

HENDERSONVILLE UTILITY DISTRICT  
OF  
SUMNER COUNTY, TENNESSEE

STANDARD WATER SPECIFICATIONS  
FOR SUBDIVISIONS AND GENERAL SYSTEM ADDITIONS

February 2022

Commissioners

W. C. Boyers, President  
Ronald E. Flowers, Treasurer  
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General Manager

Joe Rewa



DW20220120

**APPROVED WATER SPECIFICATIONS**

THE DOCUMENT BEARING THIS STAMP HAS BEEN RECEIVED AND REVIEWED BY THE

TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION

DIVISION OF WATER RESOURCES

AND IS HEREBY APPROVED FOR USE IN CONSTRUCTION BY THE COMMISSIONER

03/01/2022

THIS APPROVAL SHALL NOT BE CONSTRUED AS CREATING A  
PRESUMPTION OF CORRECT OPERATION OR AS WARRANTING BY THE  
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DESIGNED GOALS.

APPROVAL EXPIRES FIVE YEARS FROM ABOVE DATE

Prepared by

WATER MANAGEMENT SERVICES, LLC  
Consulting Engineers  
2 International Plaza  
Suite 401  
Nashville, Tennessee 37217  
(615) 366-6088

## **STANDARD WATER SYSTEM SPECIFICATIONS**

## STANDARD WATER SYSTEM SPECIFICATIONS

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## SECTION 1 - GENERAL

### 1.01 DEFINITIONS

Water Department - Hendersonville Utility District of Sumner County, Tennessee

City - City of Hendersonville, Sumner County, Tennessee

Planning Commission - Hendersonville Regional Planning Commission

Developer - Owner of a proposed development in which water lines are to be located.

Contractor - Contractor who is installing water lines in a proposed development or project.

Engineer - One who has prepared the construction drawings and specifications for the installation of water lines in a proposed development or project. As provided by the laws of the State of Tennessee, individual must be a registered professional engineer and drawings and specifications must bear their official seal.

State Regulatory Authority - Tennessee Department of Environment and Conservation  
Division of Water Supply

### 1.02 SCOPE OF REGULATIONS

These regulations shall apply to any person, developer, firm, business or entity interested in and desiring to construct additional water lines or to extend water lines within the Hendersonville Utility District's service boundaries or to construct additional water lines or extend water lines in a way that affects the water service provided by the District.

### 1.03 PLAN REVIEW PROCEDURE

Before any connection is made to a water line of the Water Department, a Developer or other party through their Engineer shall submit and receive approval of a proposed plan. The submittal shall consist of neat scaled drawings and specifications and at least two (2) copies for review and mark-up. Water Department will retain one (1) copy. Once noted changes have been corrected, Engineer is to submit eight (8) sets of plans to Water Department for approval stamp. Water Department will retain one set of stamped drawings with the remainder to be returned to the Engineer. Drawings will not be deemed approved until the Water Department's stamp of approval has been affixed to the cover sheet of the drawings and specifications. A copy of the preliminary plat or overall drawing showing the total site and location of the site shall be provided with the drawings.

The approval of the Water Department must be obtained before submittal of the drawings and specifications to the State Regulatory Authority. Both approvals must be obtained before construction is started. Evidence of State Regulatory Authority approval must be furnished to the Water Department before beginning construction. Approval of drawings for proposed water line construction for new subdivisions and other developments must be obtained from the Water Department before final approval for such developments will be granted by the Planning Commission. Approval of drawings shall be valid for one (1) year from the date of approval.

Plan submittal procedure shall be as follows:

1. All drawings shall be submitted to the Water Department with a letter of transmittal and a check for the plan review fee.
2. The Water Department will review the drawings and specifications. Upon approval drawings will be returned to the Design Engineer or Developer for submittal to the State Regulatory Authority.
3. One (1) set of State approved drawings along with copy of approval letter shall be submitted to the Water Department before start of construction.
4. Commencement of utility construction activity shall not occur until all approvals have been obtained. Contractor is responsible for all construction notifications prior to start of project.

Submitted drawings shall include the water main plans, existing and finished grades for the roadways, curbs, gutters, sidewalks and ground as well as the location, size and invert elevation of other utilities and drainage structures. The drawings shall also include the latest revision date if applicable.

For off-site water mains existing topo shall be shown including roadway paving, property lines, right-of-way, existing overhead and underground utilities, and any other feature which could affect construction.

#### **STATE APPROVED PLANS**

One set of the plan document stamped "APPROVED FOR CONSTRUCTION" and with the approved stamp from the State of Tennessee, Division of Water shall be available at the job sites at all times during construction. The Engineer or a person qualified other than the contractor or his representative, and approved by the public water system shall provide continuous adequate inspection during construction to assure that all work is done in accordance with approved plan documents. The Department's representative shall have access to the project at any time during construction. If the Department Representative observes work being done in a manner that does not conform to the approved plan documents or District Standards, he shall have the authority, through the Engineer's representative, the water system's agent or directly to the contractor to order the cessation of all work affected by the nonconformity until such discrepancies are rectified.

#### 1.04 **DESIGN FEATURES**

Water system design features shall generally conform to good municipal practice with adequate line sizes and valving. Each plan will be reviewed for conformity to Water Department practices and general plans. The following is provided for general information.

Line Size shall be adequate for the intended water service with no line smaller than 6-inches in diameter. Any line serving a fire hydrant shall be at least 6-inches in diameter, and where required, 8-inch lines or larger shall be used to ensure adequate fire flows at proper pressures.

Fire Hydrant Spacing and Locations shall be confirmed by the City of Hendersonville Fire Department before final placement during construction. In general, for residential areas one fire hydrant will be placed near each street intersection with intermediate hydrants set so that hydrants are not over 500 feet apart.

For commercial districts or commercial subdivisions, intermediate hydrants shall be set so that hydrants are not over 300 feet apart.

Fire hydrants shall have a cut-off valve in the lead line from the main to the hydrant.

Fire hydrants shall be provided at the end of all dead-end water mains.

Blow-offs - shall be standard fire hydrant with valve

Water Pressure shall be sufficient to provide proper service to all levels of a building requiring water service. The water system operates with storage facilities having overflow elevations at about 678 feet above sea level. In certain areas, high-level systems exist to provide pressures for satisfactory operation. In general, any building at or above 570 feet above sea level will have to be served by a high-level system unless approved by District personnel. Storage facilities will be generally be required on high-level systems serving more than 50 customers and may be required on smaller systems.

Backflow Preventers shall be installed where required by the Utility District. Details of this installation shall be approved prior to installation. The backflow preventer shall be installed such that it is protected from freezing and in a manner to allow for proper drainage. See Section 3.14 - Reduced Pressure Backflow Preventers.

Private Fire Protection Systems shall be metered by a master meter and a double check valve shall be installed as per section 2.15, 2.17, 3.14 and 3.15.

Separation of Water Mains and Sewers shall be maintained in accordance with the following guidelines:

For parallel installations, line separation is to be at least 10 feet edge of ditch to edge of ditch from all other utilities. If this condition cannot be obtained vertical crossing, of the water line shall be at least 18-inches above the top of the sewer. If this condition is also unobtainable, the sewer line is to be constructed of materials and have a joint design equivalent to water main standards as approved by the Water Department and shall be pressure tested to 50 PSI to assure water tightness.

Where the water line crosses house sewers, storm sewers, or sanitary sewers, a separation of at least 18-inches shall be provided between the bottom of the water line and the top of the sewer. Water mains passing under sewers shall be protected (in addition to the above water line construction) by providing: at least 18-inches between the bottom of the sewer and the top of the water line; adequate structural support of the sewer to prevent excessive joint deflection or damage to the water line; centering of the water line section to result in the water line joints being removed from the sewer line to the maximum possible extent.

No water line shall pass through or come into contact with any part of the sewer or sewer manhole.

Easements - a minimum of 15 feet easement shall be dedicated for a water main constructed outside a public right-of-way.

## 1.05 INSPECTION

All projects shall be subject to inspection during construction and upon completion of construction by an authorized representative of the Water Department. Inspection may consist of full-time resident inspection at the sole discretion of the Water Department. Presence or absence of the inspector during construction does not relieve the Developer and/or Contractor from adherence to approved drawings and specifications.

The work shall at all times be subject to the inspection of authorized representatives of the Water Department. Materials and/or workmanship found not meeting requirements of approved drawings and specifications shall be immediately brought into conformity with said drawings and specifications.

An authorized representative of the Hendersonville Utility District Water Department shall make a final inspection of the project after completion to determine acceptability of the work. Before this final inspection can be made the Engineer responsible for the project shall notify the Water Department in writing that the work has been completed in accordance with approved drawings and specifications.

Final acceptance of the work shall be accomplished as described in Paragraph 1.08.

## 1.06 FINAL ACCEPTANCE

When facilities qualify as public facilities the Hendersonville Utility District Water Department will accept ownership of the completed facilities when the work has passed the final inspection and when final drawings are submitted to the Hendersonville Utility District Water Department reflecting actual "AS BUILT" conditions. The "AS BUILT" drawings shall be complete and show all easements, final location of water lines, valves, fittings, services, fire hydrants and other items appurtenant the system. One (1) set of acceptable "AS BUILT" drawings and a digital copy of "AS-BUILT" drawings shall be submitted to the Hendersonville Utility District Water Department along with the actual cost of construction before final acceptance of the work is made. The CADD file shall be in AutoCAD (.dwg), Microstation (.dgn), or a universal (.dxf) file type.

"AS-BUILT" drawings shall consist of the following:

1. Each valve box, fire hydrant, blow-off valve, and fittings shall be stationed and located using GPS with XYZ coordinate technology to integrate with the HUD GIS system. Each located point shall be included in a Comma Separated Value (.csv), Microsoft Excel spreadsheet (.xls), or approved file format. The CSV file shall include, at minimum, the following information:

<u>Position/Column</u>	<u>Description</u>
1	Point Reference Number
2	X Coordinate (Easting)
3	Y Coordinate (Northing)
4	Z Coordinate (Elevation)
5	Point Type (Manhole, Valve, Meter, Fire Hydrant, etc.)
6	Point Description

2. All services shall be located from the lower elevation property line and located using GPS with XYZ coordinate technology.
3. One set of Mylar prints and a Portable Document Format (.pdf) file.



Final acceptance by the Water Department will be made in writing upon satisfactory completion of the project including final inspection, submittal of acceptable "AS BUILT" drawings, and payment of all fees due. The Developer shall guarantee the work for a period of one year from the date of final acceptance and shall immediately correct any deficiencies in the work due to materials and/or workmanship. The date of final acceptance shall be that date on which the Developer has fulfilled all conditions necessary for final acceptance including passing a final inspection, submittal of acceptable "AS BUILT" drawings, and payment of all fees due.

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## SECTION 2 - MATERIALS

### 2.01 - GENERAL

All materials to be incorporated in the project shall be first quality, new and undamaged material conforming to all applicable portions of these specifications.

### 2.02 CONCRETE

Cement - Cement shall be Portland cement of a brand approved by the Engineers and shall conform to "Standard Specifications for Portland Cement," Type 1, ASTM Designation C-150, latest revision. Cement shall be furnished in undamaged 94 pound, one cubic foot sacks and shall show no evidence of lumping.

Concrete Fine Aggregate - Fine aggregate shall be clean, hard uncoated natural sand conforming to ASTM Designation C-33, latest revision, "Standard Specifications for Concrete Aggregate."

Concrete Coarse Aggregate - Coarse aggregate shall consist of clean, hard, dense particles of stone or gravel conforming to ASTM Designation C-33, latest revision, "Standard Specifications for Concrete Aggregate." Aggregate shall be well graded between 1-1/2-inch and #4 sieve sizes.

Water - Water used in mixing concrete shall be clean and free from organic matter, pollutants and other foreign materials.

Ready-Mix Concrete - Ready-mix concrete shall be secured only from a source approved by the Engineer and conform to ASTM Designation C-94, latest revision, "Specifications for Ready-Mix Concrete." Before any concrete is delivered to the job site, the supplier must furnish a statement of the proportions of cement, fine aggregate and coarse aggregate to be used for each mix ordered and must receive the Engineer's approval of such proportions.

Class "A" Concrete - Class "A" concrete shall have a minimum compressive strength of 4,000 pounds per square inch in 28 days and shall contain not less than 6 sacks of cement per cubic yard.

Class "B" Concrete - Class "B" concrete shall have a minimum compressive strength of 2,000 pounds per square inch in 28 days and shall contain not less than 4-1/2 sacks of cement per cubic yard.

Metal Reinforcing - Reinforcing bars shall be intermediate grade steel conforming to ASTM Designation A-15, latest revision, "Standard Specifications for Billet Steel Bars for Concrete Reinforcement." Bars shall be deformed with a cross-sectional area at all points equal to that of plain bars of equal nominal size.

### 2.03 CRUSHED STONE

Crushed stone for pipe bedding shall be Tennessee Department of Transportation (TDOT), Bureau of Highways, Standard Size No. 67 and shall meet TDOT Standards for road construction.

## 2.04 DUCTILE IRON PIPE

Ductile iron pipe for water lines shall conform to USA Standard A21, Class 52 for centrifugally cast ductile iron pipe. The pipe shall be manufactured of iron having acceptance values of 60-42-10. Pipe shall be at least Class 52 or heavier where indicated on the drawings.

