Town of North Reading

Water Construction Standards

A. General

1. Description

(a.) The work includes furnishing and installing all pipe, fittings, valves, structures and appurtenances required for the proposed system to supply water to users of the Town of North Reading's Water System.

(b.) Work and materials shall be performed in accordance with the Massachusetts Plumbing Code when work is within ten (10) feet of buildings.

(c.) Only one water service shall be installed per parcel.

2. Submittals

(a.) Materials List and Shop Drawings

(1.) Materials list of materials proposed shall be submitted to the Town.

(2.) Approved shop drawings for all materials and structures shall be submitted to the Town.

(3.) The Town of North Reading standard detail drawings are an Appendix to this document.

(b.) As-Built Drawings

(1.) Submit three (3) copies of As-Built Drawings to the DPW upon completion and acceptance of work.

(2.) As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built Drawings shall include a minimum of three (3) ties to each valve cover and curb stop from fixed permanent objects. As-Built drawings shall also contain any additional information required by the municipality and shall be stamped with the seal of a Licensed Land Surveyor and Licensed Professional Engineer. The Town may, at its discretion, require that as-built plans be submitted on electronic form (e.g., AutoCAD release 2002 or higher).

3. Inspection

(a.) The Applicant is responsible for the provisions and all test requirements specified herein. In addition, all pipe and appurtenances may be inspected at the plant for compliance with these specifications by an independent testing laboratory.

(b.) Inspection of the pipe and appurtenances may also be made after delivery. The pipe and appurtenances shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though samples may have been accepted as satisfactory at the place of manufacture. Pipe and appurtenances rejected after delivery shall be marked for identification and shall be removed from the site at once.

4. Delivery, Storage and Handling

(a.) All materials shall be adequately protected from damage during transit. Pipes shall not be dropped.

(b.) All pipe and other appurtenances shall be inspected before placement in the work and any found to be defective from any cause, including damage caused by handling, and determined by the Town to be unrepairable shall be removed at once.

(c.) Storage and handling of pipes and other appurtenances shall be in accordance with the manufacturer's recommendations, subject to the approval of the Town.

B. Materials

1. General

(a.) The Materials section summarizes the Town's standards to be used in public or private components that affect the Town's water system. All materials should conform to the applicable AWWA standards unless otherwise noted.

2. Lead Free

(a.) All materials used in public or private water systems within the Town of North Reading's water system must be certified "lead free."

3. Pipe

(a.) All water mains shall be minimum Ductile Iron Class 52, single gasket, double sealing pipe with cement mortar lining. All ductile iron water main pipe shall be rated for a minimum operating pressure of 350 psi. All water main shall be encased in polyethylene film when the trench is backfilled with control density fill.

(b.) All water mains shall be minimum 8-inch diameter. All hydrant branches shall be a minimum of 6-inch diameter.

(c.) Push-on type joints are recommended on straight runs of pipe. Gaskets must be standard for pipe used and be acceptable to the DPW. A minimum of two brass wedges per joint shall be used to maintain conductivity and facilitate lock-on.

(d.) Mechanical joint restraints shall consist of individually actuated wedges that increase their resistance to pull out as pressure or external forces increase. The device shall be capable of full mechanical joint deflection during assembly and the flexibility of the joint shall be maintained after burial. They shall have a rated work pressure of 350 psi in sizes 16-inch and smaller and 250 psi on in sizes greater than 16 inches.

(e.) The Town has standardized on the Series 1100 MEGA-LUG restraint as produced by EBAA Iron, Inc. or approved equal.

(f.) Nitrile gaskets shall be used where petroleum contamination exists.

(g.) Ductile iron fittings shall be used and shall be cement lined. Fittings shall be equipped with a mechanical joint restraint, unless otherwise specified by the DPW. Mechanical joint fittings in sizes 4 inch through 12 inch shall be ductile iron compact fittings and rated for 350 psi working pressure. All nuts and bolts shall be of a type equal to ductile iron or KOR-10 steel T-bolts and nuts or an approved equal.

(h.) Couplings shall be provided with plain, Grade 27, rubber gaskets and track-head bolts with nuts. Couplings shall be Smith Blair, Style 441 or Dress, Style 38 or 360 repair Clamps or an approved equal. If the outer diameter of the pipe permits, a Dresser coupling is preferred.

4. Valves

(a.) **Resilient Seat Gate Valves**.

(1.) Resilient seat gate valve bodies shall be manufactured of ductile iron. Gate valves shall be open right (clockwise). All valves shall be designed for minimum 250 psi working water pressure.

(2.) The Town has standardized on American Flow Control and Kennedy or an approved equal.

(b.) Gate Boxes

(1.) Valve boxes shall be adjustable, Buffalo-Style with the lower part manufactured of cast iron and the upper part of steel or cast iron. The valve box shall be designed and constructed to prevent direct transmission of traffic loads to the pipe or valve. The top of the cover shall be flush with the top of the box rim.

(2.) Box covers shall be round frame and cover. The boxes shall be labeled to differentiate between hydrant valves ("HYD"), division valves ("DIV"), Blow-Off ("B.O.") and generic valves as indicated in the Construction Details.

(c.) Tapping Sleeves & Valves

(1.) Tapping sleeves shall be of the mechanical joint type. The valves shall be flanged by mechanical joint outlet with non-rising stem and designed for vertical burial. Tapping valves shall be rated at 200 psi working pressure and shop tested at 300 psi. Bolts on bonnet and stuffing box shall be stainless steel (316 stainless steel), stuffing boxes shall be "O" ring type. The operating nut shall be 2 inches square. Gaskets shall cover the entire flange surface. Valves shall open left, (counter clockwise).

(2.) The Town has standardized on American Darling 1004 or an approved equal.

5. Piping Connections

(a.) Service Connections

(1.) All service pipe shall be type "K" copper tubing, 1-inch minimum. All services shall have a curb valve and valve box installed at the property line.

(2.) Plastic services are allowed on a case-by-case basis. In such circumstances, the Town will require that the applicant verify that no petroleum constituents are present in subsurface soil in the vicinity of the service. Plastic water services shall be Polyethylene manufactured of PE3408 materials with SDR-9 minimum wall thickness, as defined in ASTM D3350. Polyethylene pipe shall be blue plastic and pressure class 200 psi. Dimensional and performance characteristics shall conform to the requirements of AWWA C901. The use of polyethylene pipe and tubing may be allowed for water services two (2) inches or under in diameter (4-inch and larger diameter water services shall use cement lined ductile iron water pipe). Polyethylene pipe shall be installed with enough slack to compensate for settlement and compaction and shall be laid on a bed of fine grained material

(3.) Curb valves shall include a drain.

