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Iowa City Municipal Design Standards

PART 7 - WATER DISTRIBUTION SYSTEM

(Revised 1-22-10)

7.01 APPROVALS, PERMITS, AS-BUILTS AND MAINTENANCE BONDS:

- A. Plans and specifications for public water distribution facilities must be certified by a professional engineer registered in the State of Iowa and utilize the NGVD of 1929.
- B. Plans and specifications for public water distribution facilities must be reviewed and approved by the City Engineer prior to construction.
- C. Plans and specifications for public water distribution facilities must be reviewed and approved by the Iowa Department of Natural Resources prior to construction. Other local, state and federal permits may be required, depending on the circumstances. It shall be the responsibility of the Engineer of Record to acquire all applicable permits. A copy of all permits shall be provided to the City Engineer before construction.
- D. The Engineer of Record is responsible to submit "Record of Construction" drawings to the City Engineer on reproducible vellum or mylar.
- E. A two-year maintenance bond covering defective materials and workmanship is required for all water main improvements.

7.02 DESIGN RESOURCES:

The design for water distribution facilities shall be in conformance with the following:

- A. Requirements and Standards of the Iowa Department of Natural Resources.
- B. City's Construction Specifications.
- C. City's Plumbing Code.
- D. Conflict - In case of a conflict between the above design standards, the most restrictive requirement shall apply.

7.03 DEFINITIONS:

- A. A **Distribution Main** means a water pipe owned, operated or maintained by the City which is used for the purpose of distribution of water and from which service connections are made.
- B. A **Private Service Pipe** means a water pipe installed, owned, operated and maintained by the private consumer. Service pipes are often 1 inch in size for residential and may be 2 to 6 inch in size for commercial or 8 to 12 inch for large industrial applications.

- C. A **Private Fire Hydrant** is one which is located on privately owned property, or on streets not dedicated to public use unless the water main is within a public easement. Private fire hydrants must be served by a minimum of a 6-inch pipe. A private fire hydrant is the responsibility of the property owner and is to be used for fire protection only. Where it is the owner's intention that these hydrants be used by the City Fire Department, these hydrants shall conform to the Department of Public Works specifications for fire hydrants. The City has the right to utilize the hydrants for flushing purposes.

7.04 CONSTRUCTION SPECIFICATIONS:

- A. Construction must comply with the City's standard construction specifications for water distribution facilities.

7.05 SYSTEM DESIGN:

- A. **Size:** All mains shall be a minimum of 6 inches in diameter. A larger size may be required by the City Engineer, depending upon water demand and fire flows.
- B. **Depth:** Water main shall be installed with a minimum depth of cover of 5½ feet. Generally, the maximum depth shall not exceed 7 feet.
- C. **Alignment:**
 - 1. All mains shall be looped, except for short runs to serve cul-de-sacs where the distance is less than 500 feet.
 - 2. Water mains shall be constructed such that no services shall be extended beneath the paving of the circular turnaround on cul-de-sacs.
 - 3. Water distribution mains will be extended to and through or across the frontage of all subdivisions and land development projects. Provisions will be made to connect water mains to serve future adjacent undeveloped land.
 - 4. Water mains will be located so the front of each property has access for a service connection.
- D. **Changes in Alignment:**
 - 1. Thrust restraints are required at all changes in alignment exceeding 10°, at all dead ends and on fire hydrants. Thrust restraints shall be constructed as shown in Figure 7.1. Wrap pipes and fittings in plastic before pouring thrust blocks.
 - 2. The maximum deflection at joints shall not exceed the pipe manufacturer's recommendations.
 - 3. Where there is considerable deflection of the water main materials required for either horizontal or vertical changes in alignment, ductile iron materials shall be used. PVC water main materials **shall not** be bent.

E. Separation from Sewers:

1. There shall be no physical connection between a public or private potable water supply system and a sewer appurtenance which would permit the passage of any sewage or polluted water in the potable supply.
2. Under normal conditions, water mains parallel to sewers shall be placed at least 10 feet horizontally from any sanitary sewer, storm sewer or manhole. Where local conditions prevent this separation, the water main may be laid closer provided the bottom of the water main is at least 18 inches above the top of the sewer and the water main is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the sewer.
3. Water mains crossing sewer services, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. Where local conditions prevent this vertical separation, the water main shall not be placed closer than 6 inches above a sewer or 18 inches below a sewer under any circumstances. Additionally, one full length of water pipe crossing the sewer shall be centered at the point of crossing so that the water pipe joints will be equal distance as far as possible from the sewer. The water and sewer pipes must be adequately supported and have pressure tight joints. A low permeability soil shall be used for backfill material within 10 feet of the point of crossing.
4. No water pipe shall pass through or come in contact with any part of a sewer manhole. A minimum horizontal separation of 3 feet shall be maintained.
5. Water mains shall be separated from sewer force mains by a horizontal distance of at least 10 feet unless:
 - a. the force main is constructed of water main materials meeting a minimum pressure rating of 150 psi and the requirements of Sections 8.2 and 8.4 of these standards, and;
 - b. the water main is laid at least four linear feet from the sewer force main.

