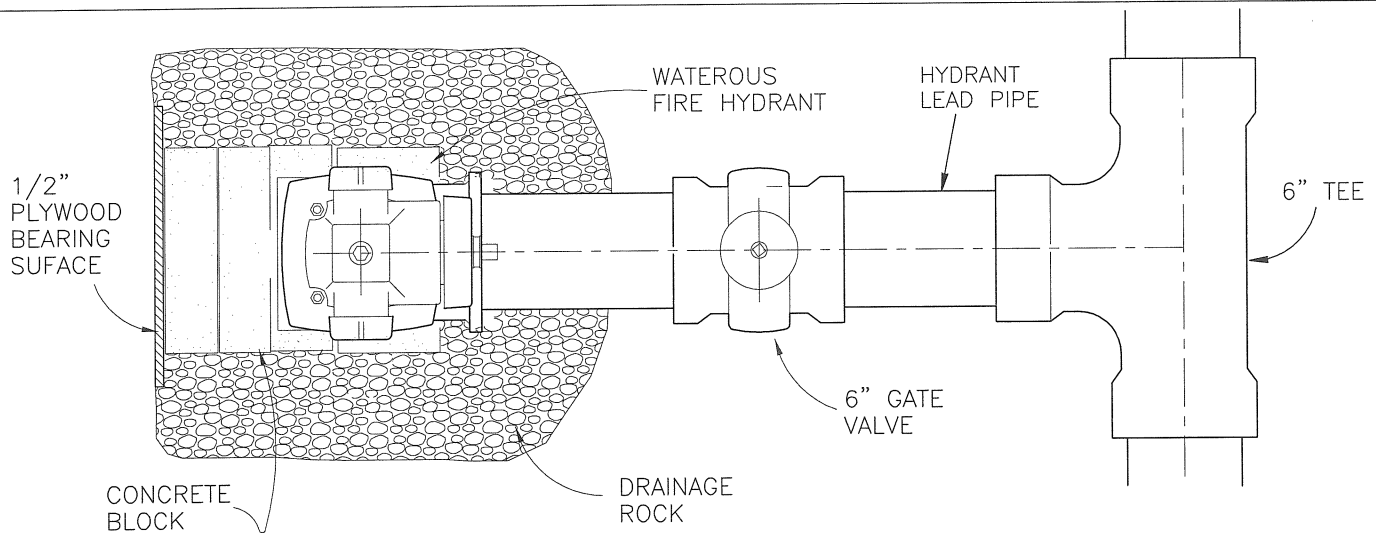


NOTES:

1. OPERATING & CAP NUTS: CITY OF FARGO STANDARDS
2. BOLTS BELOW GROUND SHALL BE STAINLESS STEEL
3. LOWER STANDPIPE OF ALL HYDRANTS SHALL BE WRAPPED WITH POLYETHYLENE FILM