(4.) The Town has standardized on lead-free service connections manufactured by either McDonald, Mueller, Ford or an approved equal. Copper tubing shall be of the type commercially known as type "K" soft and conforms to ASTM Specifications B-88-49.

(5.) Curb boxes shall be Buffalo box style.

(b.) Corporations

(1.) Corporations for 1 inch installations shall be heavy pattern, solid plug, easy turning. The inlet shall be an AWWA (CC) thread. The 1-1/2 inch and 2 inch corporations shall be of a tee head ball valve type which incorporates Teflon seats to assure self-centering of a Teflon coated bronze ball. The corporation shall be easy turning and non-binding. The inlet shall be an AWWA (CC) thread. Corporations shall be subject to a sustained hydraulic pressure of 200 psi. All 1½ and 2-inch saddles shall have stainless steel straps.

6. Hydrants

(a.) Hydrants shall have a 5-1/4-inch valve that shall open right (clockwise). The hydrant shall have one 4-1/2- inch steamer and two 2-1/2- inch hose connections. The hose and steamer connections shall have National Standard Thread. The operating nuts shall be pentagonal in shape, 1-1/2- inch from point to opposite flat and shall open left (counter clockwise). The hydrant shall be the hub or mechanical-joint type having a 6-inch pipe connection.

(b.) The hydrant valve shall consist of a cast iron valve and valve bottom and hydrant valve rubber. The rod threads shall be permanently sealed from contact with water. The hydrant valve shall seal against the bronze hydrant seat. The upper barrel shall be ductile iron with markings identifying size, model and year of manufacture. The lower barrel shall be ductile iron.

(c.) The upper barrel shall connect to the lower barrel with a breakable traffic flange and 8 bolts and nuts. This connection shall allow 360 degree rotation of the upper nozzle section.

(d.) The hydrant shall have a bronze drain ring securely held between the barrel and base flange. It shall provide bronze to bronze threaded connection for hydrant seal. The bronze drain ring shall serve as a non-corrosive multi-port drain channel.

(e.) The hydrant shall have a minimum working pressure of 200 psi. Hydrant design shall be of positive automatic drain type to prevent freezing.

(f.) All hydrants that will not be Town owned shall be painted red. Hydrants that are Town owned, or will be Town owned, shall be factory painted with Rust-Oleum brand hydrant paint to the Town's paint scheme:

Hydrant body: Safety Red

Caps: Safety Yellow

(g.) The Town has standardized on American Darling Model No. B-84B as manufactured by American Flow Control Inc, Mueller Super Centurion Model 250 as manufactured by Mueller Company, and United States Fireflo Model F-06 as manufactured by United Water products.

C. Execution

(a.) General This section summarizes the Town's standardized methods for the installation and maintenance of certain aspects of the water system. All procedures shall be performed consistent with AWWA standards.

(b.) Piping

(1.) The sizing of water mains shall be based on sound engineering principals. All water mains shall be minimum 8-inch nominal diameter. All hydrant connections shall be minimum 6-inch diameter.

(2.) All piping shall be installed with a minimum 5-foot cover. In such cases where 5-foot cover is not possible, the piping shall be appropriately insulated. Water pipe shall be installed with minimum distance from sewer and septic pipe as summarized in Section 3.3.1.2 H.

(3.) Pipe shall be laid accurately to line and grade in sand bedding conforming to MassDOT Standard Spec. M1.04.0 Sand Borrow and AWWA guidelines. The depth of the sand bedding shall be one half (1/2) the diameter of the pipe under the main and one half (1/2) the diameter of the pipe over the main or 6 inches both under and over the pipe, whichever is greater. Bedding

shall be placed in layers not over six inches thick, and each layer shall be thoroughly compacted by tamping and chinking on each side of pipe to provide uniform support.

(4.) Backfill material placed above the bedding material and below the roadway foundation shall conform to the North Reading Street Opening Construction Standards, as applicable.

(5.) Push-on type joints are recommended on straight runs of pipe. Gaskets must be standard for pipe used and be acceptable to the DPW. Mechanical joint restraints shall be used for valves, bends, hydrants and piping sections less than 50 feet.

(6.) Push-on pipe gaskets shall be clean and thoroughly coated with lubricant supplied by the manufacturer during installation.

(c.) Pressure Tests

(1.) All pressure testing shall be performed by a qualified third party approved by the Town. All pressure testing must be in conformance to a written plan submitted to, and approved by, the Town.

(2.) The pipelines shall be tested (in sections if required by the Town) for strength and for leakage at a pressure of 200 pounds per square inch. In certain circumstances, the Town may require higher pressure tests. The tests for leakage shall last for two hours although the Town may allow a one hour test subject to advanced approval. No more than 1,000 feet of water main shall be tested in a single test.

(3.) The additional water needed to maintain the required pressure shall be accurately measured in a manner approved by the Town. The container shall be clearly labeled with its capacity in gallons. Allowable leakage amounts will be determined by the AWWA standards for pressure testing Ductile Iron pipe (AWWA C600 latest revision).

(4) Tests shall be made for all newly installed pipe and when required by the Town. A 24-hour notice shall be given to the Town prior to all tests. The Contractor will make all necessary arrangements for securing the water for test purposes and will stand the expense of these arrangements. For private funded projects where water is collected straight from an un-metered source, the Contractor shall notify the Town of the quantity of water to be used. The Town will subsequently bill the contractor for that water usage.

(e.) During this test all hydrant laterals shall be in the open position. Methods of testing and plans showing sections to be tested shall be submitted to the Town for approval as requested. The Contractor will not perform a pressure test against existing valves unless authorized by the Town.

(f.) The Contractor shall submit a written report to the DPW summarizing the results. The Contractor shall repair all leaks discovered under any of the required tests and retest the pipe. The Town will not accept any installation where a final test has not been passed.