Pipe shall be furnished in lengths of 18 feet to 20 feet and, unless otherwise indicated, shall be provided with a compression type slip joint equal to the Fastite joint as manufactured by American. Gaskets and lubricants shall be furnished with the pipe. All pipes shall be capped and/or plugged on both ends to prevent debris contamination during transit and storage.

Pipe shall be furnished with standard thickness cement lining on the inside with a bituminous seal coat and a bituminous coating on the outside. Cement lining shall conform to ANSI Standard A21.4. The exterior of the pipe shall be clearly marked to indicate the manufacturer, date of manufacture, the pipe class and weight. Exterior markings shall also positively identify the pipe as being Ductile Iron.

Pipe manufacturer shall furnish, upon request, the test date for quality control during the manufacturing period for pipe furnished on the project. Testing and inspection shall be in accordance with ANSI A21.53. Tests to include hydrostatic test (500 psi - 10 sec.); tensile test; impact test; one sample to be taken during each casting period for approximately 3 hours.

Pipe manufacturer shall provide certified test reports to the Engineer to verify that all pipe furnished was manufactured and tested in compliance with all requirements of ANSI A21.53/AWWA C-153 and ANSI A21.10/AWWA C-110, latest revisions.

## 2.05 FITTINGS

All fittings shall be compact ductile iron, cement lined, bituminous coated, manufactured in accordance with USA Standards A21.53, latest revision, unless otherwise indicated or directed. Minimum pressure rating shall be 350 psi. Unless indicated otherwise on the Drawings, mechanical joint fittings shall be used.

Fitting manufacturer shall furnish certificates that fittings were manufactured in compliance with ANSI A21.53, latest revision.

All fittings, valves and etc. shall be restrained. Each fitting shall be assembled to the ductile iron pipe by the use of pipe retainer glands similar to Mega lug Series 1100 by EBAA iron or Uni-Flange Series 1400 by Ford Meter Box Company. This is in addition to or in lieu of standard concrete thrust blocking.

## 2.06 RESILIENT SEAT GATE VALVES

Resilient seat gate valves shall be iron body, machined surface, modified wedge disc, resilient rubber seat ring type valves with non-rising stems (NRS). Resilient seat gate valves shall have the bronze stem nut cast integrally with the cast iron valve disc. The valve shall have machined seating surface and capable of being installed and operated in either direction. Valves shall be furnished with mechanical joint ends in accordance with USA Standard A21.11 unless otherwise shown or directed. Valves shall be suitable for installation in approximately vertical position in buried pipe lines. Stem seal shall consist of O-ring seals. All valves shall open to the left (counterclockwise) and shall be provided with 2-inch square operating nut. All underground gate valves which have nuts

deeper than 48 inches below the valve box top shall have extended stems with nuts located within one foot of the valve box cap.

Valves shall be for working pressures up to 200 PSI and shall be equal to latest specifications of AWWA C-515, latest revision in all respects. Valves shall be equal to Mueller A-2370-20 or M&H. Valve manufacturer shall furnish certificates that all valve furnished have been tested and manufactured in compliance with AWWA C515, latest revision in all respects.

Iron body resilient seat gate valves shall be as manufactured by Mueller or M&H.

## 2.07 TAPPING SLEEVES AND VALVES

Tapping sleeves shall consist of mechanical joint tapping sleeve or Mueller 304 stainless steel or approved equal and a tapping valve. The valve shall conform to all applicable specifications for gate valves. All bolts are to be stainless steel or brass.

## 2.08 FIRE HYDRANTS

The location of each fire hydrant shall be located on a property line division unless designated by the City of Hendersonville Fire Department and approved by the Hendersonville Utility District.

All fire hydrants shall be iron bodied, fully bronze mounted hydrants manufactured to equal or exceed AWWA Specification C-502, latest revision for Dry-Barrel Fire Hydrants. Hydrants shall be suitable for 150 PSI working pressure and shall be subjected to a test pressure of 300 PSI. Inlet connection shall be 6-inch mechanical joint unless noted otherwise on project drawings. Main hydrant valve shall be compression type, closing with the pressure, with 5-1/4-inch valve opening.

Hydrants shall be of the "dry head" type with an oil reservoir and provision for automatic lubrication of stem threads and bearing surfaces each time the hydrant is operated. Double O-ring seals shall be provided to keep water out of the hydrant top. Operating nut shall be 1-1/2-inch pentagon, opening to left, and shall be equipped with a weather cap.

Hydrants shall be provided with automatic multi-port drain ports arranged to momentarily flush under pressure each time hydrant is operated. A positive stop shall be provided on the operating stem to prevent over travel when operating valve.

Fire hydrant shall be supplied with a bituminous coating for buried portion of hydrant and a yellow enamel finish or approved equal for above ground portions of the hydrant.

Single Pumper Hydrant - The single pumper fire hydrant shall be Mueller A-423 Yellow or M&H style 129 5-1/4". Minimum bury shall be 4-feet.

Single pumper fire hydrants shall be equipped with two 2-1/2-inch hose nozzles, one 4-1/2-inch pumper nozzle, breakable safety flange and safety stem coupling. Bronze nozzles shall be securely locked to prevent them for blowing off. Hose threads shall be National standard. Nozzle caps shall be equipped with non-kink chains.

Note: See Standard Detail for anchoring of fire hydrant assembly.

## 2.09 BLOW-OFF HYDRANT

Shall be standard fire hydrants with valve.

## 2.10 AIR RELEASE VALVE

Automatic air release valves shall be designed to allow a quantity of air to escape out of the orifice when air accumulates at high points in the water line. Valves shall be tested for service to pressures of 300 psi and can be made of cast iron housings. Valves shall be of similar construction to ARI Valves Model D-025 SAAR short version or approved equal. Inlet shall be one inch in diameter.

## 2.11 VALVE BOXES

Valve boxes shall be made of pre-cast concrete sections measuring 11" x 13-1/4" inside dimension and 17" x 19-1/4" outside dimension. The base section shall be enlarged to enclose and protect the valve operating nut without actually being in contact with the pipe or valve. Cover shall be heavy cast iron with the word "WATER" cast in raised letters equal to John Bouchard and Sons Company, Nashville, Tennessee, No. 8006, Roadway Type or approved equal. The word "WATER" will read with the direction of the main.

Footing blocks for standard concrete valve boxes are to be pre-cast blocks measuring 12" x 12" x 4". No reinforcing steel is required in footing blocks.

Valve box frames and covers shall be made of heavy cast iron and shall meet the requirements of ASTM A-48, Class 30.

The valve box frames and covers shall be as manufactured by Bouchard No. 8006, Roadway Type, Nashville Standard or equal. The cover shall be marked "WATER".

## 2.12 PRECAST MANHOLES FOR AIR RELEASE MANHOLES

Precast manholes shall conform to the latest revision of ASTM C-478. Drawings of manhole sections proposed for use on this project must be submitted to the Owner or his authorized representative for approval prior to use. Steps shall be furnished in accordance with Paragraph 2.17 and care must be taken to assure a firmly embedded step with no cracks from mortar shrinkage which will allow leakage. Aluminum in contact with concrete shall be coated with heavy bitumastic paint. Loose steps and shrinkage cracks passing through manhole walls shall be cause for rejection.

Manhole sections showing evidence of cracking, crazing, honeycombing, crumbling or excessive roughness will not be acceptable. Sections with improper cut-outs, misalignments or other defects shall not be utilized in the project.

Manhole sections shall be steam or water cured and shall not be delivered to job site until at least 7 days old. Each section shall be marked with date of manufacture and manufacturer's mark in a permanent manner.

Testing and Acceptance of precast manhole sections shall be done in accordance with ASTM C-478 by an independent laboratory suitable to the Owner or his authorized representative. Compression tests shall be run on specimens obtained from each day's production: a minimum of 2 cylinders or cores per day's run but no less than the maximum number designated by ASTM C-478. The absorption test shall be run on a minimum of 2 randomly selected manhole sections per each day's production.

## 2.13 MANHOLE FRAMES AND COVERS FOR AIR RELEASE MANHOLES

Manhole castings shall conform to ASTM Designation A-48, latest revision, Class 30 and shall be free from scale, lumps blisters, sand holes and defects of every nature which would impair their use. Castings shall be well cleaned with a smooth tough asphaltic coating. Covers shall be of the vented indented type with the words "WATER" cast in raised letters thereon. Bearing surfaces of frames and covers shall be machined to provide a solid bearing and prevent rocking. Pattern drawings and weights of castings shall be submitted for the approval of the Owner or his authorized representative.

Manhole frames and covers shall be equal to those listed below for particular applications.

NON-TRAFFIC (Standard)	John Bouchard No. 1155
TRAFFIC	Same as Non-Traffic type as specified above

Exceptions to the above shall be noted on construction drawings.

## 2.14 MANHOLE STEPS

Steps shall be No. R-1981-Q or plastic encapsulated steel equal to No. PS 1-45 as manufactured by M.A. Industries, Inc.

## 2.15 SERVICE LINE MATERIALS

- 2.15.1 Corporation stops shall be Mueller H-1500 or Ford F1000-3Q or approved equal with compression type connections for copper tubing.
- 2.15.2 All taps shall be direct tap into the main. No saddle taps are to be used without the approval of the Water Department.
- 2.15.3 Small copper piping in the ground shall be of standard soft water pipe (tubing) for water services, ASTM B-88, Type "K" with bronze fittings, corporation stops and valves having compression type connections copper pipe (tubing).
- 2.15.4 Meter Yokes: Meter yokes shall be Ford LSVBHH44233WRQNL for 3/4", LSVBHH44444WQNL for 1", and VBB77-00B-11-77-NL no rise for 2" or approved equal. Yokes to be fitted with angle ball valves (360 degree rotation) with provision for locking and hard copper cross tubes, Mueller 110 or "T" series compression inlet and outlet fittings. Copper cross tubes are to be of sufficient weight and hardness that they will not be bent during service installation or meter replacement.
- 2.15.5 Meter boxes for 3/4-inch and 1-inch meters shall be as manufactured by Mid States Plastics, Inc. Model MSBC 1015-18 or approved equal, with solid cast iron lids with 2-inch TR/PL hole or as required by HUD depending on the size of the meter. Meter box for 2-inch meters shall be Model MSBC 1730-18 with solid cast iron lid with 2-inch TR/PL hole.
- 2.15.6 Meters larger than 2-inches are to be direct read type meters with transmitter as manufactured by Sensus or approved equal.
- 2.15.7 Ball valves are the only approved valve for setting 3/4" to 2" meters.

2.16 SERVICE INSTALLATIONS

Service lines including corporation stop, water line, meter yokes, and meter box shall be installed by the Contractor. All commercial water taps are to be one (1) inch or larger. Water meters up to and including 2-inch shall be installed by the Water Department. Meters over 2-inches shall be installed by the Contractor and shall be Sensus meter with direct read transmitter included.

2.17 REDUCED PRESSURE BACKFLOW PREVENTERS

Backflow preventers shall be required on all commercial and industrial facilities as well as all irrigation services. All backflow preventers shall consist of a mechanical, independently operating, hydraulically dependent relief valve located between two independently operating, internally loaded check valves which, in turn, are located between two tightly closing shut-off valves. All backflow preventers shall meet the requirements of AWWA C-511 latest revision as manufactured by Watts or approved equal.

2.18 CASING PIPE

Where noted on the Drawings or required by these Specifications, roadway, railroad or other crossings shall be made utilizing carrier pipe within a casing pipe. Sizes of carrier pipe and casing pipe shall be as noted on the Drawings or described in these Specifications.

Casing pipe and joints shall be of leak proof construction. The steel casing pipe shall have a minimum yield strength of 35,000 psi and shall have the minimum wall thickness shown in the following table or as shown on the Drawings.

TABLE OF MINIMUM WALL THICKNESS  
FOR STEEL CASING PIPE  
(COPPER E-80 LOADING)

<u>Casing Diameter, inches</u>	<u>Wall Thickness with approved protective_ coating, inches</u>	<u>Wall Thickness without approved protective coating, inches</u>
Under 14	0.188	0.251
14 & 16	0.219	0.282
18	0.250	0.313
20	0.281	0.344
22	0.312	0.375
24	0.344	0.407
30	0.406	0.469
26	0.469	0.532
42	0.500	0.563

The casing pipe shall extend to the points indicated on the Drawings. The ends of the casing shall be protected against the entrance of foreign material but not tightly sealed, in a manner approved by the Engineer.

2.19 WATER LINE / VALVE MARKERS

Water line and valve markers are to be installed to identify location of water mains and valves until final paving is complete or as directed by the Hendersonville Utility District. Markers for valves and/or water lines shall be one piece for driving or settling in the ground. Marker units shall be weather resistant with identifying color and permanently affixed marker identifying water main and/or water valve and shall be a minimum of 62-inches in length. Units shall be flexible and resistant to damage by vehicles, animals, or vandals. Marker units shall be Carsonite Utility Marker, manufactured by Carsonite International - Carson City, Nevada or approved equal.