F. Location of Valves:

1. Four-way connections will have 4 valves. On looped systems, valves will generally be on the main line. Four valves may be required in specific instances.
2. Three-way connections will have 3 valves. On looped systems, valves will generally be on the main line. Three valves may be required in specific instances.
3. Maximum valves spacing will be 800 feet in residential areas or 400 feet in commercial areas. Maximum spacing of 400 feet will apply to mains bordering both residential and commercial areas.
4. A valve shall be placed two pipe lengths from all dead-ends to allow the extension of the pipe without shutting off the existing system. Do not tap services in the final two sections.
5. Auxiliary valves shall be provided for all fire hydrants.
6. Valves shall be located as close as possible to tees and crosses.
7. Valves should not be located within paving whenever possible.

G. Location of Fire Hydrants:

1. Fire hydrant spacing will be on a maximum distance of 400 feet. This average spacing will generally mean one hydrant for every block in residential, commercial and industrial areas. A fire hydrant will be required at the end of every cul-de-sac regardless of the proximity of a hydrant on the intersecting through street. A fire hydrant will be required at the end of all dead end lines.
2. The location of fire hydrants may be modified at the request of the local jurisdiction's fire department.
3. For fire hydrant installations:
 - a. Figure 7.2 – Typical Hydrant and Valve Assembly
 - b. Figure 7.3 – Dead-end Hydrant Detail
 - c. Figure 7.4 – Hydrant Detail For Future Main Extension

H. Service Pipes:

1. Water services shall be installed in conformance with the Iowa City Water Division Procedures and Policies Manual.
2. Every building, including each unit of zero-lot-line residences, shall have a direct service connection to a public water main.
3. No service connection shall be made if a foundation is not constructed.
4. No water consumer shall construct water service pipes across lots or buildings to

adjoining premises, but all service pipe shall be laid on streets, alleys or public ground to the premises to be served, and enter at the front or rear of the building nearest the main.

5. Such service pipe shall be laid in a straight line at right angles to the water main, and connection made within two lines drawn parallel to the sides of the building to be served or not more than three feet outside of these sides.
6. Multiple stop boxes shall be permanently marked to identify the correct individual metered services.
7. See Figure 7.5 for typical water service installation.

7.06 MATERIALS

A. Ductile-Iron Pipe:

1. Thickness design shall conform to AWWA C150.
2. Manufacture shall conform to AWWA C151.
3. Thickness class, unless otherwise indicated or specified, shall be Class 52.
4. Pipe is to have an exterior bituminous enamel coating and a standard cement mortar lining in accordance with AWWA C104.
5. All ductile iron pipe and fittings shall be wrapped with a 8 ml polyethylene encasement in accordance with ANSI/AWWA C105/A21.5 installation methods.
6. Use single rubber-gasket push-on joints or mechanical joints conforming to ANSI/AWWA C111/A21.11. Furnish with all necessary hardware and gaskets.
7. Bell-and-spigot pipe joints conforming to ANSI A21.6 or ANSI A21.8.
8. For bolted/restrained mechanical joint, use Class 53.
9. For unbolted/restrained mechanical joint, use Class 53.
10. Do not use drilled & tapped retainer glands.
11. Plain end of push-on pipe factory machined to a true circle and chamfered to facilitate fitting gasket.

B. Polyvinyl Chloride (PVC) Pipe:

1. Allowed for use in sizes 6 to 10 inch, except where noted otherwise in the specifications.
2. PVC pipe design shall conform to AWWA C900 and all pipe shall have the same outside dimensions as ductile-iron pipe.
3. Thickness class shall be DR 18 (Class 150).
4. PVC pipe materials shall not be used in any area where there is likelihood the pipe will be exposed to significant concentrations of pollutants comprised of low-molecular-weight petroleum products or organic solvents or their vapors.
5. PVC pipe materials shall not be used around cul-de-sacs or other small radius curves and shall not be installed under public roadways.
6. PVC water main shall be marked with an insulated wire for the entire length to make electronic location possible.
 - a. The insulation shall be protected to prevent accidental grounding. Make few splices, and where necessary, splice the wire together using an approved wire connector.
 - b. The wire shall be installed continuously as the pipe is backfilled. The wire shall be fixed to the side of the pipe at a position of 2 o'clock or 10 o'clock and attached with duct tape every 5 feet.
 - c. Bring the wire to the ground surface at each fire hydrant and loop the wire in a tracer wire terminal box. These boxes shall be located between the hydrant and the hydrant valve with at least two feet of extra wire inside the box. The tracer wire terminal box must be installed flush with the finished grade. If there is no fire hydrant within 500 feet, bring the wire to the surface in an approved "daylight box" which is a full-size valve box and mark the drawings appropriately.
 - d. See Figure 7.6 for typical detail of tracer wire daylight box.
7. Where there is evidence there will be considerable underground construction or several large diameter service taps or connections, ductile iron pipe materials will be used.
8. Where there is considerable deflection of the water main materials required for either horizontal or vertical changes in alignment, ductile iron materials shall be used. PVC water main materials may not be deflected. PVC water main joint deflections shall be limited to manufacturer's recommendations.