(d.) Chlorination of the Pipeline

(1.) Prior to disinfection, the Contractor shall submit a detailed disinfection plan to the DPW. The plan shall be prepared consistent with AWWA standards and it shall outline and describe the disinfection procedures. At minimum, the plan shall include the following components:

- Chlorine dosage and Injection – The Disinfection Plan shall summarize the intended chlorine dosage and the method for establishing that dosage. The disinfection may be accomplished by introducing into all the various parts of the new water mains a liquid solution containing one percent available chlorine in such volume that the rate of dosage to the water mains shall be at least 50 parts per million of available chlorine. The Disinfection Plan shall document the locations and methods for applying the chlorine into the pipeline.
- Disinfection Period and Flushing – The contact period for this disinfection shall be at least twenty-four hours, and a longer period will be required if tests of residual chlorine show it to be less than the required minimum of 25 mg/l. The pipeline shall be adequately flushed with potable water and the Disinfection Plan shall document the method for de-chlorinating and discharging the residual water. All discharges must comply with local, state and federal requirements.
- Sampling – Sampling shall be performed by an independent certified laboratory according to AWWA C651 – Disinfecting Water Mains. After flushing he chlorine, the water shall sit in the pipe for 24 hours and then be sampled. After this sample is taken, the same water shall remain for another 24 hours' retention time and shall be sampled again (i.e., samples will be taken at 24 and 48 hours after flushing).

(2.) The Contractor shall not proceed with the disinfection procedures until the Disinfection Plan has been approved by the DPW. All sampling results shall be submitted to the DPW prior to activation of the water main.

(3.) Continuous lengths of water main can be chlorinated in lengths up to 1,000 feet unless otherwise approved by DPW.

(4.) Connections at cuttings shall be swabbed with a 50-PPM solution of chlorine at locations when other methods are not applicable.

(5.) All water used to disinfect pipe shall be discharged and managed consistent with the appropriate state and local regulations. These shall include the Town of North Reading Conservation Commission permitting and the Illicit *Discharges to Municipal Separate Storm Sewer System* bylaw and rules & regulations.

(d.) Valves

(1.) All material shall be inspected for defects prior to installation. Defective materials shall be immediately removed from the site. All foreign matter shall be removed from valve openings and seat faces. All nuts and bolts shall be checked for tightness. Non-wooden blocking shall be placed under each valve to insure against settlement.

(e.) Tapping

(1.) Where there is more than one public water main in a street, the Town shall determine which main the owner may tap for water service pipe connection. Water mains designated as transmission mains shall not be tapped for water service, except when approved by the Town.
(2.) Tapping sleeves are allowed for taps up to and including ½ diameter of the main being tapped. Any tap greater than ½ diameter of the main shall require a solid 3-way Tee unless written approval is granted by the Town.

(f.) Thrust Restraint

(1.) Thrust Blocks

A. Thrust blocks may only be used against undisturbed soil. They shall be designed in accordance with the Design Standards using the appropriate concrete and pressures as specified in the Construction Details and the AWWA standards and guidelines.

(2.) Tie Rods

A. Tie rod systems may be used where approved by the Town. All materials shall be steel and coated with an approved bituminous coating or other approved corrosion resistant coatings. Unless otherwise required or approved by the Engineer, the Contractor shall install tie rods in accordance with the following schedule for all fittings:

Minimum Tie Rod Design

Pipe Size (inches)	Number of Rods	Tie Rod Diameter (inches)
4"-12"	2	¾"
16"	4	¾"

(g.) Electrical Grounding

(1.) No electrical grounds shall be made on water service pipes where a driven ground rod can provide the needed grounding service. Electrical grounding shall be provided in accordance with the Massachusetts Electric Code.

(h.) Sprinkler Connections

(1.) Sprinkler connection shall be coordinated with the property owner. Sprinkler valves shall only be operated by a certified sprinkler operator. The certified sprinkler operator shall bleed air from the sprinkler system upon completion of installation.

D. References

1. All materials and execution shall conform to the highest applicable standards. If there is a conflict between other standards, or between other standards and these Design standards, then the most stringent criteria shall be used.
2. The Town commonly references AWWA standards as guidance for the materials and execution of work performed on the Town's water infrastructure. The following summarizes select AWWA standards applicable to the sections in these Design Standards. This list is not exclusive as other standards may apply. The latest revision of each standard shall be referenced.

Standards	Title/Subject
ASTM D3350.	Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
AWWA C104/ ANSI 21.4.	American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105/ ANSI A21.5.	American Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110/ ANSI A21.10.	American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 Inch Through 48 Inch for Water
AWWA C111/ ANSI A21.11.	American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C150/ ANSI A21.50.	American National Standard for the Thickness Design of Ductile-Iron Pipe
AWWA C151/ ANSI A21.51.	American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C153/ANSI A21.53.	American National Standard for Ductile-Iron Compact Fittings, 3 In. Through 64 In.
AWWA C502. AWWA	Standards for Dry-Barrel Fire Hydrants
AWWA C504 AWWA	Standard for Rubber-Seated Butterfly Valves
AWWA C509. AWWA	Standard for Resilient-Seated Gate Valves for Water Supply Service
AWWA C515. AWWA	Standard for Reduced-Wall Resilient-Seated Gate Valves for Water Supply Service
AWWA C600. AWWA	Standard for the Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C651. AWWA	Standard for Disinfecting Water Mains
AWWA C901.	Polyethylene (PE) Pressure Pipe and Tubing, ½ Inch – 3 Inch, for Water Service