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## SECTION 3 - CONSTRUCTION

### 3.01 LOCATION OF LINES

The streets, roads, and easements in which lines shall be placed shall be shown on the drawings. Final location of the pipe lines within these locations shall be made by the Engineer and the Water Department at the time of construction. All water lines shall be constructed of Class 52 ductile iron pipe. Water line and valve markers are to be installed to identify location of water mains and valves until final paving is complete or as directed by the Hendersonville Utility District.

### 3.02 TRENCHING

Trenching must be done in a neat and workmanlike manner, maintaining proper alignment except where necessary to make deviations to miss obstruction. Trenching for installation of water distribution piping shall be such that the pipe will have a minimum cover of 30-inches over the bell. The bottom of trenches must be shaped by hand and bell holes must be dug so that full length of pipe is resting on trench bottom. Blocking shall not be used.

All shade trees, telephone poles, power poles, etc. along the line of work shall be protected, and sufficient barricades, lanterns, etc. shall be provided for the protection of the public.

#### 3.02.1 Rock Excavation in Trenches

Where rock is encountered in trenches, the excavation shall be carried to a depth of 12-inches below the barrel of the pipe and the excess excavation shall be backfilled with approved bedding material firmly compacted. Boulders and large stones, rock or shell shall be removed to provide a clearance of at least 12-inches below all parts of the pipe or fittings and to a clear width of at least 12-inches on each side of all pipe and appurtenances.

Where rock is encountered, the Contractor shall "mattress" the trench during blasting operations and shall use all precautions necessary to protect adjacent property against damage resulting from his operations. Rock excavation in proximity to other pipes or structures shall be conducted with the utmost care to prevent damage to the existing structures and any such damage caused shall be promptly repaired at the Contractor's expense. Blasting operations shall be conducted within 25 feet of finished sewer or water pipe; and rock excavation shall be completed at least 25 feet ahead of pipe laying.

Extreme care shall be exercised in blasting with the signals of danger given and displaced before the firing of any charge. The Contractor shall, in all his acts, conform to and obey all rules and regulations for the protection of life and property that may be imposed by any public authorities, or they may be made from time to time by the Engineer relative, to the storing and handling of explosives and the blasting operations. No blasting shall be done at any time except by persons experienced in this line of work.

#### 3.02.2 Obstructions of Streets, Premises, Etc.

All materials excavated shall be placed so as to interfere as little as possible with public vehicular traffic. In general, excavated material shall be kept clear of the

sidewalk except where local conditions make other arrangements desirable. In this event the Contractor will receive appropriate instructions from the Engineer.

At such street crossings and other points as may be directed by the Engineer the trenches shall be bridged in a proper and secure manner so as to prevent any serious interruption of travel upon the roadway or sidewalk and also to afford necessary access to particular public premises.

The Contractor will not be permitted under any circumstances to close to vehicular traffic any roadway, neutral grounds, or street except by special permission of the City of Hendersonville for a specified period. Alternate streets crossing the work must always be kept open. Contractor shall notify local police and fire officials in the event closure is allowed.

### 3.02.3 Surface Obstructions

All buildings, walls, fences, poles, bridges, railroads, trees, and other property improvements encountered shall be carefully protected from all injury. In the event that any of the foregoing are damaged or removed during the process of the work they shall be repaired or replaced in a satisfactory manner. Special care must be exercised in trenching under or near railroads in order to avoid or minimize delays or injuries. Where it is necessary to cross beneath railroad tracks the Contractor shall make such installations in a casing of larger diameter as approved by the railroad company, the Engineer and the Hendersonville Utility District Water Department.

### 3.02.4 Subsurface Obstructions

In excavating, backfilling and laying pipe, care must be taken not to remove, disturb, or injure other pipes, conduits, or structures without the approval of the Water Department. If necessary, the Contractor, at his own expense, shall sling, shore up and maintain such structures in operation and within the reasonable time shall repair any damage done thereto. Repairs to these facilities shall be made to the satisfaction of the Hendersonville Utility District Water Department.

The Contractor shall give sufficient notice to the interested utility of his intention to remove or disturb any other pipe, conduit, etc. and shall abide by their regulations governing such work. In the event subsurface structures are broken or damaged in the prosecution of the work, the Contractor shall immediately notify the proper authorities and shall be responsible for any damage to persons or property caused by such breaks.

When pipes providing service to adjoining buildings are broken during the progress of the work the Contractor shall notify the Water Department immediately. Contractor shall be responsible for repair of all damaged facilities. The Owner reserves the right to make repairs at the Contractor's expense without prior notification. Delays that would result in buildings being without service overnight or for needlessly long periods during the day will not be tolerated. Should it become necessary to move the position of a pipe, conduit, or structure relocation shall be done by the Contractor in strict accordance with instructions given by the Engineer or the Hendersonville Utility District Water Department.

The Water Department or Engineer will not be liable for any claim made by the Contractor based on underground obstructions being different than indicated on

the drawings. Where ordered by the Engineer, the Contractor shall uncover subsurface obstructions in advance of construction so that the method of avoiding same may be determined before pipe laying reaches the obstructions.

The Contractor shall be governed by instructions of the Engineer regarding the laying of pipe along State Highways and the latter will determine whether the pipe shall be laid over, under, or along the end of various drainage structures encountered.

### 3.03 LAYING WATER PIPE

#### 3.03.1 General

In case of any item not covered by this section, the manufacturer's recommendations shall govern the manner in which water pipe is laid.

Immediately before being placed in trench, all pipes shall be examined for defects and shall be swabbed clean and free of all dirt or rubbish. While suspended in sling and before lowering in trench, pipe shall be inspected and if found to be defective removed at once from work area.

Bell holes for bell and spigot and mechanical joint pipe shall be dug in trench to allow entire length of pipe barrel to be bedded and to allow proper jointing of pipe. Alignment of pipe shall be as true as possible in order to avoid air pockets. Open ends of the pipe shall be securely plugged to prevent the entrance of foreign materials when work is suspended either for the night or for any other reason. Dead ends of the pipe and unused branches of crosses, tees, valves, etc. shall be closed with plugs suitable to the type of pipe in use.

Cutting of pipe shall be done in a neat, workmanlike manner without damage to pipe, coatings and linings and so that a smooth end remains at right angles to axis of pipe.

No pipe shall be laid which prevents successful jointing, laying or backfilling of trench.

#### 3.03.2 Removal of Water

The Contractor shall be responsible for handling run-off and ground water in such a way as to maintain trenches and excavations in a dry condition until the work is completed. Pumps, piping, well points, labor, fuel, and other facilities necessary to control, intercept, remove and/or dispose of water shall be provided by the Contractor at his own expense. Water removed from trenches or holes shall be discharged to natural drains in such a way as to avoid danger or damage to adjacent property owners. No discharge into sanitary sewers will be permitted.

Where the Contractor fails, refuses, or neglects to control water in trenches or other excavations, and corrective work is deemed by the Engineer to be necessary as a consequence thereof, such work shall be at the Contractor's expense.

Work under this section shall be approved by the City of Hendersonville Public Works Department.

### 3.03.3 Ductile Iron Pipe

Provision of AWWA Specifications C600, latest revision, "AWWA Standard for Installation of Gray and Ductile Cast Iron Water Mains" shall apply. Laying conditions shall be Type 2 (flat bottom trench without blocks) with tamped backfill.

Joints shall be an approved slip-on type or mechanical joint. Unless otherwise indicated on Drawings, lines laid below ground shall have approved slip-on joints; lines laid above ground shall have mechanical joints. Flanged joints shall be used only where designated on Drawings. Cement joints will not be permitted.

Mechanical joint and slip-on type water line shall be jointed together in trench according to recommendations of pipe manufacturer. Inside of bell and outside of spigot end shall be thoroughly cleaned to remove oil, grit, excess coating and other foreign matter. Circular rubber gasket shall be flexed inward and inserted in gasket recess of bell socket. Thin film of gasket lubricant shall be applied to inside surface of gasket or spigot end of pipe or both. Gasket lubricant shall be as supplied by pipe manufacturer and approved by Engineer. Spigot end of pipe shall be inserted into socket, with care used to keep joint end to bottom of socket with forked tool, jack-type tool, or other device approved by Engineer. Pipe not furnished with depth mark shall be marked before assembly to assure that spigot is inserted to full depth of joint. Field cut pipe lengths shall be filled or ground to resemble spigot end as manufactured. All mechanical joints shall have a three foot splice piece between fittings.

Whenever it is desirable to deflect slip-on joint pipe in order to form long-radius curve amount of deflection shall not to exceed maximum limits as follows:

<u>Diameter</u>	<u>Joint Length</u>	<u>Deflection</u>
6" thru 12"	18 ft.	18 in.
14" thru 30"	18 ft.	10 in.

Whenever water lines cross over or under sewer lines, the water line is to be encased in concrete. Minimum vertical separation between water and sewer is to be 18-inches.

All pipe joints installed inside of casing pipe shall be restrained by the use of locking gaskets.

## 3.04 INSTALLATION OF FITTINGS

### 3.04.1 General

Fittings in pipe lines shall be firmly secured to prevent the fitting from being blown off the line when under pressure. When connections are made between the new work and existing mains, the connections shall be made using materials approved by Hendersonville Utility District.

All tees, caps, plugs, bends or other fittings subjected to unbalanced forces tending to pull the joints apart shall be protected with concrete thrust blocks. Thrust blocks shall be provided in accordance with details shown on Drawings

and must bear against an undisturbed trench face. Thrust blocks may be required by Hendersonville Utility District.

All fittings shown on the drawings are to be restrained to the ductile iron pipe by the use of pipe retainer glands similar to Mega lug Series 1100 by EBAA iron or Uni-Flange Series 1400 by Ford Meter Box Company. This is in addition to or in lieu of standard concrete thrust blocking.

Fittings shall be placed in locations indicated on Drawings or designated by Engineer and shall be installed in accordance with provisions of these Specifications dealing with laying of Ductile Iron Pipe. Joints shall be as designated under Section 2, Materials.

All fittings may be subject to inspection by Engineer or Water Department before being placed in trench. Any defective, unsound or damaged fittings shall be rejected and Contractor shall remove at once from work area.

#### 3.04.2 Fittings

Fittings shall be installed in accordance with provisions of these specifications dealing with lying of ductile iron pipe. Joints shall be as designated under Division 2, "Materials".

#### 3.05 INSTALLATION OF VALVES, VALVE BOXES

Valves shall be placed in the locations indicated on the Plans or at locations designated by the Engineer. All valves shall be set vertically. Before being placed in the trench, all valves shall be carefully examined by the Contractor and Engineer to see that they are in good working order. At the intersection of all lines a valve shall be installed in each direction or as directed by the Hendersonville Utility District.

A valve box shall be placed over each valve. All operating nuts shall be 48-inches below the top of the valve box unless approved by the Water Department.

The valve box shall not come in contact with valve, valve stem, extension, or operating nut at any point. Backfill around boxes shall be tamped to maintain centered and plumbed alignment of box.

Box shall be installed with top set flush with finished surface in paved areas and to 2-inches above natural ground level in unpaved areas.

Valve and valve box installations shall conform to the standard detail drawing of these specifications. All valves shown on the drawings are to be restrained to the ductile iron pipe by the use of pipe retainer glands similar to Mega lug Series 1100 by EBAA iron or Uni-Flange Series 1400 by Ford Meter Box Company. This is in addition to or in lieu of standard concrete thrust blocking.

Upon completion of project, the Contractor shall operate all buried valves in accordance with manufacturer's recommendations in the presence of a Hendersonville Utility District Representative to verify proper operation.

### 3.06 INSTALLATION OF FIRE HYDRANTS

Hydrants shall be located generally as shown on the Drawings subject to review and approval by the Hendersonville Utility District and Fire Department. Location shall provide complete accessibility and minimize possibility of damage from vehicles or injury to pedestrians.

Hydrants shall stand plumb (vertically) with pump nozzle facing street or public rights-of-way. Hydrants shall be set so that ground line, as indicated on hydrant barrel, is within 6-inches of finished grade. Hydrants without ground lines marked on barrel shall be set so that barrel flange is 6-inches above finished grade. Hydrant barrels shall be minimum bury of 48-inches. Greater burial depths might be required to accomplish the above described grade setting. It is desired to accomplish the proper grade setting without the use of barrel extensions.

A hydrant drain consisting of at least 7 cubic feet of clean, washed gravel or crushed stone covered with non-woven fabric shall be placed around base of hydrant. After installation is complete hydrant will be tested for drainage and Contractor must correct situation if hydrant does not drain satisfactorily.

The Contractor shall use locked joint base fittings, anchoring fittings, or pipe clamps and tie rods to anchor valve and the fire hydrant to main line tee. (See detail drawings enclosed.) All fire hydrant and valve restraints are to be restrained to the ductile iron pipe by the use of pipe retainer glands similar to Mega lug Series 1100 by EBAA iron or Uni-Flange Series 1400 by Ford Meter Box Company. All fire hydrants placed at the end of the line shall be restrained by using lock type gaskets in the last three joints of pipe before the valve. There should be no less than 3 feet of pipe between the valve and hydrant.

Concrete thrust block may be poured at base of hydrant with care taken not to plug hydrant drains. Blocks may be poured in addition to retainer glands, locked joint base fittings, anchoring fittings, or pipe clamps and tie rods.

Painting of hydrants: All hydrants shall be yellow in color from factory.