C. Fittings:

1. All fittings shall conform to ANSI/AWWA C110/A21.10, with pressure rating of Class 250.
2. Mechanical-joint fittings shall be ductile iron compact C153/A21.53 or ductile standard C110/A21.10. Large fittings, 12-inch through 20-inch shall be ductile iron standard C110.A21. Swivel tees shall be ductile iron standard C110.A21.10. Where ductile iron is not available (i.e., offsets), cast iron standard C110.A2 shall be provided.
3. All fittings shall be Class 250, shall be bituminous coating inside and outside, shall be furnished complete with necessary accessories including plain rubber gaskets, ductile iron glands, NSS Cor-Blue bolts and nuts. Verify the gasket seats are not made irregular by improper application of the lining materials.

D. Valves & Valve Boxes:

1. Resilient-seated gate valves shall conform to AWWA C509. Use full line size gate valves with epoxy coating inside and outside and with stainless steel nuts and bolts. Valve bodies shall be ductile iron or cast iron. Valves are to be non-rising stem with the stem, nut and thrust collar made of bronze. Use valves with at least 200 psi working pressure. The waterway must be a full sized waterway. Valves shall be capable of being repacked or replacing O-rings under pressure.
2. Butterfly valves shall conform to AWWA C504, for buried service, Class 150B. Valve seat to be installed on disk or valve body. Valves shall be short body pattern with mechanical joint ends. Shaft seals shall be o-ring type. All interior and exterior cast iron, ductile iron or steel surfaces shall be painted with an epoxy coating and contain stainless steel bolts and nuts. Working pressure of the valve shall be at least 150 psi. Butterfly valves shall not be utilized in sizes smaller than 16-inch unless so noted in special provisions.
3. Valves shall open left and be furnished with a 2" square operating nut. Use Cor-Ten steel.
4. Valve Boxes shall be 2-piece or 3-piece slip type, range 51" to 71". Use lids marked "water".
5. Tapping valves shall be as specified for resilient-seated gate valves with the exception that one end shall be mechanical joint and the other end shall be flanged to match the tapping sleeve and shall have oversize seat rings to permit the entry of the tapping machine cutters. Valves shall be epoxy coated inside and out with stainless steel nuts and bolts. Valves shall be 175 psi minimum working pressure, mechanical joint.

E. Hydrants:

Specification standard:	AWWA Standard C502
Type of shutoff:	Compression
Type of construction:	Break flange or break bolt above the ground line and a breakaway stem connection. All bolts to be stainless steel
Main valve opening:	4½" for 12-inch water main and under, 5 ¼" for 16-inch water main and above
Nozzle arrangement and size:	3 nozzle, two-2 ½" hose nozzles and one-4 ¼" pumper Nozzle, with caps attached with chains. The 4½" pumper nozzle is to face the street, or at an intersection, face the higher classification street.
Nozzle thread:	National Standard Hose Threads
Type of inlet connection:	Mechanical Joint
Size of inlet connection:	6 inch
Depth of bury:	6-feet
Direction of opening:	Open to right (clockwise)
Packing:	Conventional or O-Ring
Size and shape of operating nut:	1½ inch, standard pentagon
Working pressure:	250 psi
Color:	Safety Red

F. Special Fittings:

1. Special pipe fittings must be approved by the City Engineer.
2. Special fittings must be the same diameter, thickness and pressure class as standard fittings.
3. Special fittings shall be manufactured to meet requirements of same specifications as standard fittings except for laying length and types of end connection.
4. Retaining spools may be used.
5. Full body tapping sleeves shall be mechanical joint, split construction with end Gaskets, manufactured to fit cast iron or ductile iron pipe. Branch shall have a flange fitting to match the tapping valve. Sleeve shall meet the OD requirements for Class A, B, C, or D pit cast pipe and shall be furnished with all accessories. Bolts must be stainless steel and/or NSS Cor-Blue. Full body tapping sleeves are required for 12-inch and larger pipe or under paving.
6. Stainless steel tapping sleeves shall be epoxy coated with ductile-iron flange and stainless steel bolts and shall be compatible with approved tapping valves. Valves shall meet the OD requirements for Class A, B, C, or D pit cast pipe. Nitrile gaskets shall be used in L.U.S.T. areas.
7. Tapping sleeves for 12" or 16" shall be ductile iron or CASI. The outlet of the tap shall not be greater than ½ of the diameter of the pipe tapped.