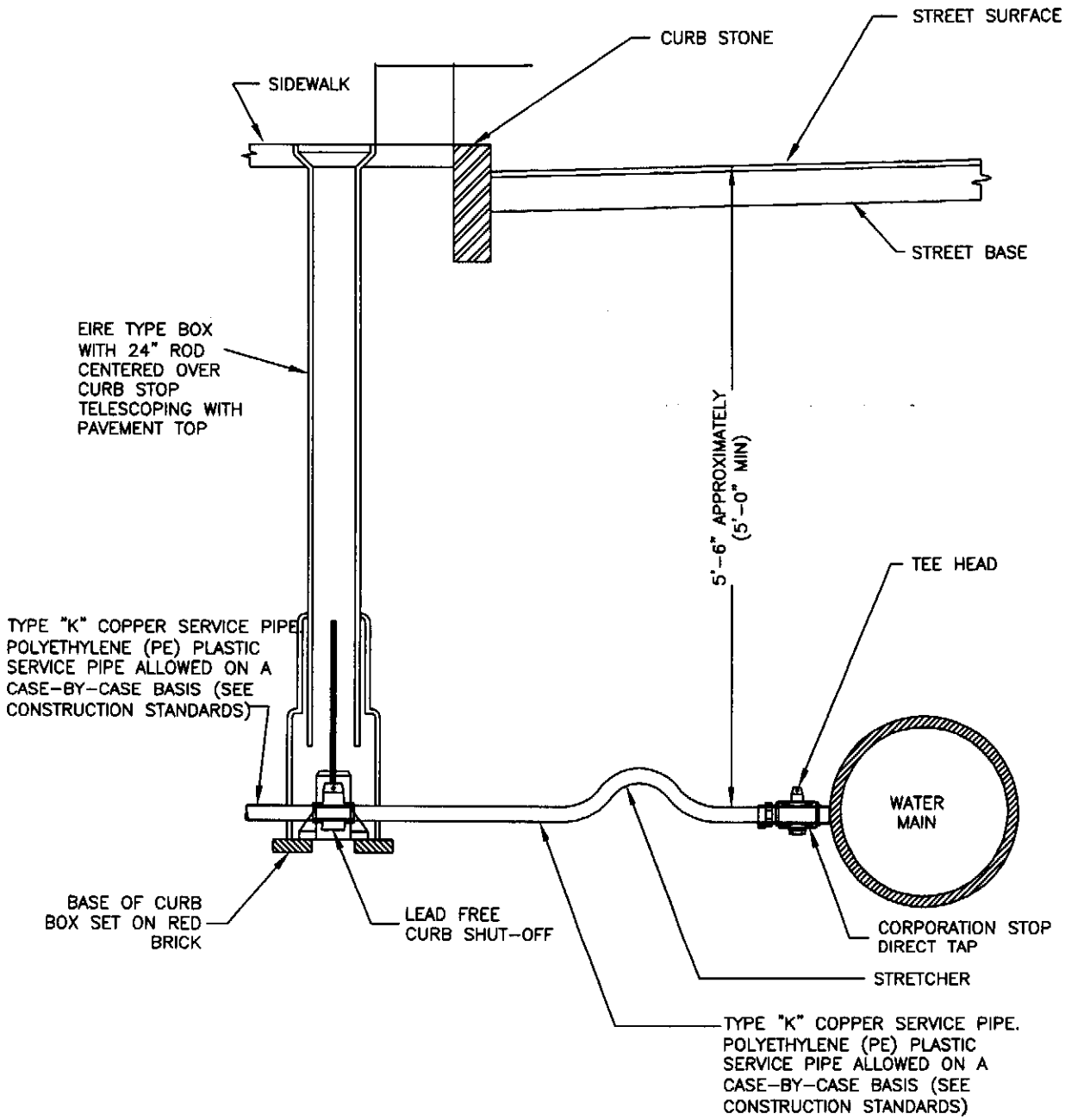
TOWN OF NORTH READING

APPENDIX

WATER CONSTRUCTION STANDARDS

STANDARD DETAIL DRAWINGS

W-1	Typical for 1" water service connection
W-2	Typical for 1-1/2" to 2" water service connection
W-3	Typical Tapping sleeve water main connection
W-4	Typical thrust restraints using tie rods and friction clamps
W-5	Water main trench detail
W-6	Fire hydrant installation
W-7	Meter installation
W-8	Gate Valve installation



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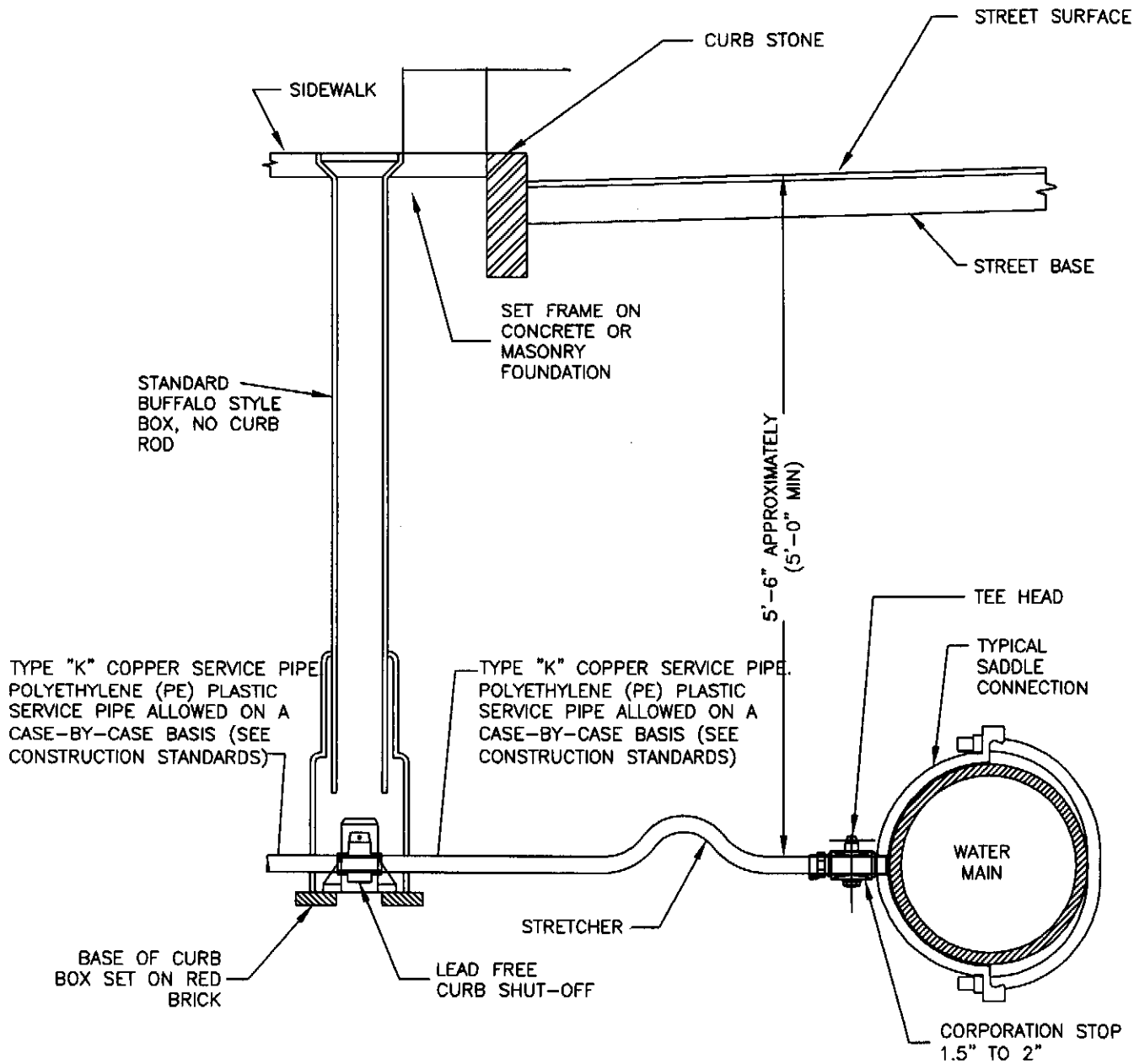
TOWN OF NORTH READING DEPARTMENT OF PUBLIC WORKS	TYPICAL WATER CONNECTION FOR 1" SERVICE	DATE: JANUARY 2012	DETAIL NO. W-1