In case of damaged or otherwise unsatisfactory paint, Contractor shall apply two (2) coats of approved enamel.

Hydrant installation shall conform to details in these specifications.

### 3.07 INSTALLATION OF SERVICES

Services shall be installed in the best workmanlike manner with 30-inches minimum cover. Corporation cock at the main shall be installed in top quadrant of the main. The service line shall run from main to meter box in as straight a line as possible and at an angle of 90 degrees to the main. Water service line is to extend a minimum of 3-feet past the meter yoke.

Meter box shall be installed in public right-of-way adjacent to right-of-way line with top of casting at finished grade. Top of meter yoke must be 18-inches below final grade.

Installation shall be in accordance with the standard detail drawing of these specifications.

### 3.08 INSTALLATION OF SPECIAL ITEMS

#### 3.08.1 Connections to Existing Mains

Connections to existing mains for line extensions or fire hydrant installation shall be made in the manner approved by the Hendersonville Utility District Water Department.

Where existing mains must be valved off to make connections, the Contractor shall notify the Water Department not less than 72 hours prior to the making of the connection. The actual time of the service interruption shall be subject to the approval of the Hendersonville Utility District Water Department.

It shall be the responsibility of the Contractor to measure outside diameters of existing pipes before ordering tapping sleeves or other fittings intended for connection to existing mains.

#### 3.08.2 Concrete Work

Concrete is to be proportioned in two classes according to use as follows:

Class "A" for reinforced concrete structures, non-reinforced portions of manholes, control chambers and interceptor structures, curbs and gutters, driveways, sidewalks, and surface base courses for highway and street paving.

Class "A" concrete is to be proportioned one 94 lb. sack Portland Cement, 195 lbs. sand, and 270 lbs. coarse aggregate. These proportions may be varied by the Engineer after the materials supplied have been tested and proportions for the greatest density and workability determined. In no case shall more than 7.25 bags or less than 5.5 bags of Portland cement per cubic yard of concrete will be required.

Class "A" concrete shall have a minimum compressive strength of 4,000 lbs. per square inch in 28 days.

Class "B" for encasement around sewers and water lines for cradle, refill and tunnel backfill, for thrust blocks.

Class "B" concrete shall have a minimum compressive strength of 2,000 psi and shall contain not less than 4-1/2 sacks of cement per cubic yard of concrete. The relative amounts of fine and coarse aggregate shall be comparable to that for Class "A" concrete.

Standard Detail W-4 shall be used with the installation of a 5-1/4 inch M&H 129 yellow fire hydrant assembly or approved equal.

Blow-off installation shall conform to the standard detail drawings of these specifications.

#### 3.08.3 Installation of Stub-outs for Future Lines

The Contractor shall anchor the valve and stub-out for future lines to the main line tee. These anchors are to be in addition to the standard concrete thrust blocking.

### 3.09 BACKFILLING

#### 3.09.1 General

Backfilling shall be carried out as expeditiously as possible but shall not be undertaken until the Engineer has been given the opportunity to inspect the work. The Contractor must carry out all backfilling operations with due regard to: (1) the protection of pipes, structures and appurtenances; (2) the use of prescribed backfill materials; and (3) procedures to obtain the desired degree of compaction. No equipment may be used which will result in damage to or misalignment of the pipe.

#### 3.09.2 Acceptable Backfill Material

All backfill material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks or stones, or other material that in the opinion of the Engineer is unsuitable. From one foot above top of pipe to within twelve-inches of finished grade in unpaved areas back fill may contain stones up to six inches in their greatest dimension, unless otherwise specified. Back fill containing rock must contain enough dirt to fill voids between rocks.

When backfill material is not specified on Project Drawings or elsewhere in these Specifications Contractor may backfill with the excavated material provided material consists of loam, clay, sand, gravel, or other materials that, in opinion of Engineer or Hendersonville Utility District Water Department, are suitable for backfilling.

Backfilling shall not be done in freezing weather and it shall not be made with frozen material. No fill shall be made where material already in trench is frozen. Backfill shall not be made with material which, in Engineer's or Hendersonville Utility District Water Department's opinion, is too wet.

Where crushed stone backfill is required the crushed stone shall be No. 67 size as designated by the Tennessee Department of Transportation Standards for crushed stone used in road construction.

#### 3.09.3 Backfilling Under Pipe

All trenches shall be backfilled by hand from bottom of trench to centerline of pipe. Approved backfill material (Crushed Stone No. 67) shall be placed in 6-inch layers and thoroughly compacted by hand tamping. Backfill material shall be deposited in trench for its full width on each side of pipe, fittings and appurtenances simultaneously. Care must be taken to compact fill along sides of pipe and appurtenances adjacent to pipe wall.

#### 3.09.4 Backfilling Under Pipe in Rock

Where trench is excavated in rock or shale a 12-inch space below pipe shall be backfilled with approved bedding (Crushed Stone No. 67) material firmly compacted to form a cushion for pipe and appurtenances.

#### 3.09.5 Backfilling Over Pipe

From centerline of pipe, fittings and appurtenances to a depth of 1 foot above top



of pipe, trench shall be backfilled by hand or by approved mechanical methods of 6-inch layers and thoroughly compacted. Contractor shall use special care in placing this portion of backfill in order to avoid injuring or moving pipe.

After the backfill has been placed to a depth of at least 12-inches above top of pipe additional backfill may be placed by means of front end loaders, bulldozers or other suitable mechanical equipment subject to a 9-inch limitation of maximum thickness of layers placed before compaction.

### 3.09.6 Backfilling To Grade

From one foot above top of pipe to grade, trench shall be backfilled by hand or by approved mechanical methods (power equipment).

#### 3.09.6.1 In Areas Subject to Vehicular Traffic or Under Sidewalks

Where excavation is made through pavement, curbs, driveways, sidewalks, road shoulders, or other areas subject to vehicular traffic or supporting permanent structures, or where such areas, items or structures are undercut by excavation, entire backfill shall be crushed stone (No. 67) which shall be placed in layers or lifts not exceeding 9-inches in thickness.

After placing in layers crushed stone shall be carefully compacted to maximum density or minimum volume. Such backfill, placed where called for on the Drawings or as directed by the Engineer shall be designated as Crushed Stone Backfill.

Where excavation is made through permanent pavements backfill shall be placed as described above to subgrade elevation only. Remainder of backfill shall be crushed stone placed as directed to finished pavement grade to serve as temporary pavement.

The last 8 to 10-inches of backfill shall be compacted pug mix to stabilize trench cut.

#### 3.09.6.2 In Areas Not Subject to Vehicular Traffic

Where excavation is made in areas not subject to vehicular traffic or supporting permanent structures and where settlement is not as critical Contractor may backfill trench from 1 foot above top of pipe to top of trench with approved excavated material using hand or approved methods. Backfill material shall be brought up to the original ground level in layers and walked in with suitable equipment. More restrictive compaction of this backfill material will not be required; however, the Contractor shall be responsible for bringing in such additional fill material as may be required from time to time during the one year warranty period to fill in areas where excessive settlement has occurred.

### 3.10 PAVEMENT REMOVAL

The Contractor shall take necessary steps to minimize damage where existing paved streets, roads, parking lots, drives, or sidewalks must be disturbed during construction of the project. Permanent type pavement shall be cut or sawed in a straight line before removal and care shall be taken during excavation to avoid damage to adjacent

pavement. Areas shall be suitably protected where trucks or other heavy equipment must cross curbs or sidewalks. A Street Cut Permit shall be obtained from the City of Hendersonville Public Works Department prior to commencement of any work within the right-of-way.

### 3.11 REPLACING ROAD SURFACING, DRIVEWAY, ETC.

In paved or improved roads or where sidewalks, curbs, gutters or driveways have been damaged by the Contractor, items shall be repaired or replaced without needless delay in the best workmanlike manner with the same kind of materials as were removed or damaged in construction operation. Underlying foundation courses of roads, driveways, finished surface, etc. shall conform to undisturbed portions of the damaged item and shall in every respect be equal to quality, materials, and workmanship to the original, undisturbed item.

Decision of the Owner or his authorized representative shall be final as to classification of any form of pavement or surfacing not specified on the Construction Drawings or of any forms of pavement or surfacing where classification is in question. Should the Contractor fail or refuse to repair any damage after receiving directions of the Owner or his authorized representative the Owner may, after 24 hours written notice, employ such force and furnish such materials as may be necessary to do the work with cost to be billed to the Contractor.

City of Hendersonville Public Works Department shall make final acceptance of all right-of-way street related facilities. A Street Cut Permit shall be obtained from the City of Hendersonville Public Works Department prior to commencement of any work within the right-of-way. All asphalt repairs must be approved by the City of Hendersonville Public Works Department.

All water valves and manholes will be adjusted to the final surface elevations by the Contractor. Cost to be merged into price for pavement replacement.

### 3.12 CLEAN-UP PROCEDURES AND REQUIREMENTS

The Contractor shall not, without the permission of the Engineer or Hendersonville Utility District Water Department, remove from the line of work any earth excavated there from which may be suitable for backfilling or surfacing until the excavation has been refilled and surfaced.

Within areas of existing development, as soon as the backfilling of any excavation is completed, the Contractor must at once begin the removal of all dirt except that which is actually necessary to provide for the settlement of the fill. Contractor shall also remove all pipes and other material placed or left on the street except material needed for the replacement of paving. The street shall be made passable for traffic and opened as soon as possible. Following the above work the repairing and complete restoration of the street surfaces, bridges, crossings, and all places affected by the work shall be completed as promptly as possible.

All excavated material shall be cleared from adjacent street surfaces, gutters, sidewalks, parkways, railroads, grass plots, yards, etc., and all work shall be left in an acceptable condition. Contractor will be required to re-grass lawns or neutral grounds where trenches are excavated in these locations or where contractor has damaged lawns or neutral grounds by his operations.

The Engineer or Hendersonville Utility District Water Department shall be sole authority in determining when rough and final clean-up shall occur. Rough clean-up shall consist of removal of rocks larger than one foot in any dimension, grading of excess backfill material over pipe line or removal of sand material, opening of any drainage device, restoration of any street or roadway to condition so that traffic may safely and conveniently use street or roadway, restoration of pedestrian ways to condition where pedestrians may safely and conveniently use same. In general rough clean-up shall commence no later than one day after pipe laying and backfilling or no farther behind pipe laying operations than 1,000 feet; whichever time limit is shortest. Final clean-up consisting of pavement replacement, sidewalk replacement, removal of rocks, hand raking with seeding, strawing, etc. of lawns and neutral grounds, adjusting grade of ground over pipeline, property repairs, and other items shall, in general, be prosecuted no later than 2 to 3 weeks after pipe has been laid and backfilled.

### 3.13 SLOPE PROTECTION AND EROSION CONTROL

Consists of temporary control measures as shown in the Drawings or directed by the Engineer or as required by the State of Tennessee - Water Pollution Control Division during the life of the Contract to control erosion and water pollution through the use of hay bales and other control devices. All slope protection and erosion control shall be approved by the City of Hendersonville Public Works Department.

The Contractor's attention is directed to the requirement for executing a Notice of Intent (NOI) for storm water discharges. The Developer will pay required fee and transmit the NOI package to the State for review and approval. This NOI must be approved by the State of Tennessee prior to beginning work.

It shall be the responsibility of the Contractor to fully comply with all requirements and regulations of the NOI, storm water discharge regulations, and all other requirements contained herein.

Note: The Developer/Contractor's attention is directed to the fact that a permit from the Division of Water Pollution Control might be required for aquatic resource alteration for work in and/or around streams.

### 3.14 INSTALLATION OF REDUCED PRESSURE BACKFLOW PREVENTERS

All backflow prevention assemblies shall be installed in accordance with the Manufacturer's installation instructions. The Hendersonville Utility District reserves the right to supersede these instructions when necessary.

The entire backflow prevention assembly, including test cocks, shut-off valves, strainers, and any other part, must be easily accessible for annual testing and repair.

The entire backflow prevention assembly shall be located a minimum of 12-inches plus the nominal diameter of the device above the floor surface. Maximum height above the floor surface shall not be more than 48-inches. Clearance from all wall surfaces or other obstructions shall be a minimum of 6-inches.

All backflow prevention assemblies shall be protected from freezing, vandalism, abuse, and any other corrosive, sticky, greasy, abrasive environment. No electrical grounding shall be allowed upstream of the backflow prevention assembly. Grounding after the backflow prevention assembly will be allowed with prior approval from Hendersonville Utility District personnel.

All backflow prevention assemblies shall be positioned where discharge from the relief port will not create undesirable condition that might cause undue damage to the backflow assemblies operation. An approved Air Gap shall separate the relief port of the backflow prevention assembly from any drainage system. Any indoor installation of a backflow prevention assembly must have a floor drain that is 2-1/2 times the diameter of the size of the backflow preventer. The installation will be considered non compliant if sufficient drainage is not included, Installation will not be approved unless a waiver is signed by the owner of the company and/or the property.

An approved strainer, fitted with a drain cock, shall be installed on the immediate upstream side of the backflow prevention assembly.

Below ground installation of backflow prevention assemblies are not permitted.

Duplicate backflow prevention assemblies shall be installed in parallel in cases where the water supply cannot be interrupted for routine testing and maintenance of a single assembly.