G. Sleeve Type Couplings:

1. Bolted straight coupling shall be 6 bolt, 6" long, with stainless steel nuts and bolts.

H. Gaskets, Bolts, and Nuts:

1. Mechanical joints made with:
 - a. Bolts: 3/4 inch NSS Cor-Blue.
 - b. Stainless steel bolt studs with stainless steel nut on each end.
2. All thread rod used to restrain fittings shall be stainless steel with stainless steel nuts and 3/4" diameter.

7.07 BEDDING AND BACKFILL:

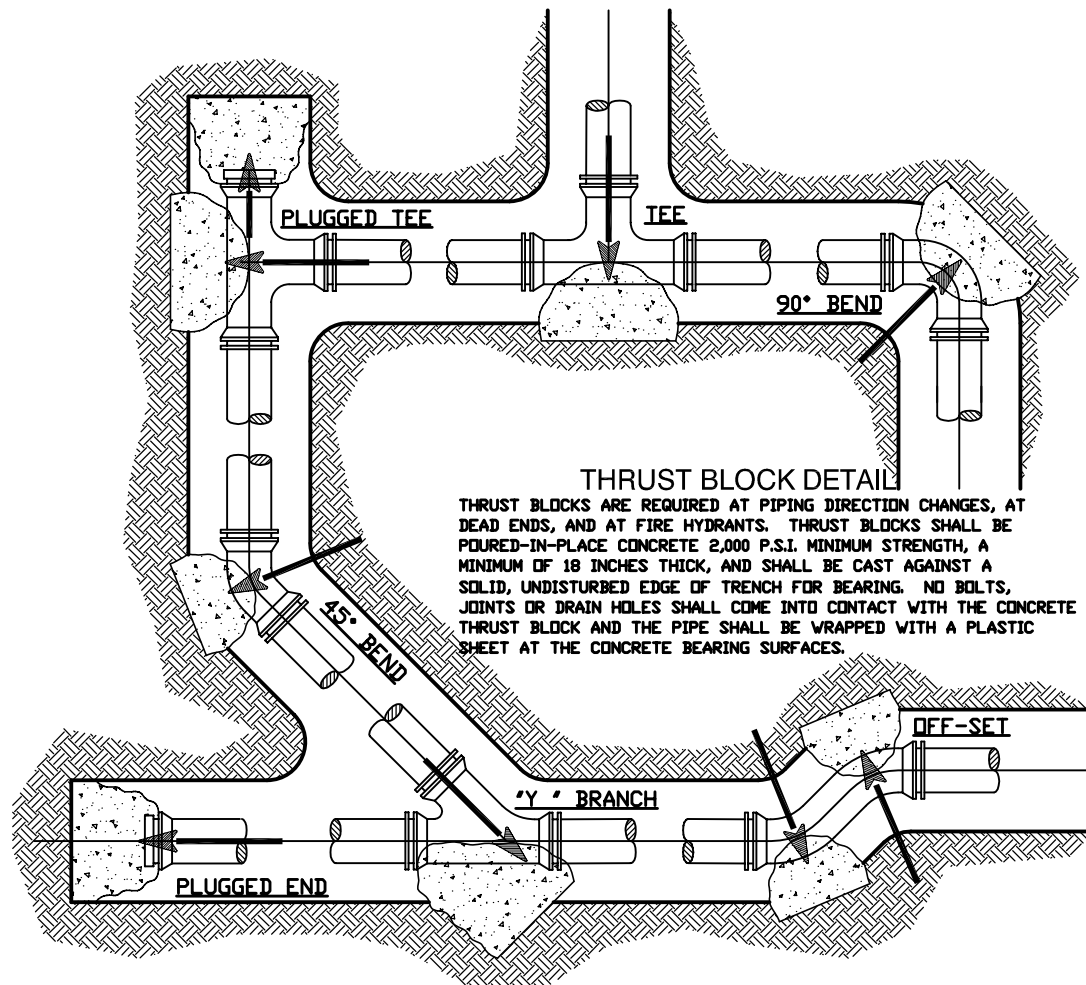
- A. All mains 12" and larger shall be bedded in crushed stone to a depth of one-half the pipe diameter. See jurisdictional construction specifications for type of crushed stone.
- B. All other pipe shall be bedded in accordance with manufacturer's recommendations.
- C. Within public right-of-way, backfill shall consist of Class A crushed stone or suitable job excavated material placed in one foot lifts compacted to 90% Modified Proctor Density. If crushed stone is used, the top 12 inches of backfill shall consist of suitable job excavated materials. See City's construction specifications for type of crushed stone. Flowable mortar may be used upon approval of mix design by the City Engineer. Sand backfill is not permitted.
- D. In all other areas backfill shall consist of suitable job excavated material placed in one foot lifts and compacted to 85% Modified Proctor Density.