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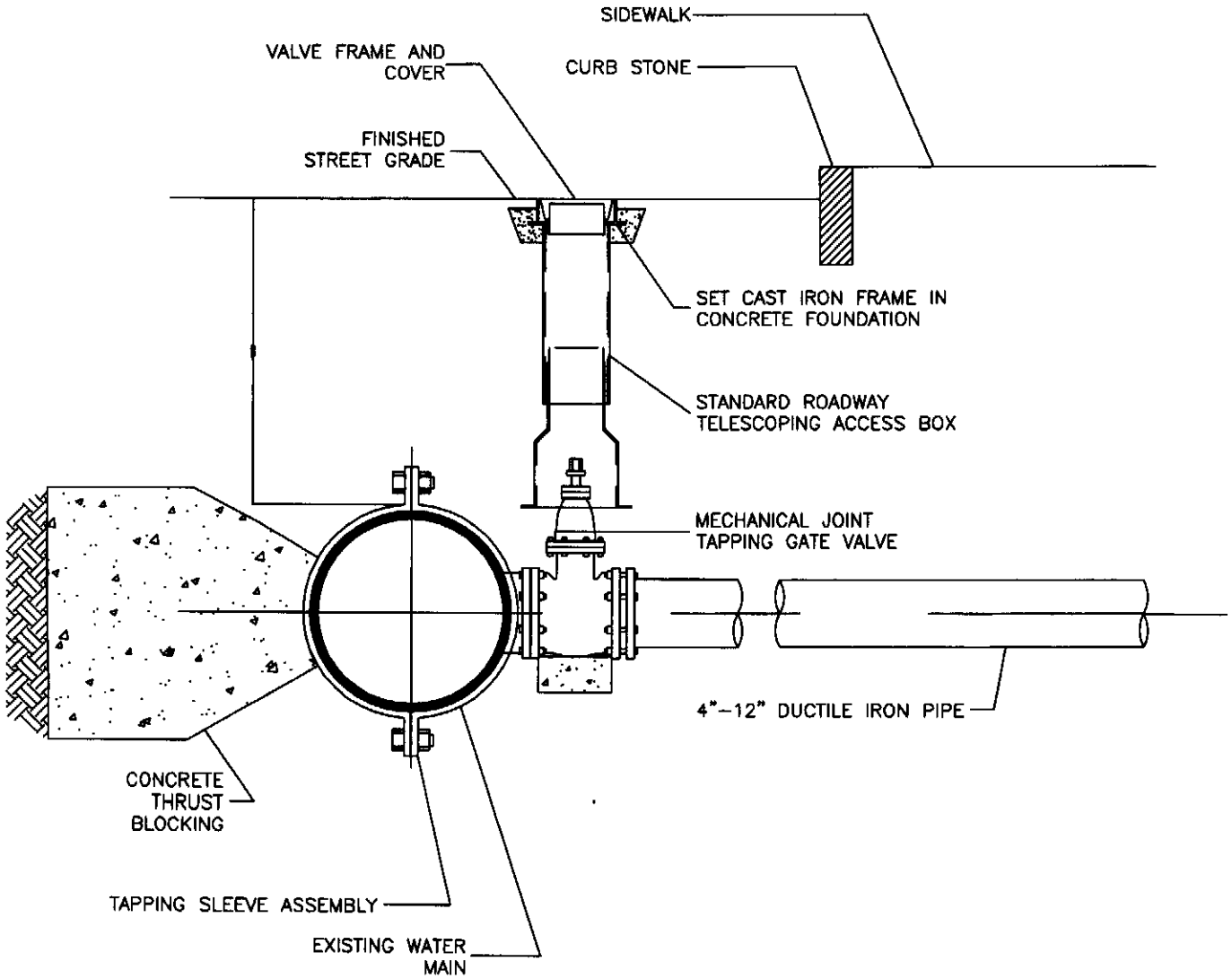


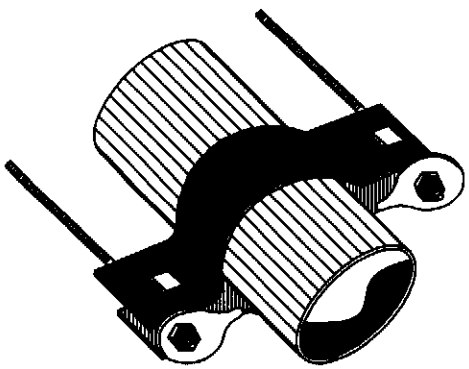
NOTES

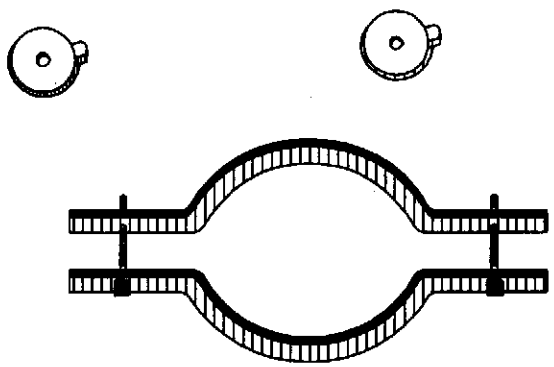
1. MAXIMUM TAPPING SLEEVE SHALL NOT BE GREATER THAN 1/2 DIAMETER OF CONNECTING MAIN
2. MEGA LUG RESTRAINTS ON ALL MECHANICAL JOINTS