All new backflow prevention assembly installations shall include test fittings and protective caps. Threads on test fittings must be wrapped with teflon tape.

Backflow prevention assemblies that are installed on in-ground irrigation systems or hose bibb connections shall be removed during winter periods to protect from freezing unless the assembly is protected by an approved engineered protective covering.

All backflow prevention assemblies installed on fire sprinkler systems must be tested and maintained annually by licensed sprinkler contractors with certified cross connection personnel. Only licensed sprinkler contractors with certified cross connection personnel may install, repair, or test backflow prevention devices on fire protection systems. Annual test records must be submitted to the Hendersonville Utility District within seventy-two (72) hours of inspection/test. Test reports shall be delivered to the Hendersonville Utility District Senior Inspector. Double check valve and Double Check Detector Check valve assemblies are allowed only on fire sprinkler systems.

All other water lines, meters, chill lines, boiler lines or other lines that are deemed to require backflow protection shall include an approved reduced pressure backflow prevention assembly to Hendersonville Utility District specifications. All commercial buildings, regardless of type of business that occupies the property, must have a reduced pressure backflow prevention assembly installed for the domestic water line between the water meter and the first connection.

All in-ground irrigation systems, hose bibb or hydrant bibbs that are directly connected to a water meter must have a reduced pressure backflow prevention assembly installed between the water meter and the first connection.

In situations where a backflow prevention assembly fails a test Hendersonville Utility District will give notice in writing of a certain amount of days to have the problem resolved. The amount of days will be determined by the degree of hazard of the property being protected. In the event that the backflow prevention assembly is not repaired Hendersonville Utility District will allow a maximum of two (2) re-tests before the water service is disconnected. Backflow prevention assemblies on irrigation systems, hose connections and bibb connections will be allowed a maximum of two (2) re-tests before water service is discontinued.

The Hendersonville Utility District reserves the right to discontinue water service to any commercial or residential user who is in danger of contaminating the public water supply. The Hendersonville Utility District will consider a failed backflow prevention assembly as a dangerous threat to the public water supply. For annual testing purposes the Hendersonville Utility District reserves the right to access any area or property where a backflow prevention assembly is located.

All secondary "Watering Meters" (meters such as for irrigation, filling swimming pools, fire protection, etc.), regardless of application must be protected by a reduced pressure backflow prevention assembly installed to Hendersonville Utility District specifications.

Atmospheric vacuum breakers, hose-bibb vacuum breakers, dual check devices, and spill-resistant pressure vacuum breaker assemblies are not considered sufficient protection against backflow or backsiphonage by the Hendersonville Utility District and cannot be used in any application.

The Hendersonville Utility District reserves the right to inspect any building or property to determine if backflow protection is needed. The Hendersonville Utility District also reserves the right to require any property or building that is deemed a potential to contaminate the water supply to be retrofitted with backflow prevention.

### 3.15 INSTALLATION OF ULTRASONIC FLOW METERS ON FIRE LINES

All fire lines shall be metered with a Sensus F-2 Series meter.

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## SECTION 4 - TESTING AND DISINFECTION

### 4.01 GENERAL

Upon completion of the construction work the Contractor shall conduct the necessary pressure and leakage tests in the presence of an authorized representative of the Water Department. The Main shall be disinfected using AWWA rules C-651, latest revision

Inspection, testing, tap and connection fees shall be paid by the contractor or developer prior to acceptance.

**Note: No connections to the existing water system will be permitted until the new lines have been satisfactorily inspected, tested, and disinfected.**

### 4.02 PRESSURE TESTS

Each section of the completed water line shall be subjected to a pressure test. The section to be tested shall be valved off after having been filled with water, and a positive displacement test pump shall be used to pump clean water into the section to build up a test pressure of 200 psi at the point of maximum pressure in the test section. Each valved section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. The system shall be allowed to stabilize at the test pressure before conducting any leakage test. The test pump shall then be valved off from the system and the pressure shall be observed over a period of at least 2 hours.

Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place at the discretion of the Owner.

Any exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until it is satisfactory to the Owner.

No pipe installation will be accepted if the leakage is greater than that established in AWWA C600. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

A drop in pressure of 5 psi or more during the one-hour test shall be taken as an indication of leakage. In the event leaks are found and corrected, the Contractor shall repeat the pressure test using the same procedure described above. Should the Contractor be unable to obtain a satisfactory pressure test over a duration of at least 2 hours, he shall then be required to perform a leakage test using a water tap and standard water meter to measure the leakage in the test section at system pressure over

a period of 24 hours. Leakage during the 24-hour period must not exceed the allowable leakage for mechanical or push-on joints as shown in Table 7 of AWWA C600, latest revision and reproduced on the following page. Should the system fail to pass the leakage test, the Contractor will be required to locate and correct the leaks and to retest the system until satisfactory results can be obtained.

The Contractor shall provide suitable first-quality pressure gauges with 5 lb. or smaller graduations. Pressure gauge shall be in good condition and shall be subject to such tests for proof of accuracy as required.

4.03 DISINFECTION

All water main extensions and appurtenances shall be disinfected as per AWWA C-651, latest revision. The contractor will be required to furnish a gallon meter and a diffuser. The contractor will be required to record the gallons used during flushing.

Samples of water shall then be taken by methods and personnel approved by the Engineer and the Owner and shall be submitted to the bacteriological laboratory of the State Division of Water or the Owner as the Owner may direct. In the event any of the bacteriological samples show the presence of coliform organisms or an excessive total count, the disinfection procedure shall be repeated until samples of satisfactory bacteriological quality can be obtained.

All chlorine used must come from the pipe supplier. No chlorine from a pool place will be accepted.

The Contractor shall furnish the chlorine for main disinfection and shall furnish all labor, tools and equipment for the disinfection and sampling. The sample bottles will be furnished at no cost by the Hendersonville Utility District Water Department.

Disinfection procedures shall generally be in accordance with the AWWA Standard for Disinfecting Water Mains, AWWA C651 (latest revision).

New Line Disinfection 65% HTH granules/powder Required for 24 hour detention time @ (50 mg/l)										
Pipe Length										
Pipe Diameter	100 ft ounces	200 ft ounces	300 ft ounces	400 ft ounces	500 ft ounces	600 ft ounces	700 ft ounces	800 ft ounces	900 ft ounces	1000 ft ounces
4"	.7	1.3	2.0	2.7	3.3	4.0	4.7	5.4	6.0	6.7
6"	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12.1	13.6	15.1
8"	2.7	5.4	8.0	10.7	13.4	16.1	18.8	21.4	24.1	26.8
10"	4.2	8.4	12.6	16.7	20.9	25.1	29.3	33.5	37.7	41.9
12"	6.0	12.1	18.1	24.1	30.1	36.2	42.2	48.2	54.2	60.3
16"	10.7	21.4	32.1	42.9	53.6	64.3	75.0	85.7	96.4	107.1
18"	13.6	27.1	40.7	54.2	67.8	81.4	94.9	108.5	122.1	135.6
24"	24.1	48.2	72.3	96.4	120.5	144.7	168.8	192.9	217.0	241.1

\* Note: When rounding off, always round up.

Formulas:

$$\text{Pipe Volume, gal/ft}^3 = (.758) (D)^2 (L) (7.48)$$

$$\text{Feed rate, Ounces} = [ (\text{desired dosage, mg/L}) (\text{pipe volume, gal.} / 1,000,000) (8.34) ] \times 16$$

(% chemical purity, expressed as decimal)

#### 4.04 Testing of Valves

Upon completion of project, the Contractor shall operate all buried valves in accordance with manufacturers recommendations in the presence of a Hendersonville Utility District Representative to verify proper operation.

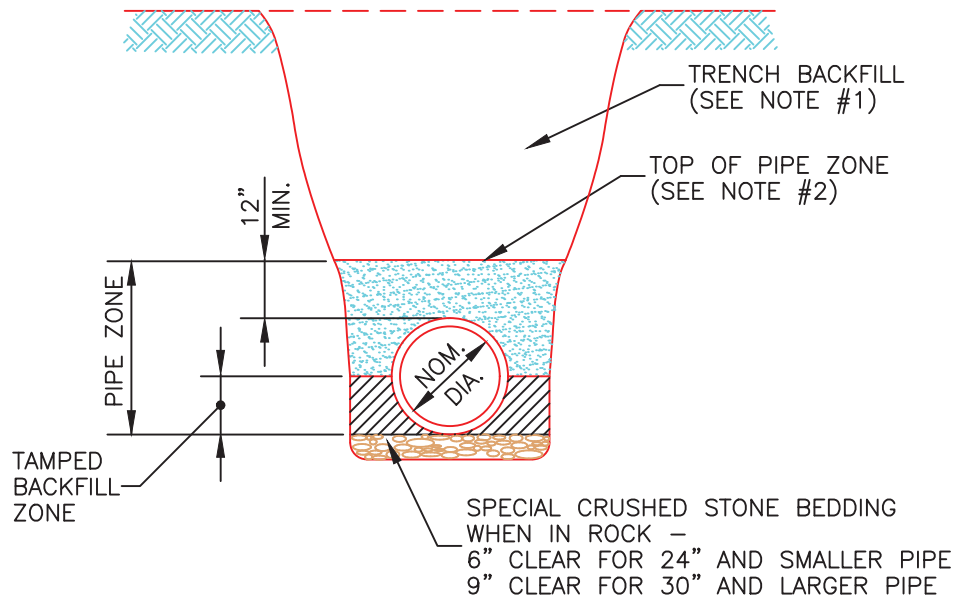
\* \* \*



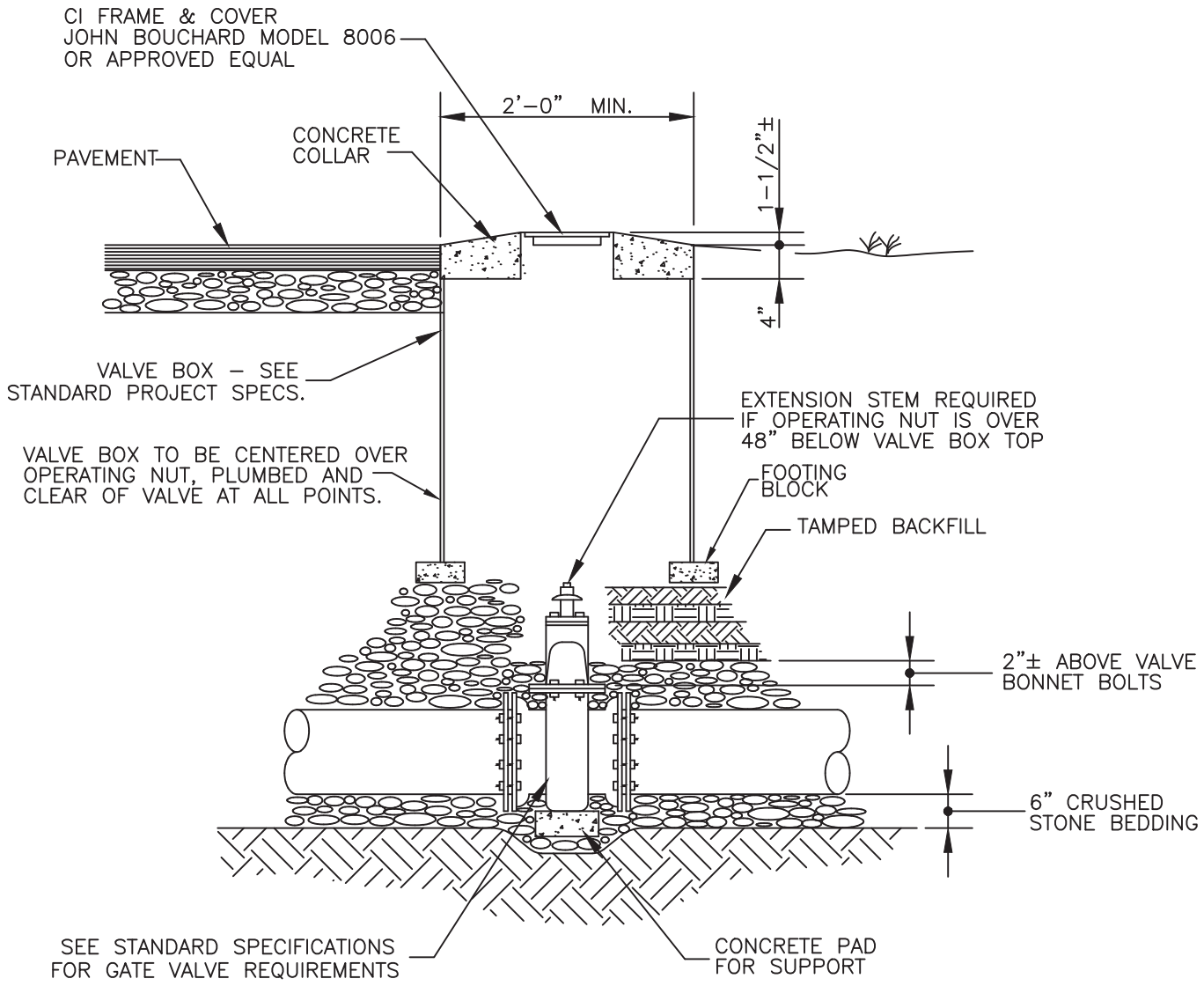
STANDARD WATER DETAILS

NOTES:

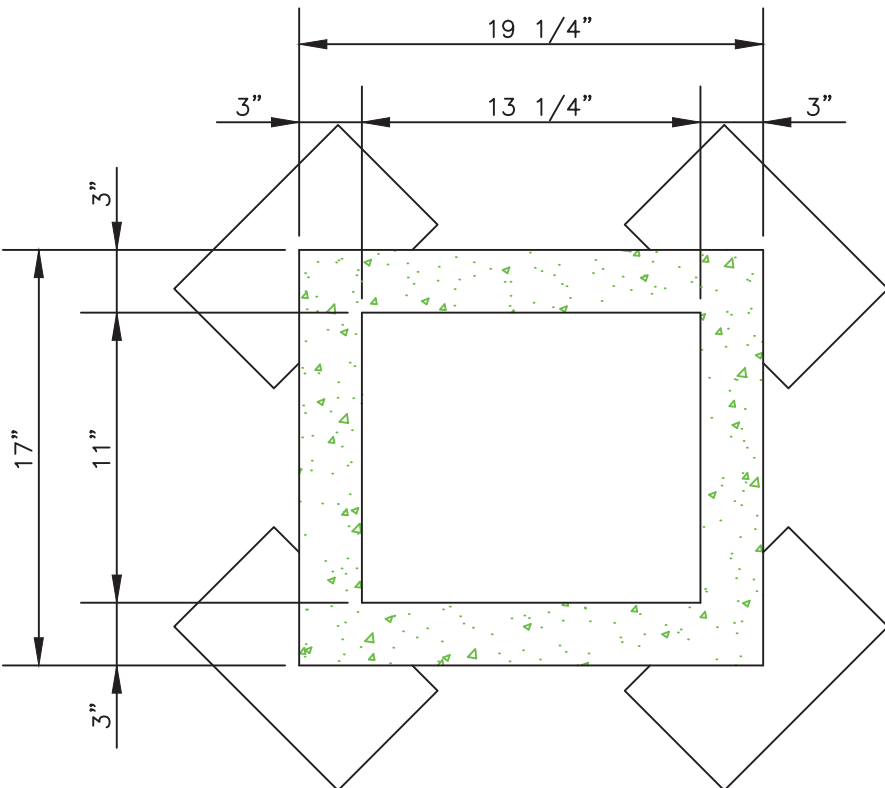
1. SEE PROJECT SPECIFICATIONS FOR BACKFILL REQUIREMENTS.
2. "PIPE ZONE" EXTENDS TO 12" ABOVE TOP OF PIPE AND IS AREA IN WHICH SPECIAL CARE IS TO BE GIVEN TO PLACEMENT AND COMPACTION TO PROJECT PIPE DURING AND AFTER LAYING.
3. LIMIT TRENCH WIDTH AT TOP OF PIPE TO NOMINAL PIPE DIAMETER PLUS 16", UNLESS PERMITTED OTHERWISE BY ENGINEER.
4. TRENCH SHALL BE DUG TO GIVE PIPE FULL AND CONTINUOUS SUPPORT. ALL ROCK TO BE REMOVED TO WITHIN 6" OF PIPE – BED TO PIPE GRADE WITH CRUSHED STONE BEDDING. BEDDING FROM PIPE GRADE TO 1/2 PIPE DIAMETER TO BE TAMPED EARTH, CRUSHED STONE OR OTHER MATERIAL (APPROVED).
5. PIPE TO BE CONTINUOUSLY SUPPORTED ALONG LENGTH OF PIPE BARREL EXCEPT AT BELLS. BELL HOLES ARE REQUIRED SUCH THAT NO BEARING LOAD IS TAKEN BY THE BELL.



WATER LINE INSTALLATION  
FLAT BOTTOM TRENCH – TAMPED BACKFILL



GATE VALVE

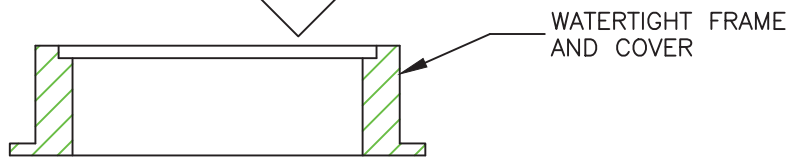


WEIGHTS

2"	G.R.	-	32#
4"	G.R.	-	63#
6"	G.R.	-	95#
12"	BOX	-	189#
18"	BOX	-	283#

NOTES:

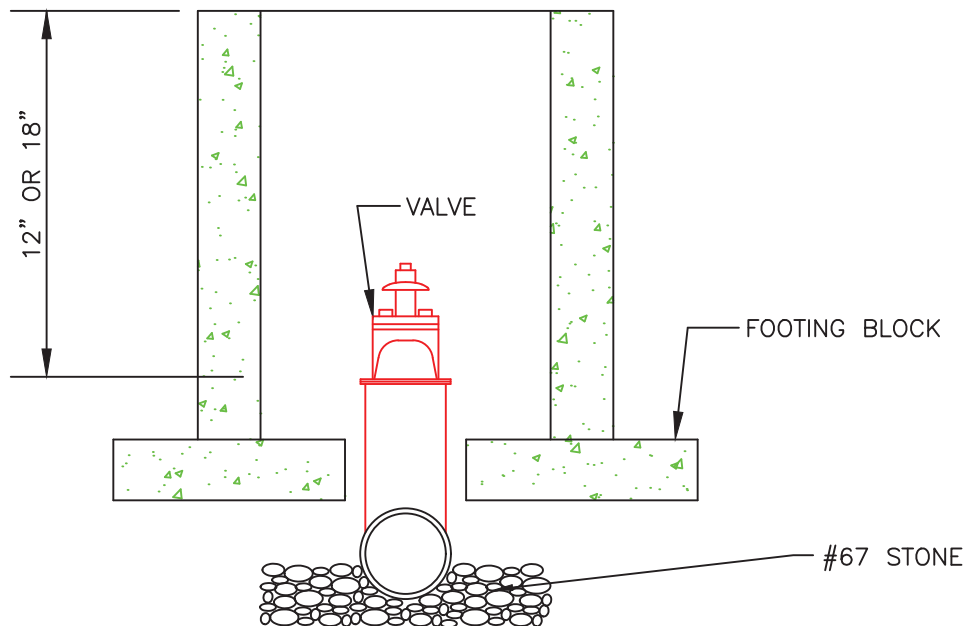
1. CONCRETE: 4500 PSI @ 28 DAYS
2. BOX DIMENSIONS FOR VALVE
3. SQUARE BOX FOR F.H.
4. FOOTING BLOCKS (1'-0") WIDE EACH CORNER



WATERTIGHT FRAME AND COVER



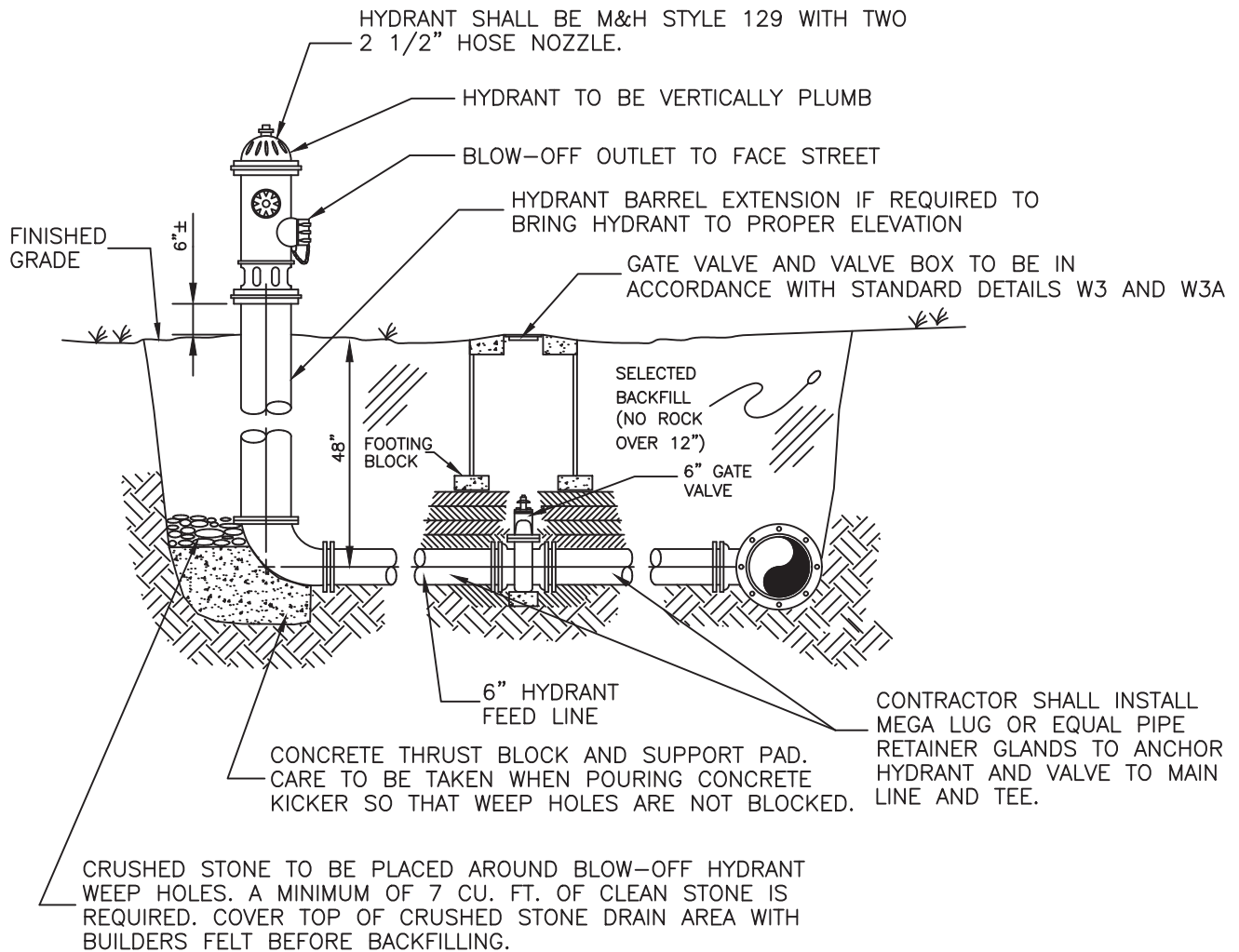
2", 4" OR 6" GRADE RINGS



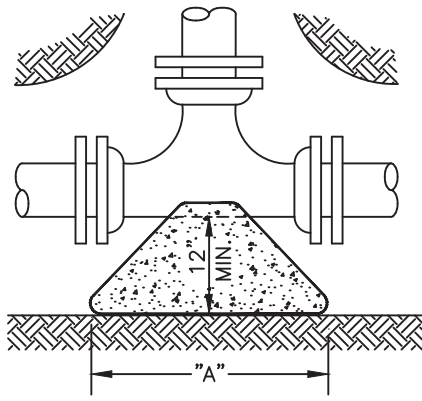
**VALVE BOX**  
NOT TO SCALE

**NOTE:**

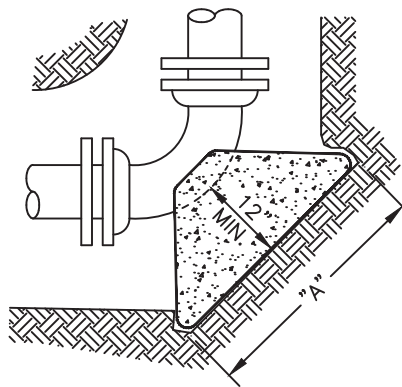
ALL FIRE HYDRANTS, VALVES AND FITTINGS ARE TO BE RESTRAINED TO THE DUCTILE IRON PIPE BY THE USE OF PIPE RETAINER GLANDS SIMILAR TO MEGALUG SERIES 1100 BY EBAA IRON OR UNI-FLANGE SERIES 1400 BY FORD METER BOX COMPANY. ALL HYDRANTS SHALL BE YELLOW IN COLOR FROM FACTORY.



**TYPICAL FIRE HYDRANT INSTALLATION**



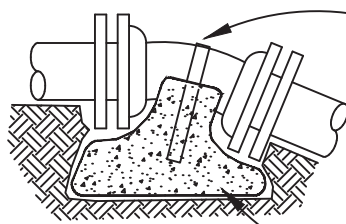
PLAN: TEE



PLAN: 90° BEND

**NOTES:**

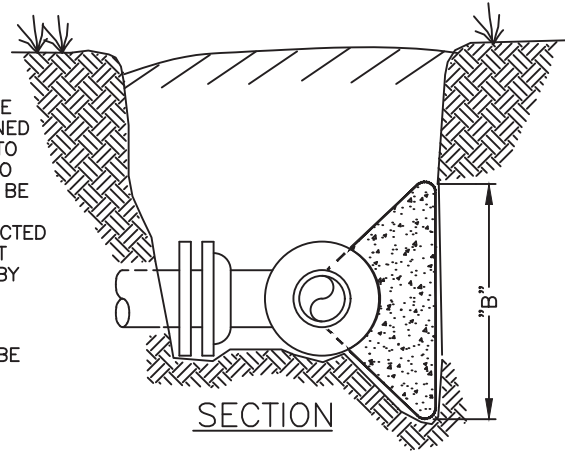
1. CONCRETE TO BE CLASS "B" (2000 P.S.I.) OR STRONGER.
2. DIMENSIONS AS SHOWN ARE APPROXIMATE - SUBJECT TO CHANGE AT DIRECTION OF OR APPROVAL OF ENGINEER.
3. KEEP CONCRETE CLEAR OF ANY PIPE JOINT, GLAND BOLTS, ECT.
4. CONCRETE TO BEAR AGAINST UNDISTURBED EARTH WITH BEARING AREA EQUIVALENT TO AT LEAST AxB.