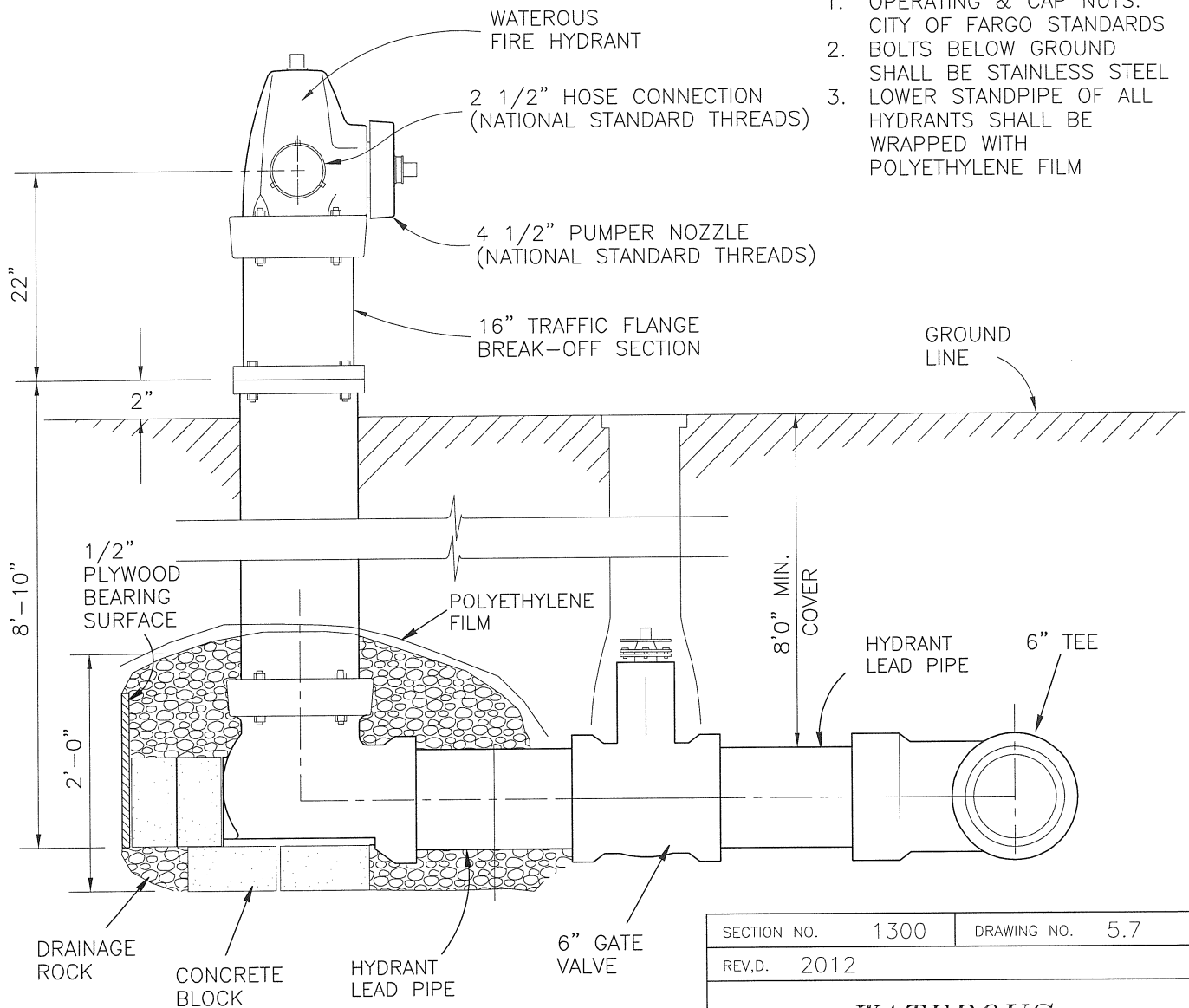


SECTION NO.	1300	DRAWING NO.	5.6
REV.D.	2012		
<b>AMERICAN DARLING HYDRANT CONNECTIONS</b>			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	BED		DATE 2-21-2012



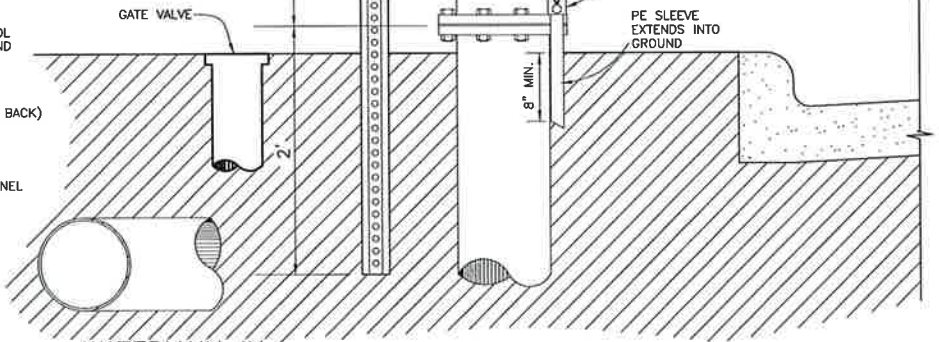
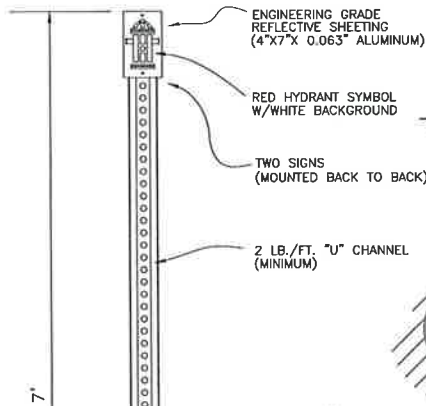
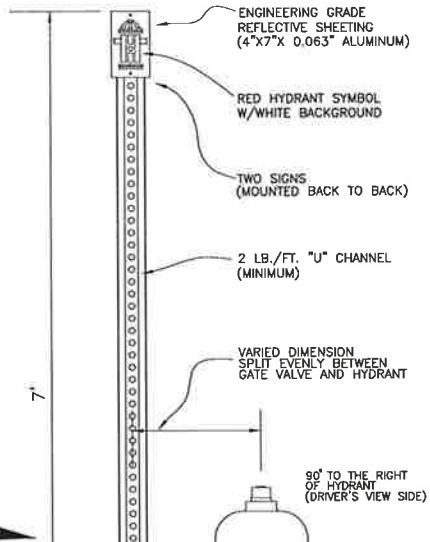
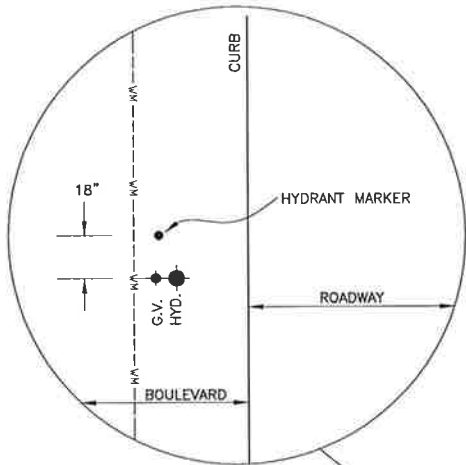
NOTES:

1. OPERATING & CAP NUTS: CITY OF FARGO STANDARDS
2. BOLTS BELOW GROUND SHALL BE STAINLESS STEEL
3. LOWER STANDPIPE OF ALL HYDRANTS SHALL BE WRAPPED WITH POLYETHYLENE FILM



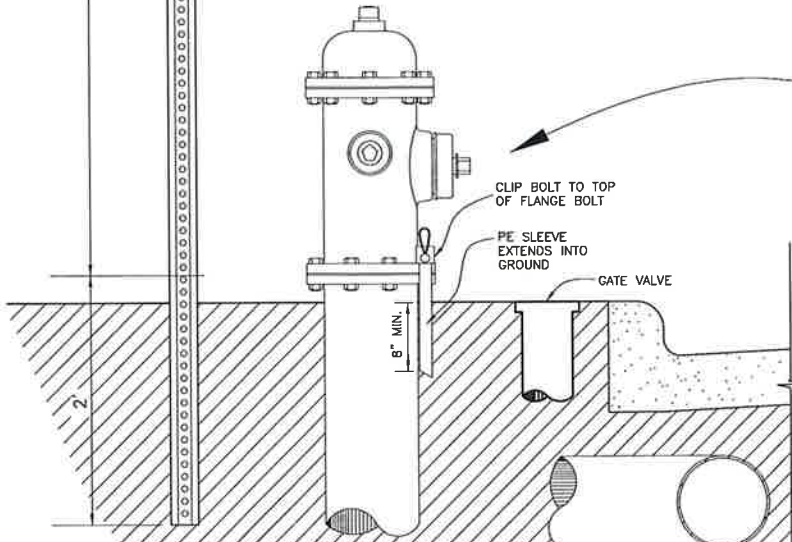
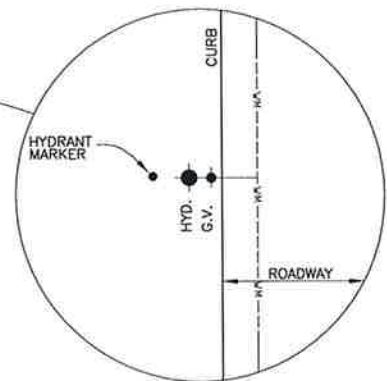
SECTION NO.	1300	DRAWING NO.	5.7
REV.D.	2012		
<b>WATEROUS HYDRANT CONNECTIONS</b>			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	BED		DATE 2-21-2012