NOT TO SCALE

TOWN OF NORTH READING DEPARTMENT OF PUBLIC WORKS	TYPICAL CONNECTION (TAPPING SLEEVE)	DATE: JANUARY 2012	DETAIL NO. W–3

SCHEDULE OF TIE RODS		
PIPE SIZE	NUMBER OF RODS PER FITTING	DIAMETER OF RODS
4" – 12"	2	3/4"
16"	4	3/4"
20" – 24"	4	1 1/2"





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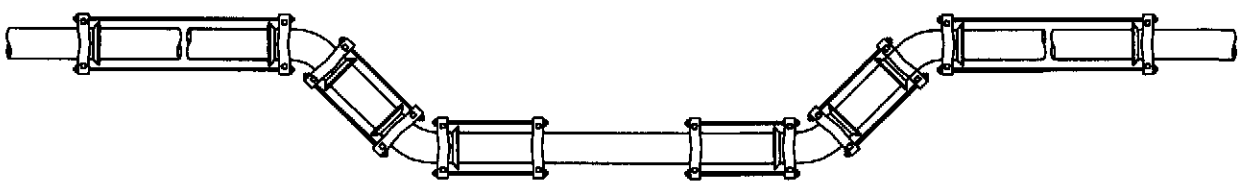

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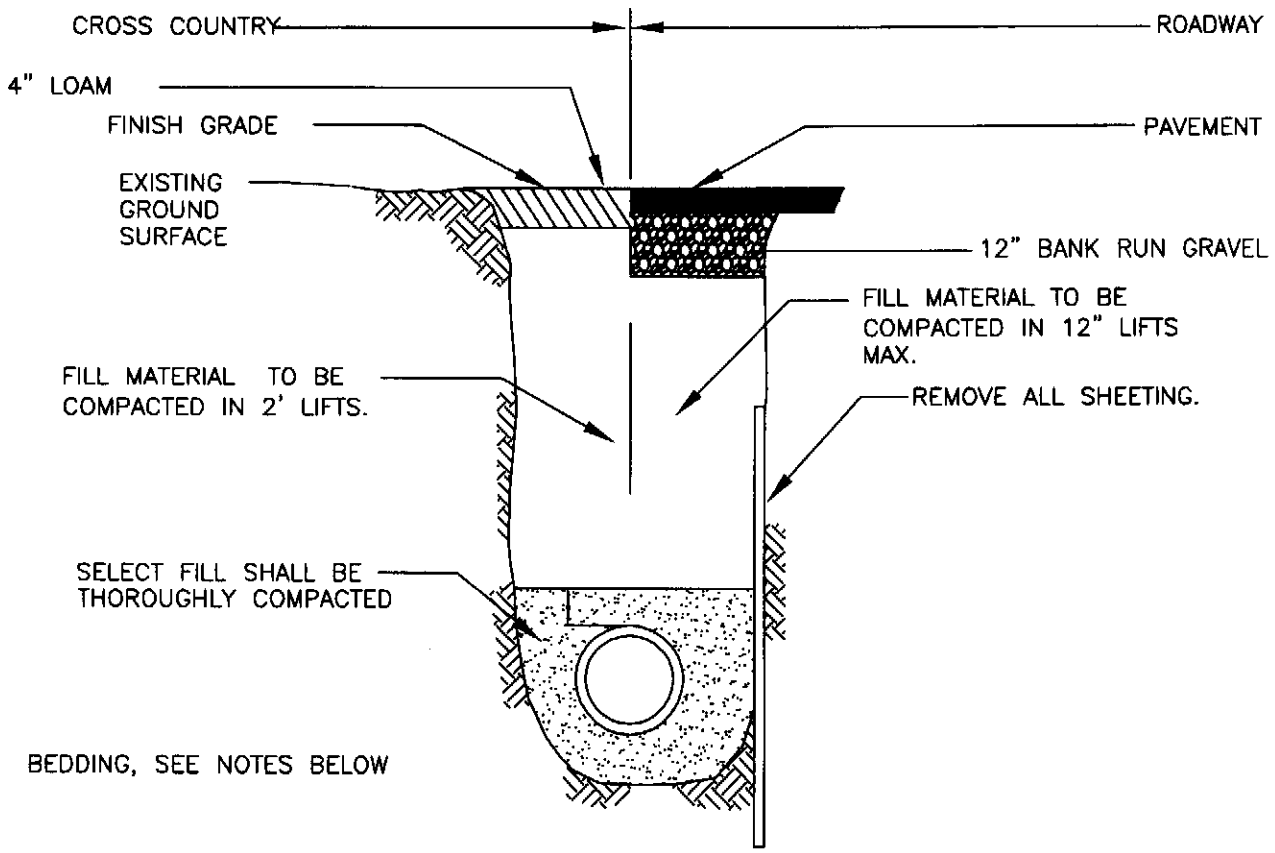
TOWN OF NORTH READING DEPARTMENT OF PUBLIC WORKS	TYPICAL THRUST RESTRAINTS USING TIE RODS AND FRICTON CLAMPS	DATE: JANUARY 2012	DETAIL NO. W–4