GRAVITY-TYPE THRUST BLOCK

FOR UPPER THRUST BLOCK ON A VERTICAL BEND, CONCRETE VOLUME SHALL BE AS DETERMINED BY ENGINEER. LOWER BLOCK TO HAVE DIMENSIONS ACCORDING TO SCHEDULE BELOW. FITTING TO BE FIXED TO UPPER BLOCK USING 1/4" x 2" STEEL STRAP PROTECTED WITH 2 COATS BITUMASTIC PAINT (OR AS OTHERWISE APPROVED BY ENGINEER).

WEIGHT IS CRITICAL - MUST BE DETERMINED OR APPROVED BY ENGINEER.



SECTION

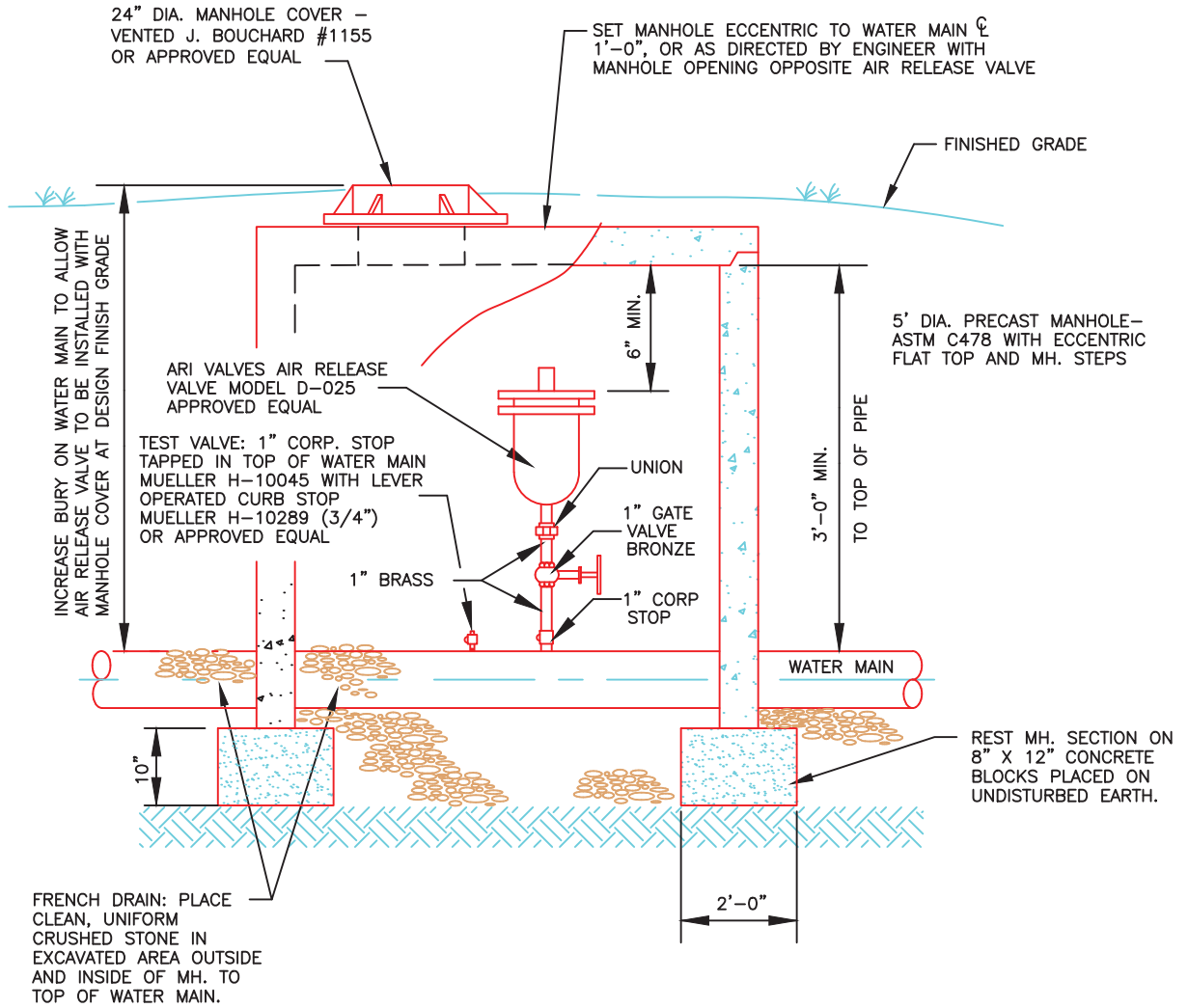
SCHEDULE OF MINIMUM BEARING AREA REQUIRED					
BASED ON 200 PSI INTERNAL PRESSURE AND 4000 PSF SOIL BEARING CAPACITY*					
PIPE SIZE	TEE OR DEAD END	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND
4"	1.0	1.5	1.0	1.0	1.0
6"	2.5	3.0	2.0	1.0	1.0
8"	4.0	5.5	3.0	1.5	1.0
10"	6.0	8.5	4.5	2.5	1.5
12"	8.5	12.0	6.5	3.0	2.0
16"	15.0	21.5	11.5	6.0	3.0
VALUES ARE TABULATED IN SQUARE FEET					

\*Engineer to confirm actual required dimensions before construction of the Thrust Block. Bearing Area (square feet) = A(feet) x B(feet)

# CONCRETE THRUST BLOCK

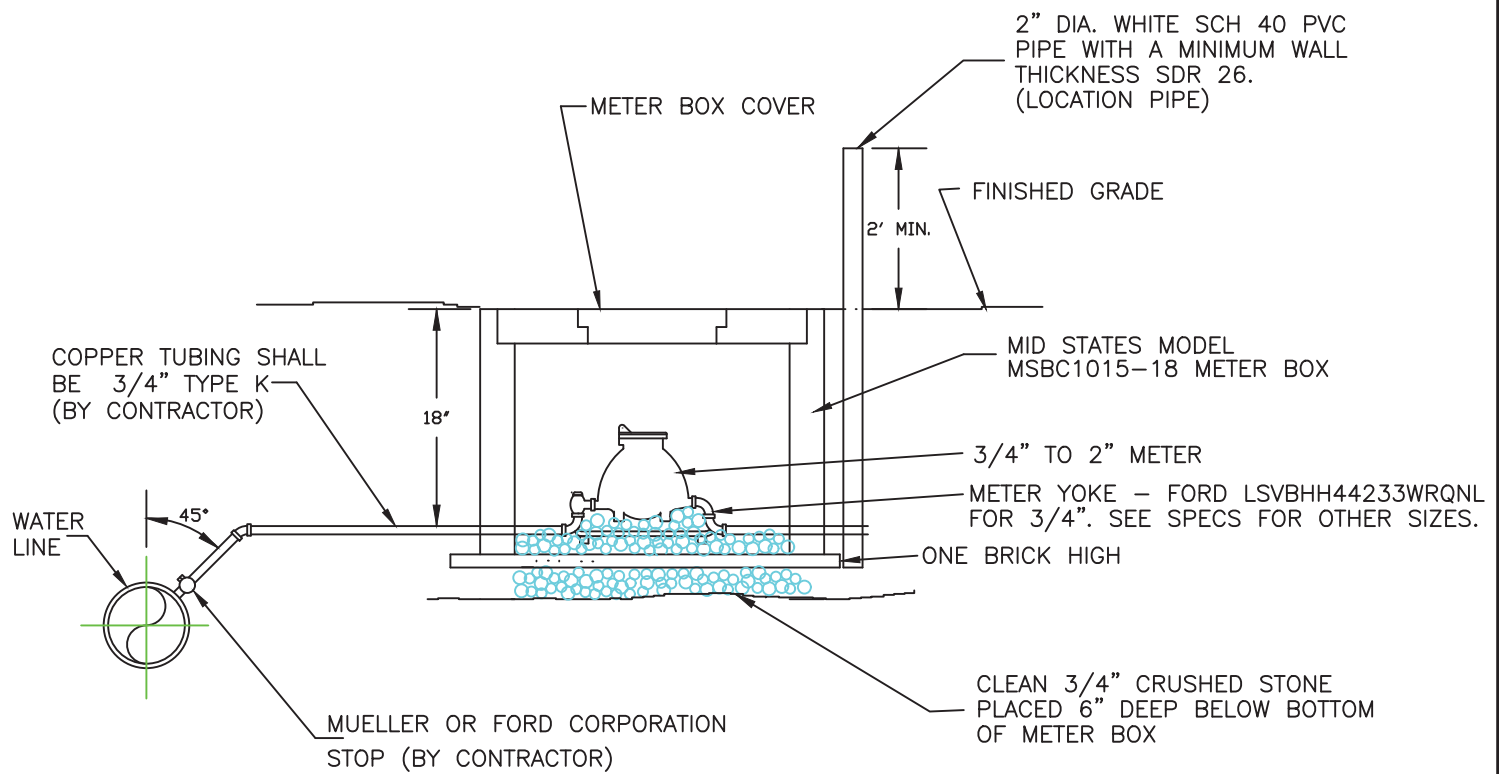
**NOTE:**

IF AIR RELEASE MANHOLE IS TO BE LOCATED IN ROADWAY, HENDERSONVILLE UTILITY DISTRICT IS TO BE CONSULTED ON INSTALLATION PROCEDURES AND LOCATION.