PLAN VIEW



WATERMAIN IN BOULEVARD

PLAN VIEW



WATERMAIN UNDER ROADWAY

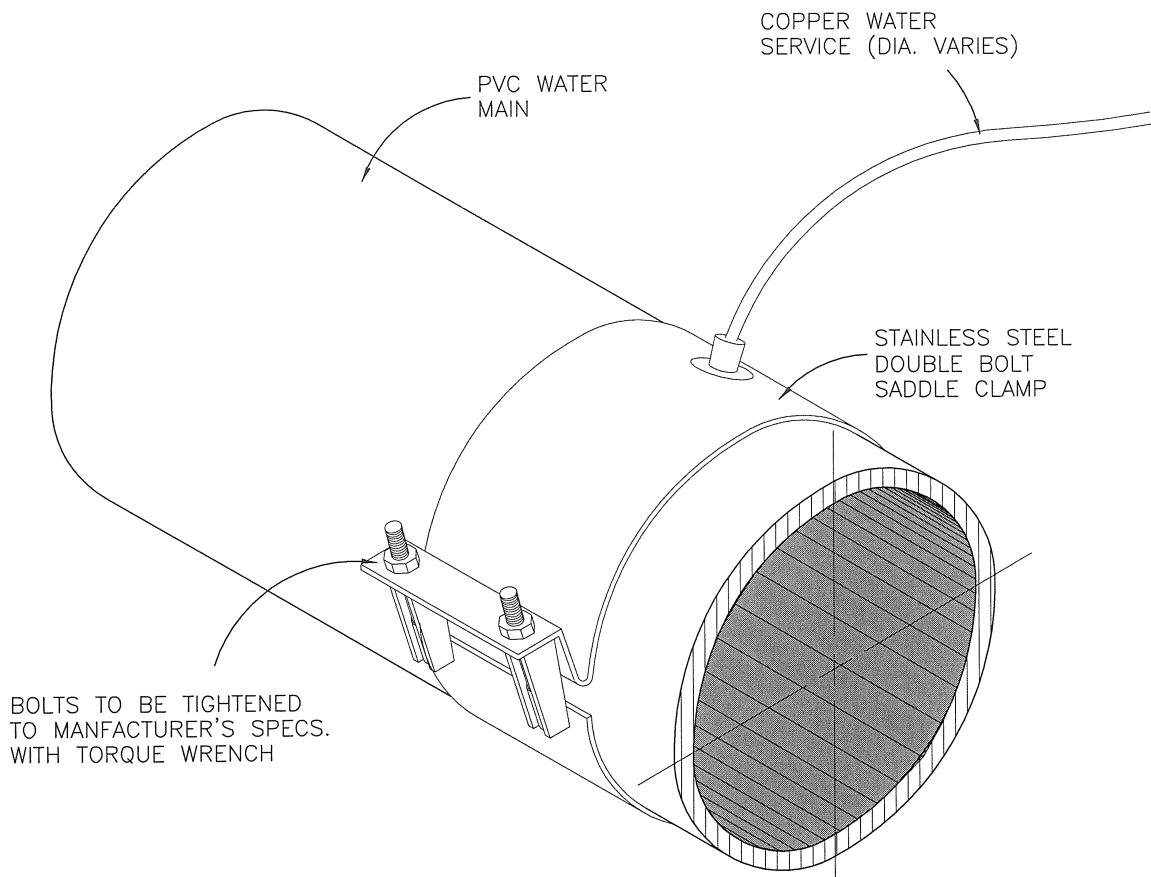
SECTION NO. 1300 | DRAWING NO. 5.8

REV.D. 2015

**HYDRANT MARKER  
DETAIL**

CITY OF FARGO  
ENGINEERING DEPARTMENT

APPROVED *JME* | DATE 12/3/14



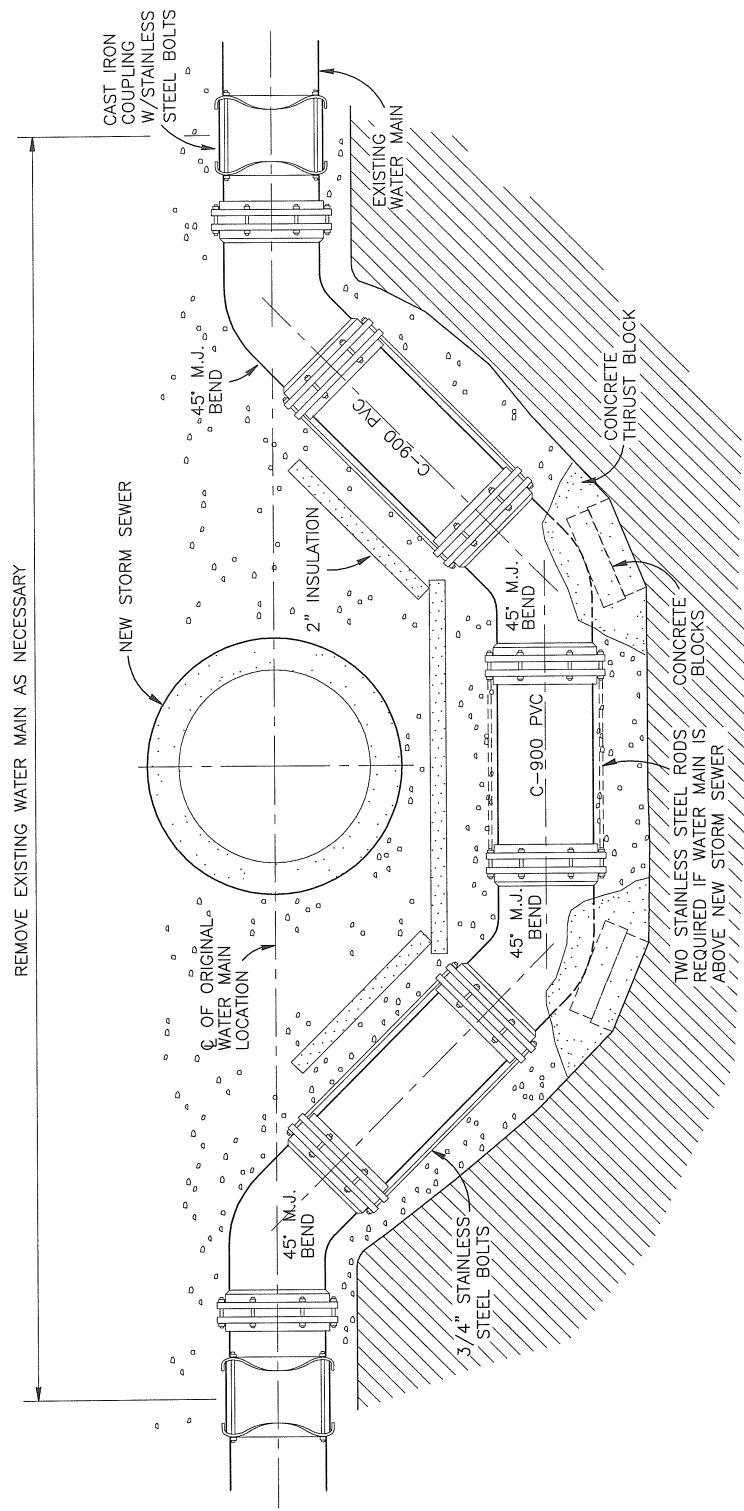
BOLTS TO BE TIGHTENED TO MANUFACTURER'S SPECS. WITH TORQUE WRENCH

NOTE:

THE CONTRACTOR WILL BE REQUIRED TO USE ALL STAINLESS STEEL SADDLE SERVICES. DIRECT TAPS WILL NOT BE PERMITTED.

ROMAC 304, FORD FS303, POWERSEAL 3412-AS OR CASCADE CSC1 AND CSC2 ARE APPROVED FOR INSTALLATION.

SECTION NO. 1300	DRAWING NO. 5.9
REV.D. March, 2007	
<b>WATER MAIN TAPPING SADDLE</b>	
CITY OF FARGO ENGINEERING DEPARTMENT	
APPROVED <i>BED</i>	DATE <i>2-21-2012</i>