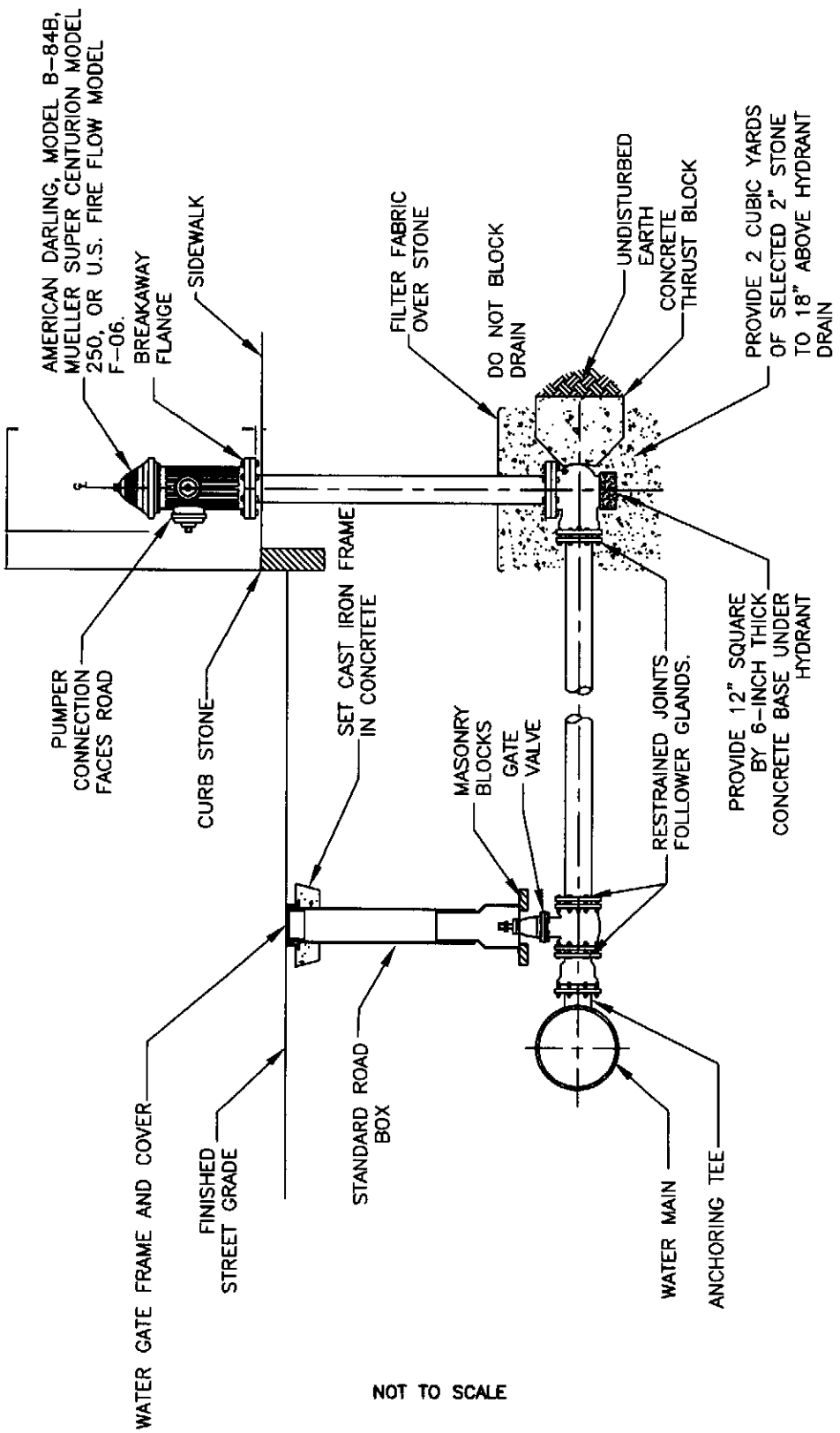
NOTE: 5'-0" MIN. COVER

NOTES

1. TOWN OF NORTH READING MAY REQUIRE FLOWABLE FILL AT ITS DISCRETION.
2. FOR LOCATIONS WHERE LEDGE IS NOT ENCOUNTERED IN TRENCH, PIPE CAN LAY ON UNDISTURBED EARTH, OR ON SAND BEDDING CONSISTENT WITH AWWA GUIDELINES.
3. FOR LOCATIONS WHERE LEDGE IS ENCOUNTERED, SAND BEDDING SHALL BE A MINIMUM OF 12" THICK UNDER PIPE.
4. FILL MATERIAL SHALL BE COMPACTED TO 95% PROCTER DENSITY.
5. SEE THE TOWN OF NORTH READING STREET OPENING CONSTRUCTION STANDARDS FOR TRENCH BACKFILLING AND PAVEMENT RESTORATION.

NOT TO SCALE

TOWN OF NORTH READING DEPARTMENT OF PUBLIC WORKS	WATER MAIN TRENCH DETAIL	DATE: JANUARY 2012	DETAIL NO. W-5



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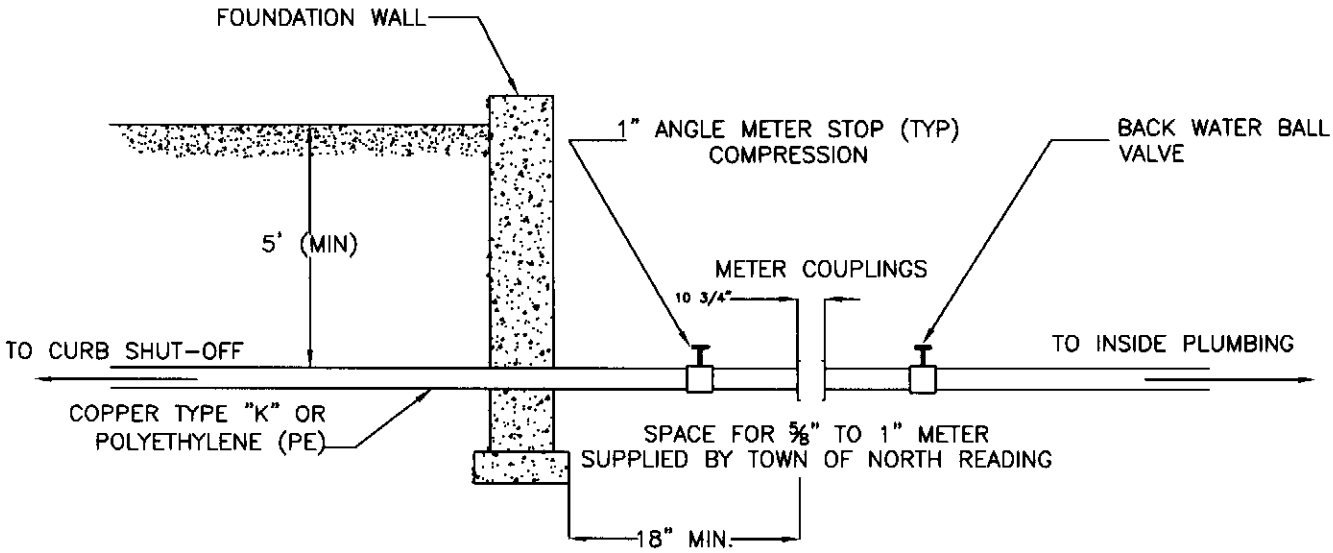
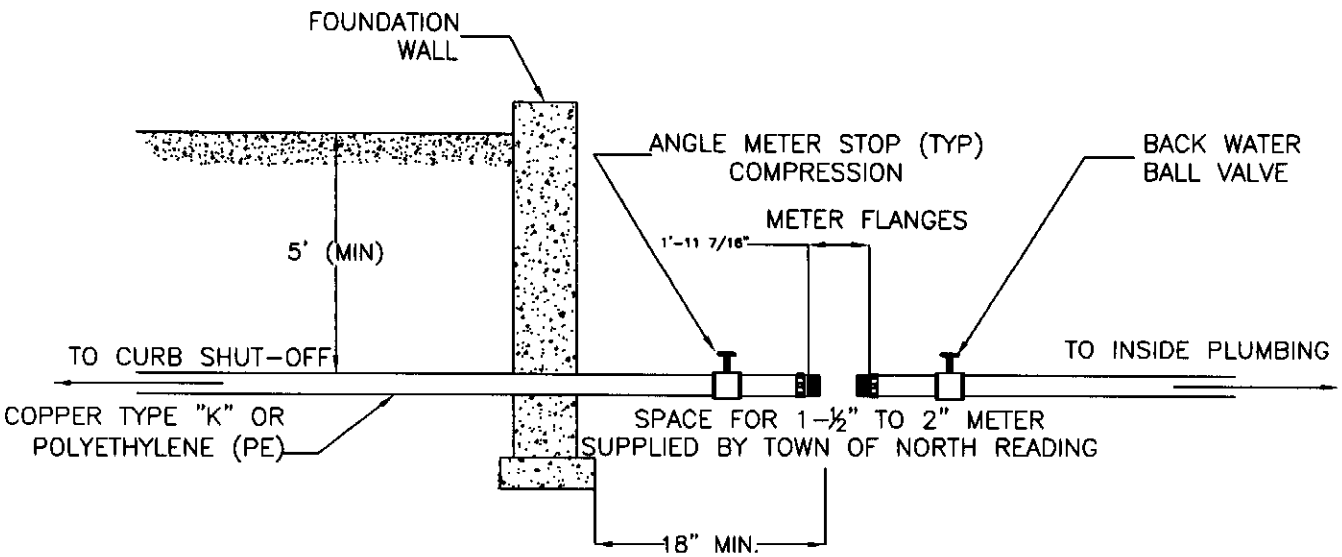
TOWN OF NORTH READING DEPARTMENT OF PUBLIC WORKS	FIRE HYDRANT INSTALLATION	DATE: JANUARY 2012	DETAIL NO. W-6