7.08 PERFORMANCE AND TESTING:

- A. Bacterial test for coliform organisms shall be performed by the contractor in accordance with AWWA C601. A minimum free residual chlorine concentration of 10mg/l shall be maintained for the 24-hour disinfection period. The contractor shall provide documentation of bacterial tests from a certified laboratory.
- B. Pressure and leakage test in accordance with AWWA C600.
- C. Valves shall be located and tested to verify operation.
- D. Fire hydrants shall be tested to verify operation.
- E. Flow tests shall be conducted to verify that all components of the water system are fully open and operational and to determine fire flow capacity.

7.09 LOCATION OF EASEMENTS:

- A. All public water mains should be located within the public right-of-way. In rare exceptions, dedicated easements may be used for location of water main outside of public right-of-way.
- B. To limit damage to structures in the event of a main break, water mains shall be placed a minimum distance of 1.5 times the depth from building setback lines. Greater separations are desirable.
- C. All water mains outside public right-of-way shall be placed in an easement for operation and maintenance. Easement width from the center of the pipe shall generally be 1.5 times the pipe depth rounded up to the nearest 5 feet.
- D. The minimum easement width is 15 feet.

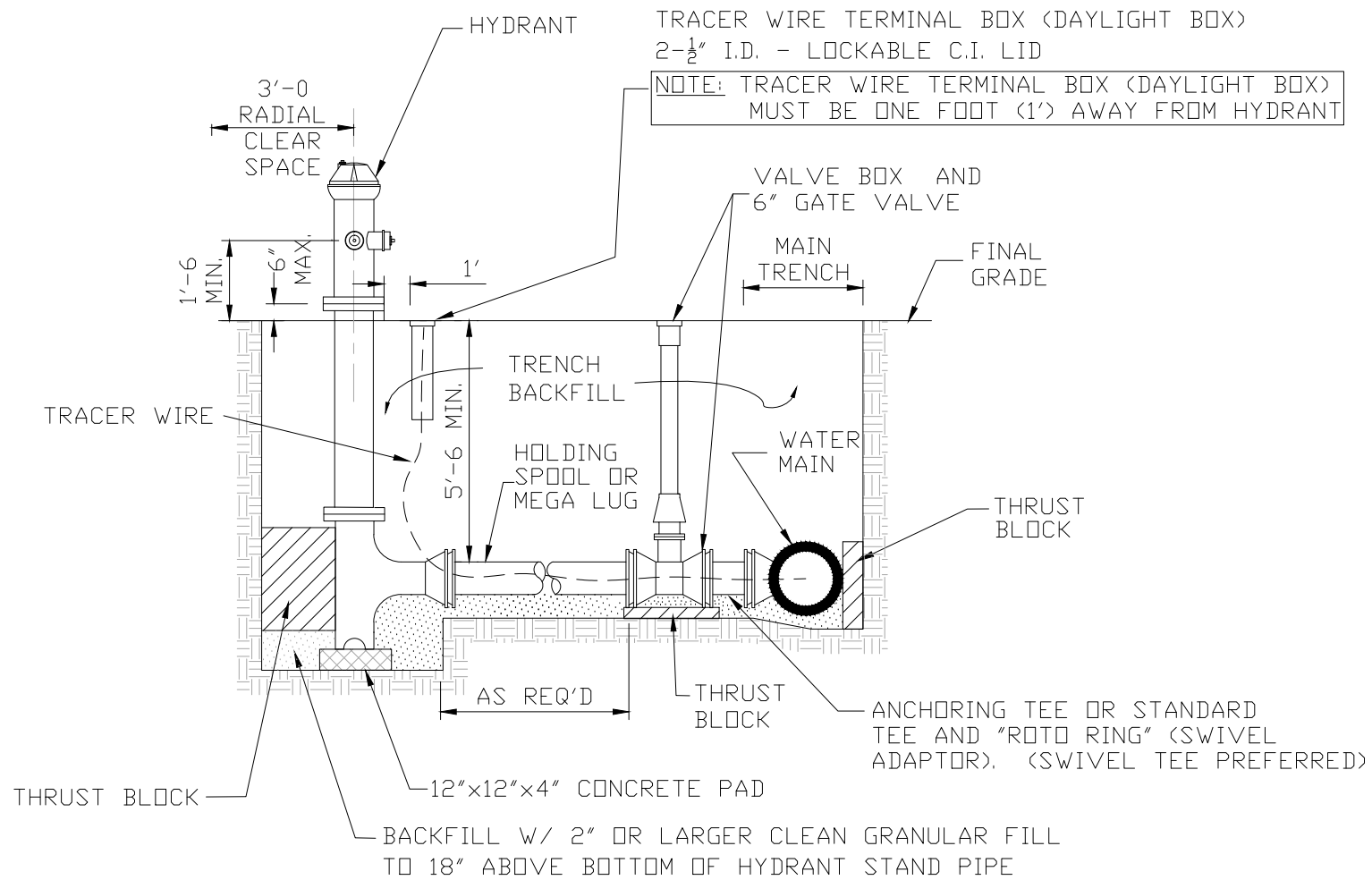


THRUST BLOCK QUANTITIES (SQUARE FEET)

PIPE SIZE	DEAD END OR TEE	90° BEND	45° BEND	11-1/4 BEND	22-1/2 BEND
4"	1.4	1.9	1.0	1.0	1.0
6"	2.8	4.0	2.1	1.1	1.0
8"	4.8	6.8	3.7	1.9	1.0
10"	7.3	10.3	5.8	2.8	1.4
12"	10.3	14.5	7.9	4.0	2.0
16"	17.8	25.2	13.6	7.0	3.5
20"	27.5	38.9	21.0	10.7	5.4
24"	39.2	55.5	30.0	15.3	7.7
30"	60.3	85.3	46.2	23.5	11.8
36"	86.4	122.2	66.1	33.7	16.9
42"	116.6	165.0	89.3	45.5	22.9
48"	152.0	215.0	116.3	59.3	29.8
54"	192.1	271.6	147.0	74.9	37.6

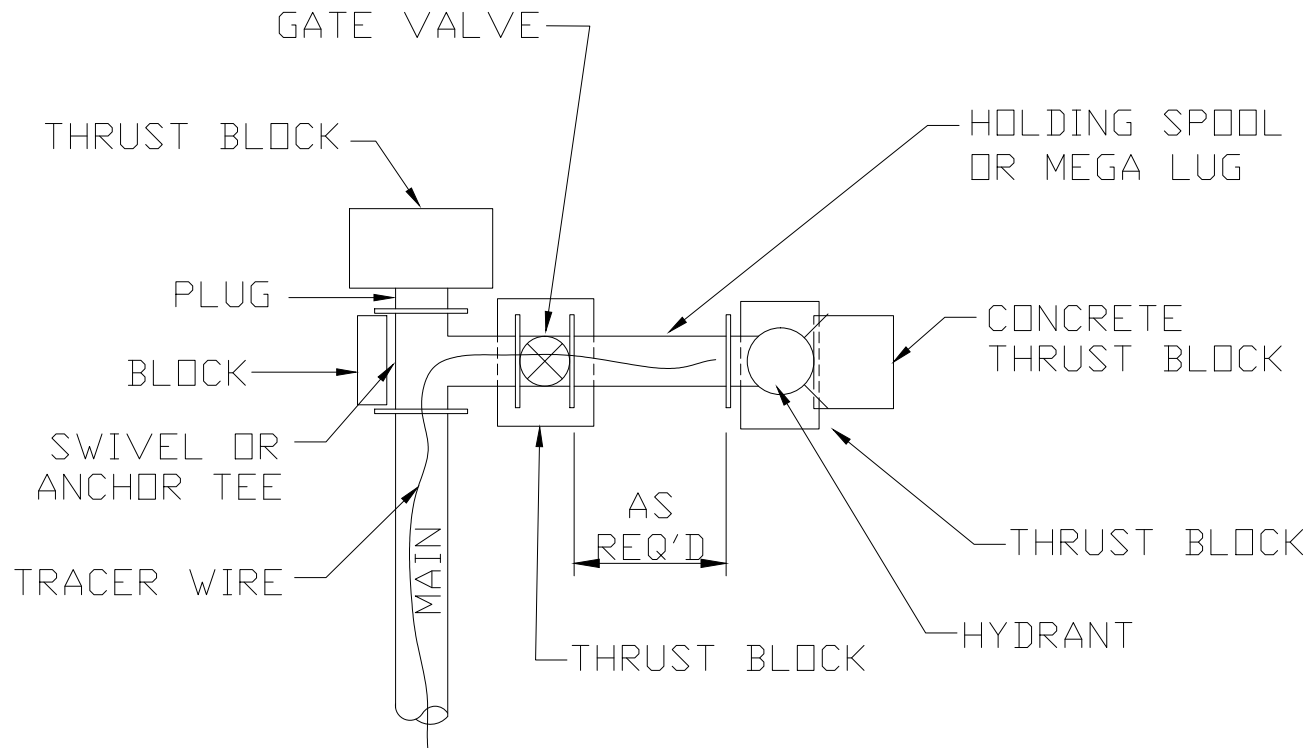
THE ABOVE AREAS ARE BASED UPON A SOIL BEARING CAPACITY OF 2000 PSF OF UNDISTURBED SOIL. IF ACTUAL SOIL BEARING STRENGTH IS LESS THAN 2000 PSF, THE THRUST BEARING AREA SHALL BE INCREASED BASED ON ACTUAL SOIL BEARING STRENGTH.