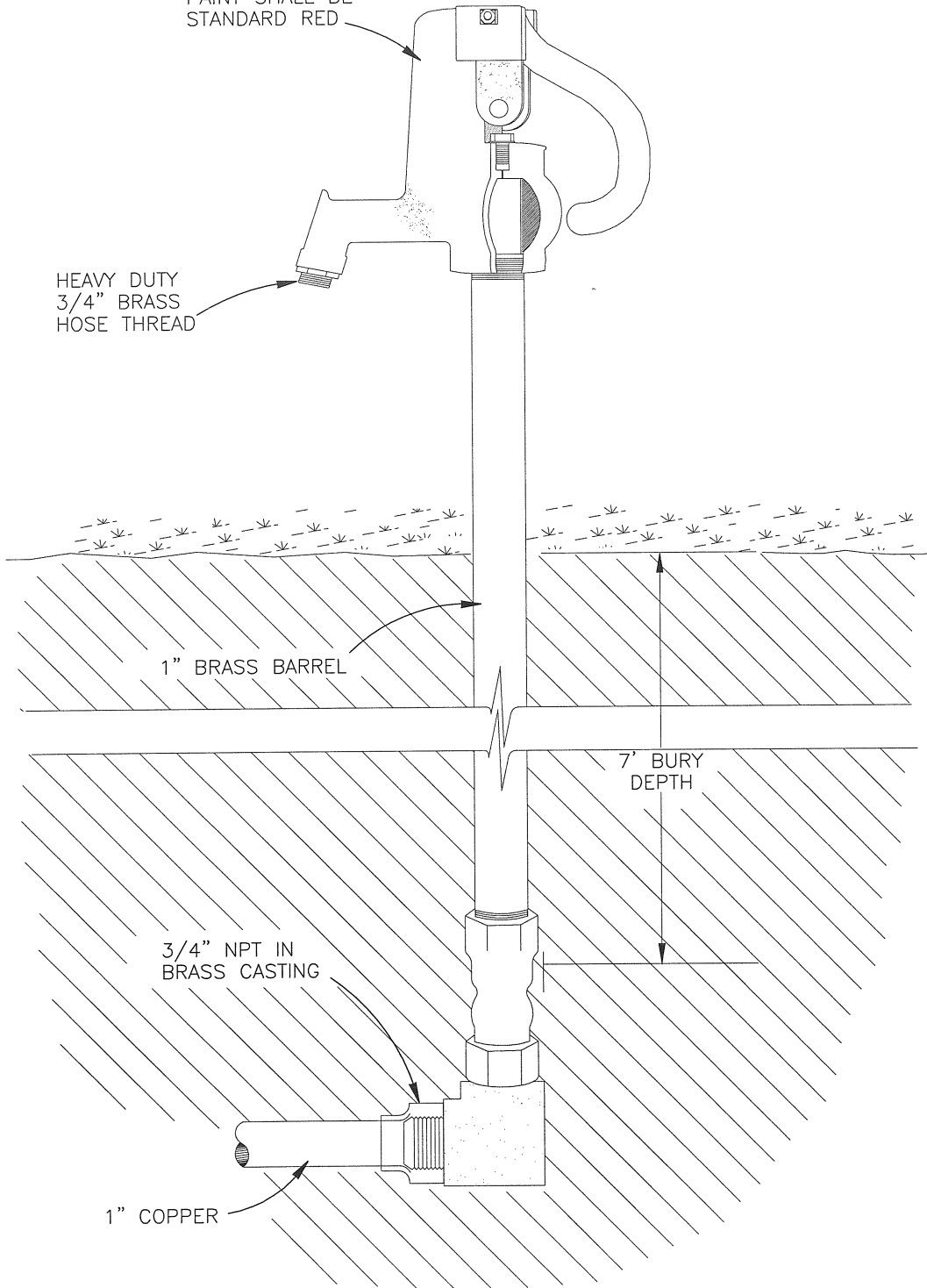


NOTE:  
 ALL FITTINGS TO BE WRAPPED IN POLYETHYLENE  
 PLASTIC (8 MIL MIN.)  
 BELLS AND BOLTS TO BE KEPT FREE OF CONCRETE.

SECTION NO.	1300	DRAWING NO.	5.10
REV.D.	2012		
<b>WATER MAIN RELOCATION DETAIL</b>			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	<i>BED</i>	DATE	<i>2-21-2012</i>