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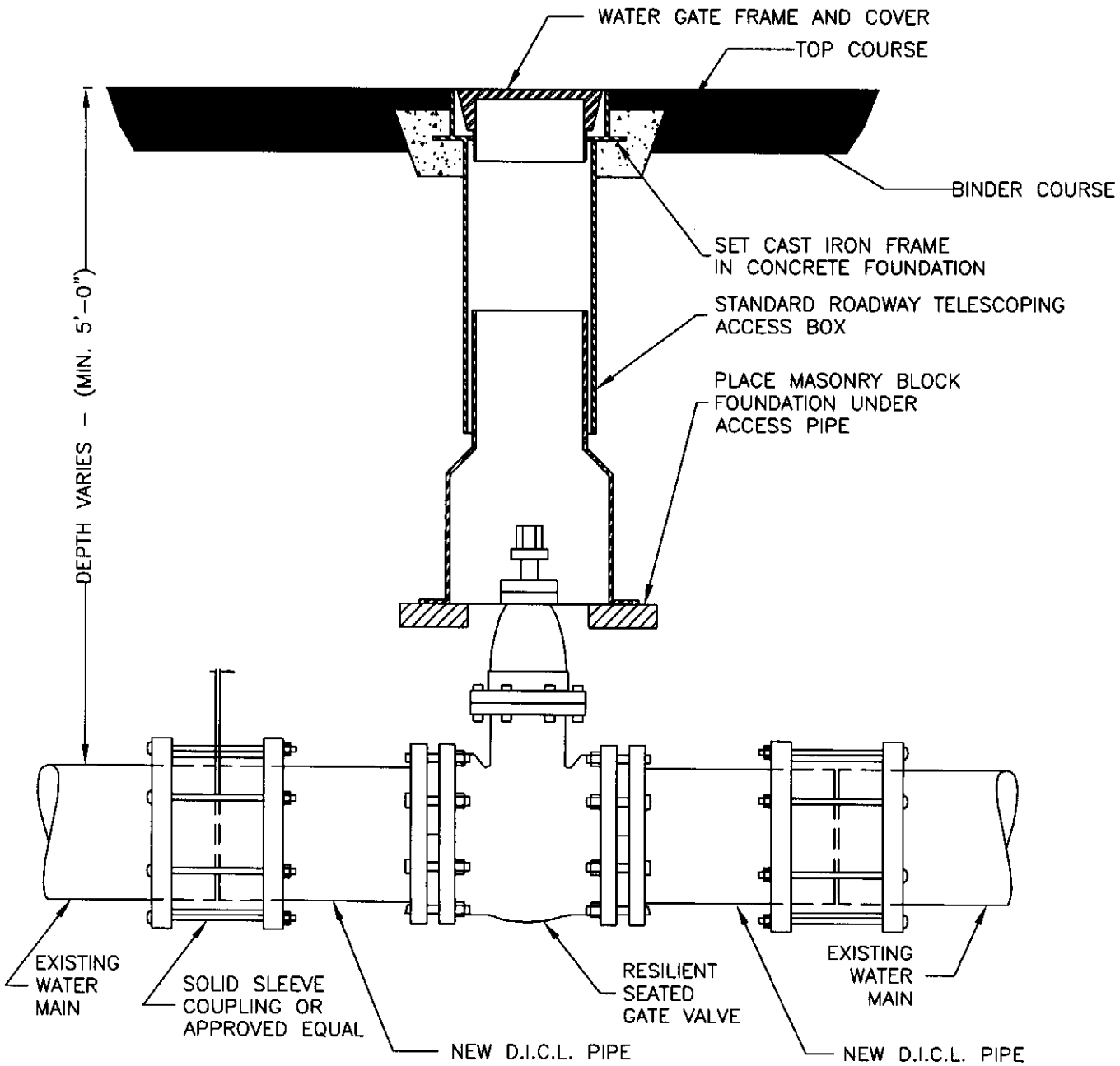

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TOWN OF NORTH READING DEPARTMENT OF PUBLIC WORKS	GATE VALVE	DATE: JANUARY 2012	DETAIL NO. W-8