THRUST BLOCK BEARING AREA (in square feet) (FIGURE 7.1)



TYPICAL HYDRANT & VALVE ASSEMBLY
(Fig 7.2)

NOTE TRACER TERMINAL BOX NOT SHOWN FOR CLARITY. TERMINAL BOX IS PLACED 1' FROM HYDRANT, REFER TO FIGURE 7.2



DEADEND HYDRANT DETAIL

(Fig. 7.3)

NOT TO SCALE

20' OF PIPE AFTER
VALVE FOR FUTURE
(12" AND LARGER MAY
REQUIRE ADDITIONAL FEET
OF PIPE)

EXTEND TRACER
WIRE TO END OF
PIPE

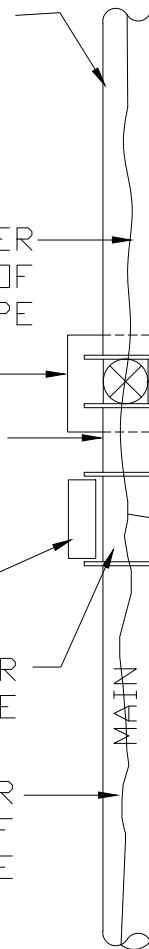
BLOCK

HOLDING SPOOL OR
MEGA LUG

BLOCK

SWIVEL OR ANCHOR
TEE

EXTEND TRACER
WIRE TO END OF
PIPE



NOTE TRACER TERMINAL BOX NOT
SHOWN FOR CLARITY. TERMINAL BOX IS
PLACED 1' FROM HYDRANT, REFER TO
FIGURE 7.2

GATE VALVES

HOLDING SPOOL OR
RODDED OR MEGA LUG

CONCRETE
THRUST BLOCK

AS
REQ'D

BLOCK

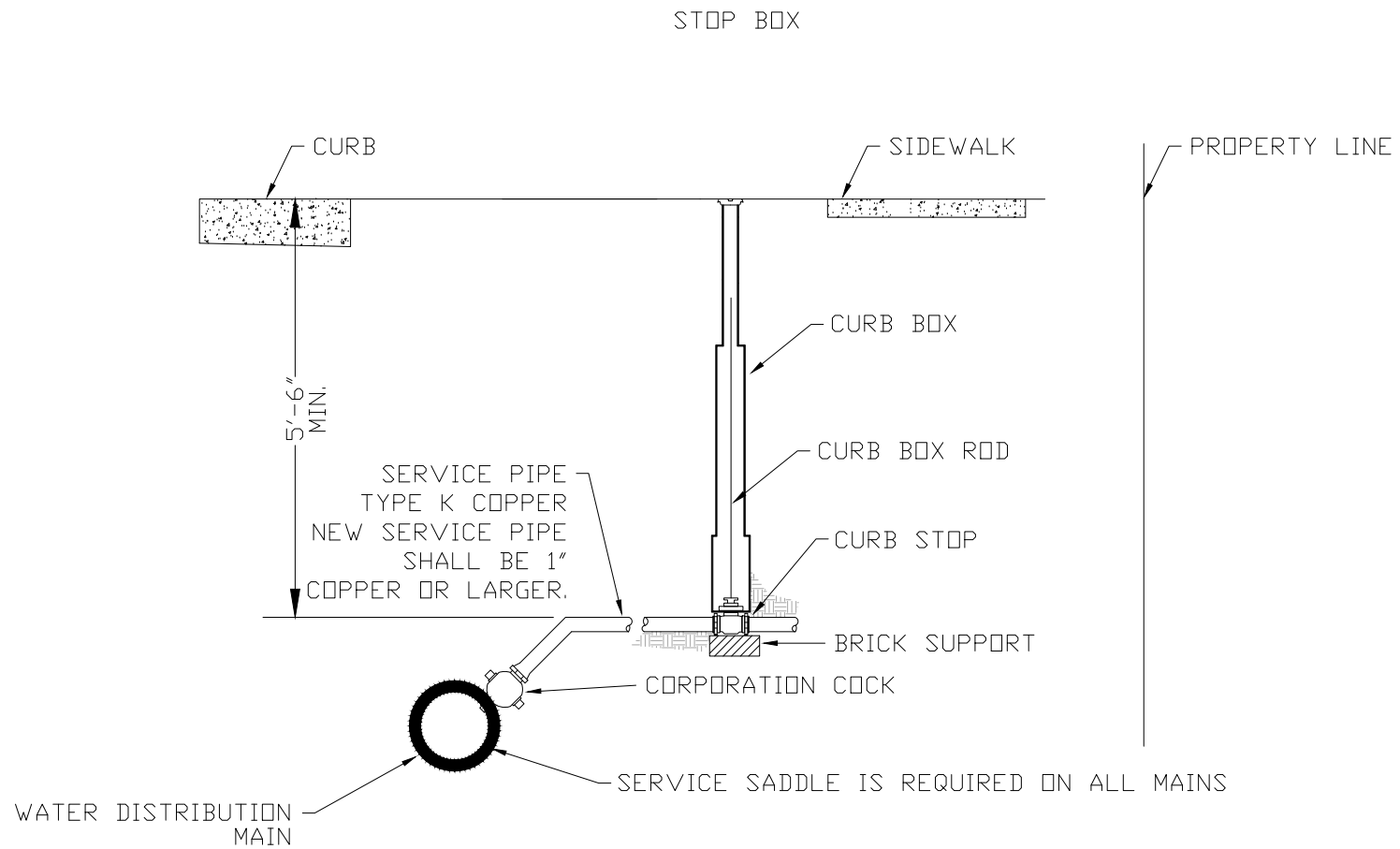