NOTE:  
PAINT SHALL BE  
STANDARD RED

HEAVY DUTY  
3/4" BRASS  
HOSE THREAD



1" BRASS BARREL

7' BURY  
DEPTH

3/4" NPT IN  
BRASS CASTING

1" COPPER

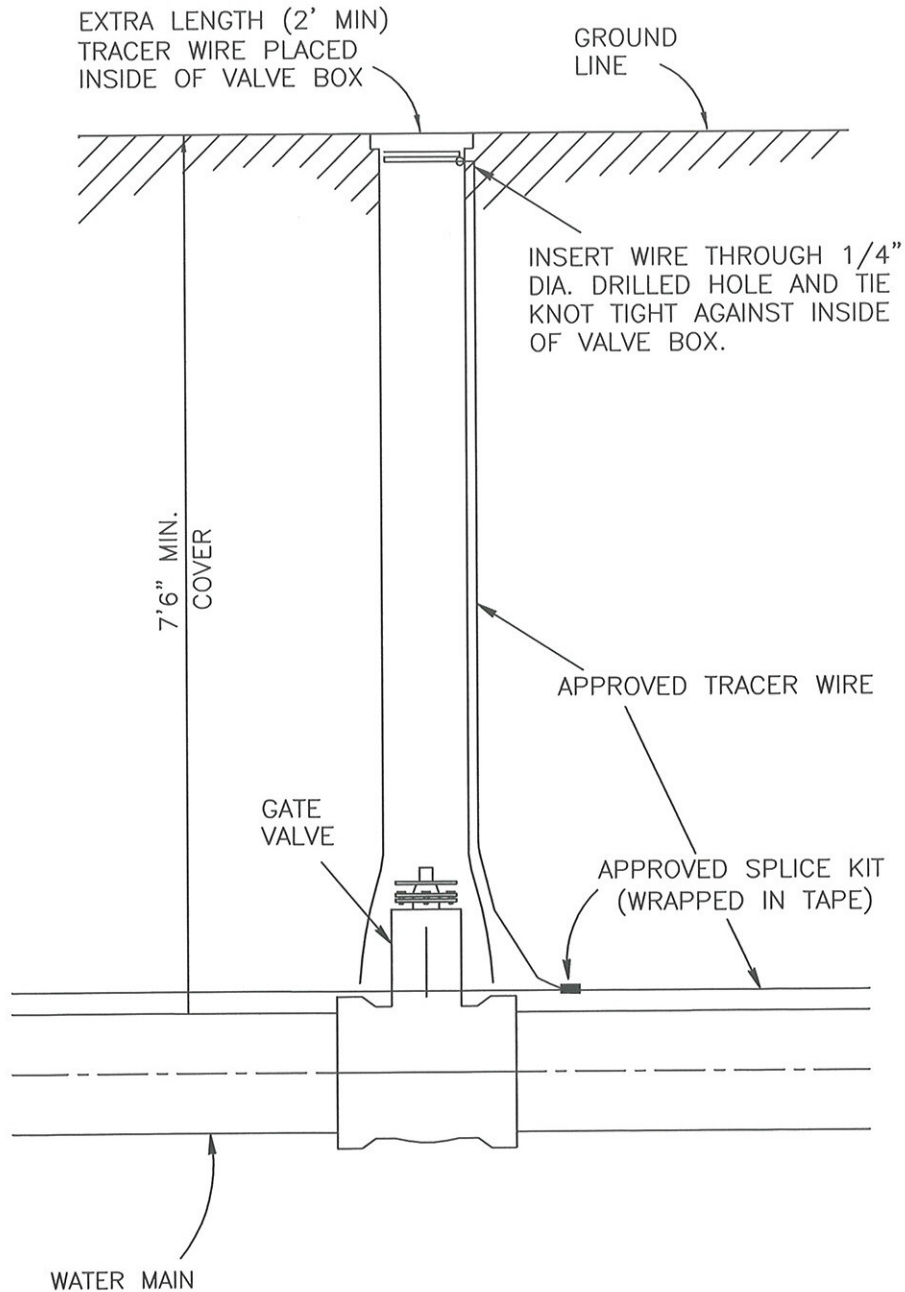
SECTION NO. 1300 DRAWING NO. 5.11

REV.D. MARCH, 2000

*FROST PROOF  
YARD HYDRANT*

CITY OF FARGO  
ENGINEERING DEPARTMENT

APPROVED *BED* DATE *2-21-2012*



NOTE:  
 TRACER WIRE WILL NOT NORMALLY BE  
 INSTALLED VERTICALLY UP VALVE BOXES AS  
 SHOWN. THIS DETAIL APPLIES ONLY WHERE  
 SPECIFICALLY CALLED FOR ON THE PLANS OR  
 AS DIRECTED BY THE ENGINEER.

SECTION NO. 1300	DRAWING NO. 5.12
REV.D. 2013	
<b>VALVE TRACER WIRE DETAIL</b>	
CITY OF FARGO ENGINEERING DEPARTMENT	
APPROVED <i>JME</i>	DATE 1-2-13