BLOCK

HYDRANTS:

4½" FOR 12" DIA. MAINS OR SMALLER

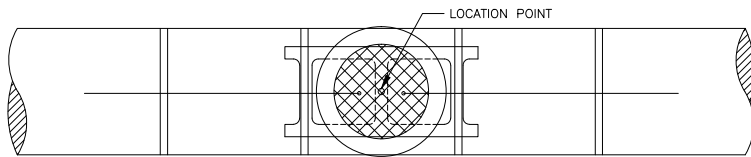
5¼" FOR 16" DIA. MAINS OR LARGER

**HYDRANT DETAIL FOR
FUTURE WATER MAIN EXTENSION
(Fig. 7.4)**



WATER SERVICE
(Fig. 7.5)

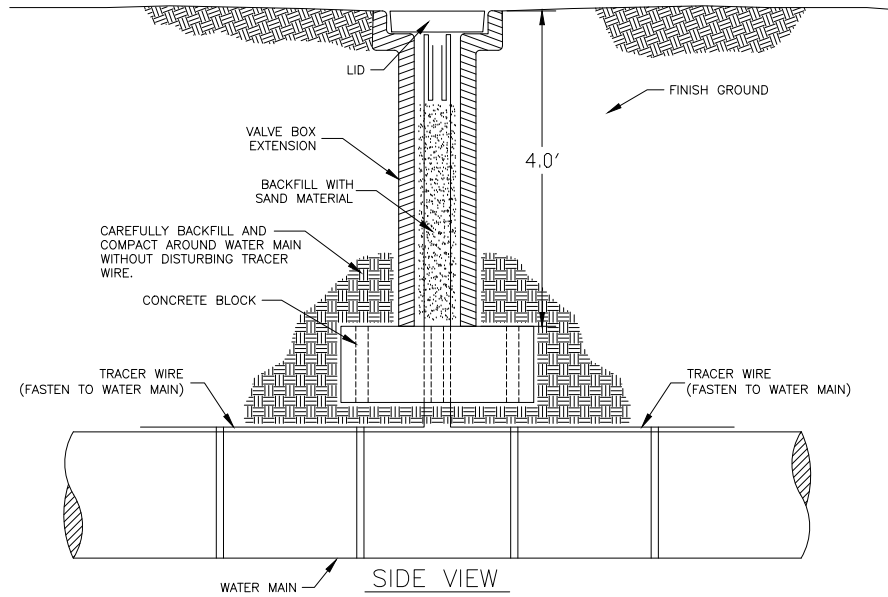
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PLAN VIEW

NOTES:

1. FASTEN TRACER WIRE TO WATER MAIN.
2. VALVE BOX EXTENSION SHALL NOT SIT DIRECTLY ON TOP OF WATER MAIN.
3. EXTEND TRACER WIRE 3.0' BEYOND TOP OF VALVE BOX EXTENSION. PLACE EXCESS TRACER NEATLY INSIDE OF VALVE BOX EXTENSION AND INSTALL LID.
4. USE EXTREME CAUTION NOT TO DAMAGE TRACER WIRE WHILE BACKFILLING AND COMPACTING.



SIDE VIEW

TYPICAL DETAIL
TRACER WIRE DAYLIGHT

SCALE: NOT TO SCALE

(Fig. 7.6)