**AIR RELEASE MANHOLE**

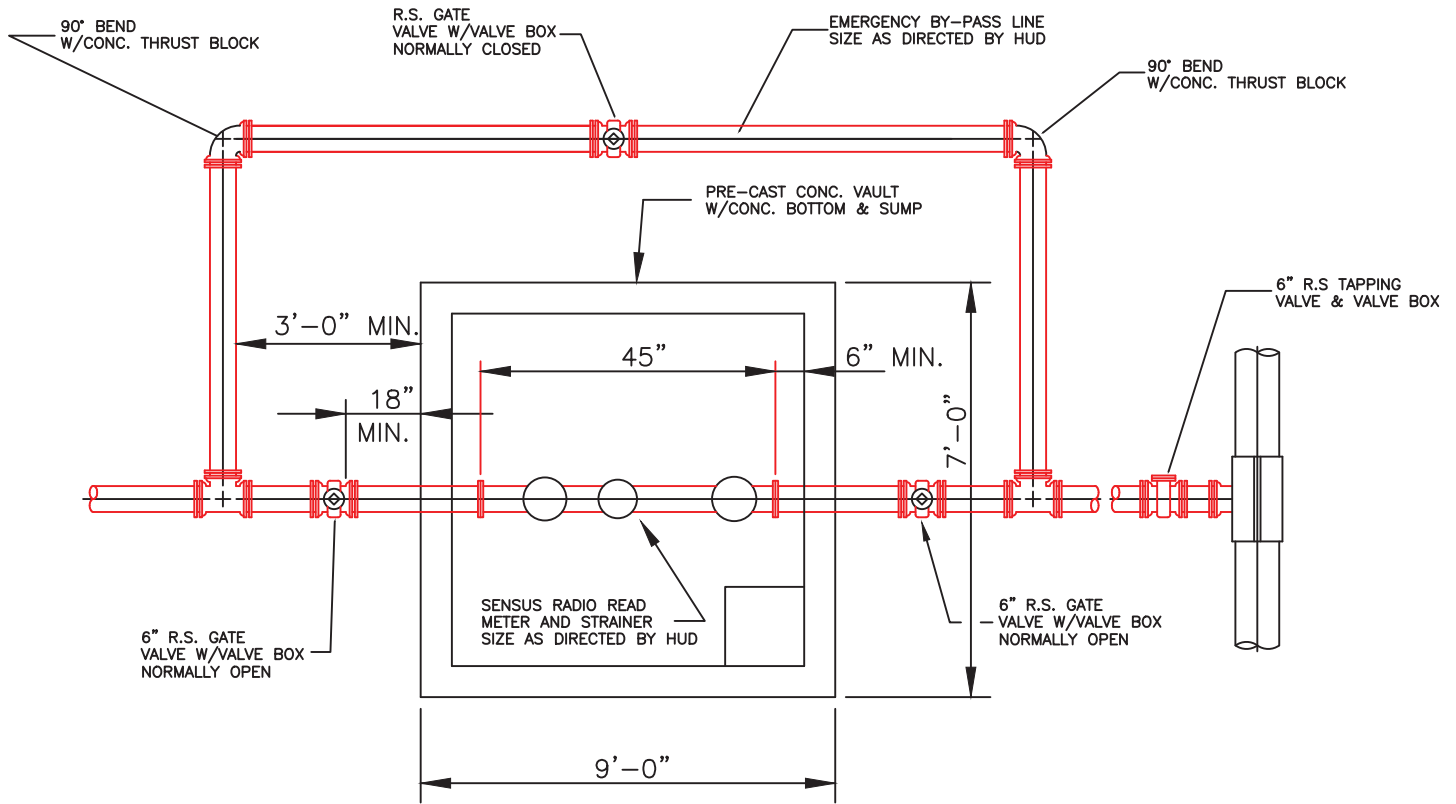
NOT TO SCALE



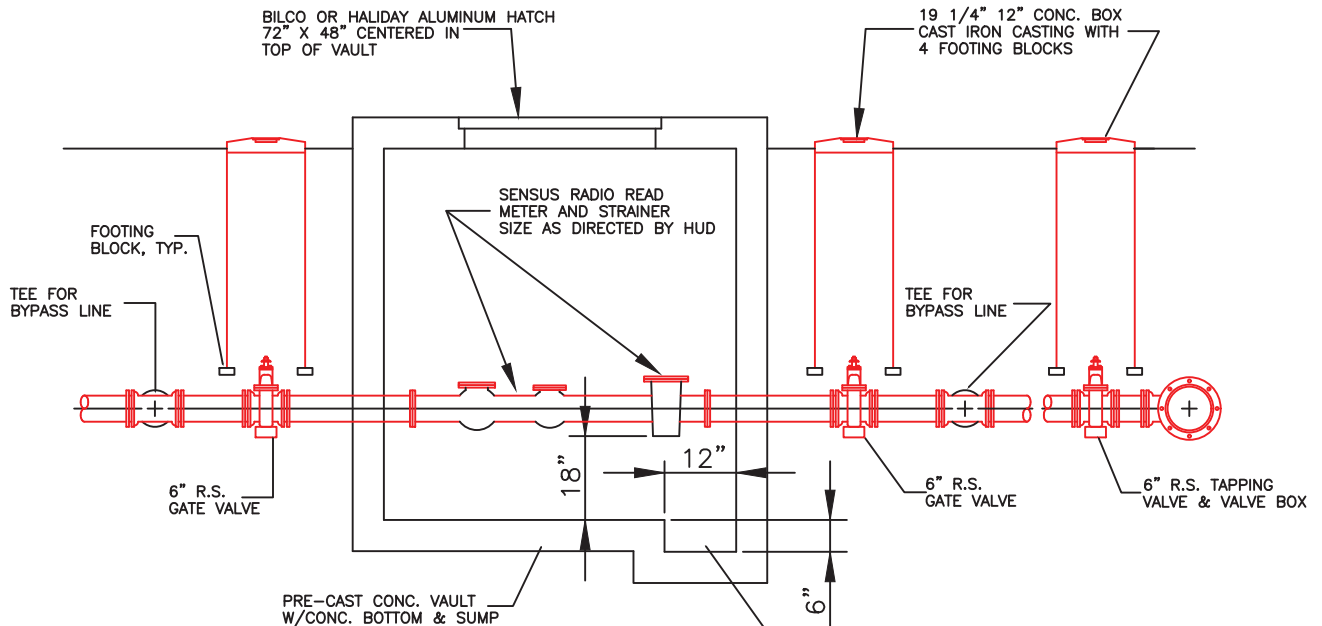
## TYPICAL SERVICE ASSEMBLY

NO SCALE





**PLAN**



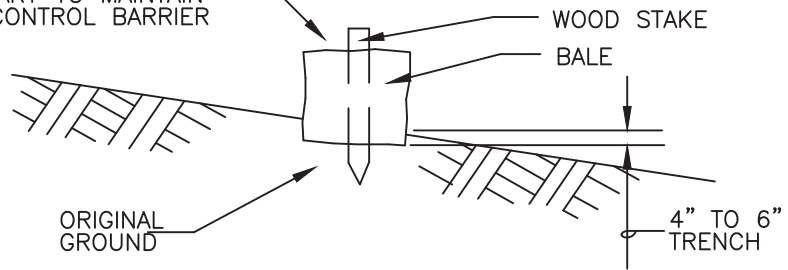
**ELEVATION**

VAULT SHALL BE 108"L X 84"W X 72"D  
OUTSIDE DIMENSIONS FOR 4", 6", AND 8"  
METERS.

CONTRACTOR SHALL INSTALL SUMP PUMP AND  
ELECTRICAL WIRING FOR PUMP OPERATION AS PART OF  
VAULT.

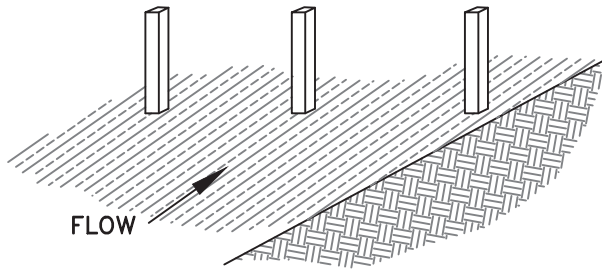
**PRE-CAST CONCRETE METER VAULT FOR 4" AND LARGER METERS**

PLACE AND MAINTAIN CONTINUOUSLY  
AS NECESSARY TO MAINTAIN  
SEDIMENT CONTROL BARRIER

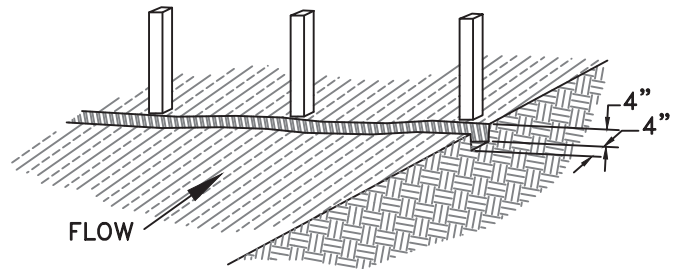


SEDIMENT CONTROL BARRIER  
STRAWBALE STAKING DETAIL

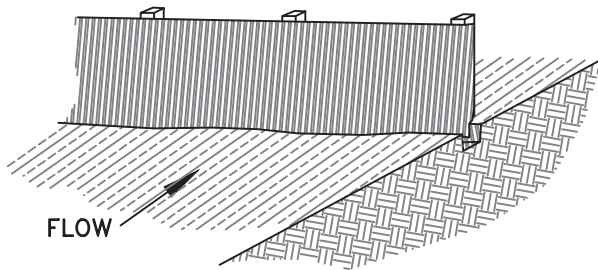
1. SET THE STAKES.



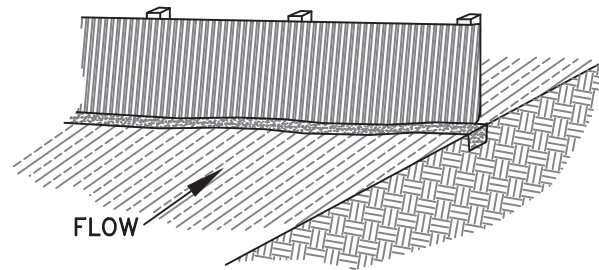
2. EXCAVATE A 4"x4" TRENCH UPSLOPE ALONG THE LINE OF STAKES.



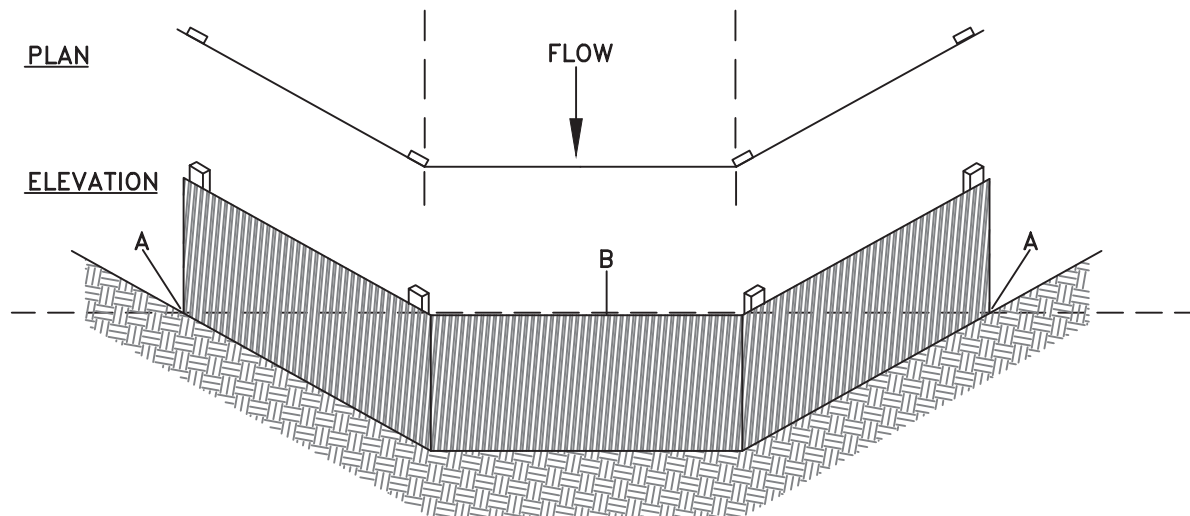
3. STAPLE FILTER MATERIAL TO STAKES AND EXTEND IT INTO THE TRENCH.



4. BACKFILL AND COMPACT THE EXCAVATED SOIL.



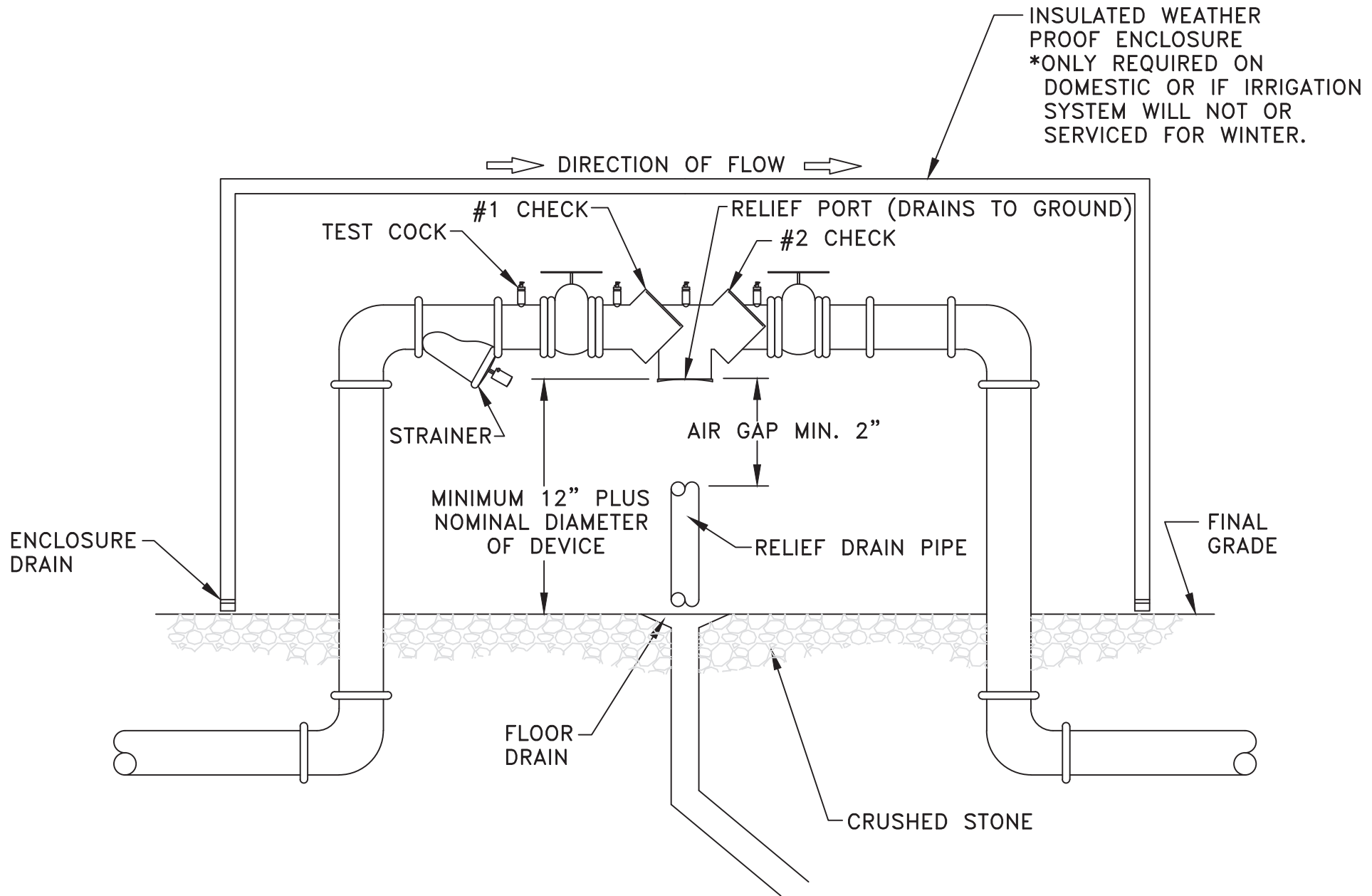
CONSTRUCTION OF A FILTER BARRIER



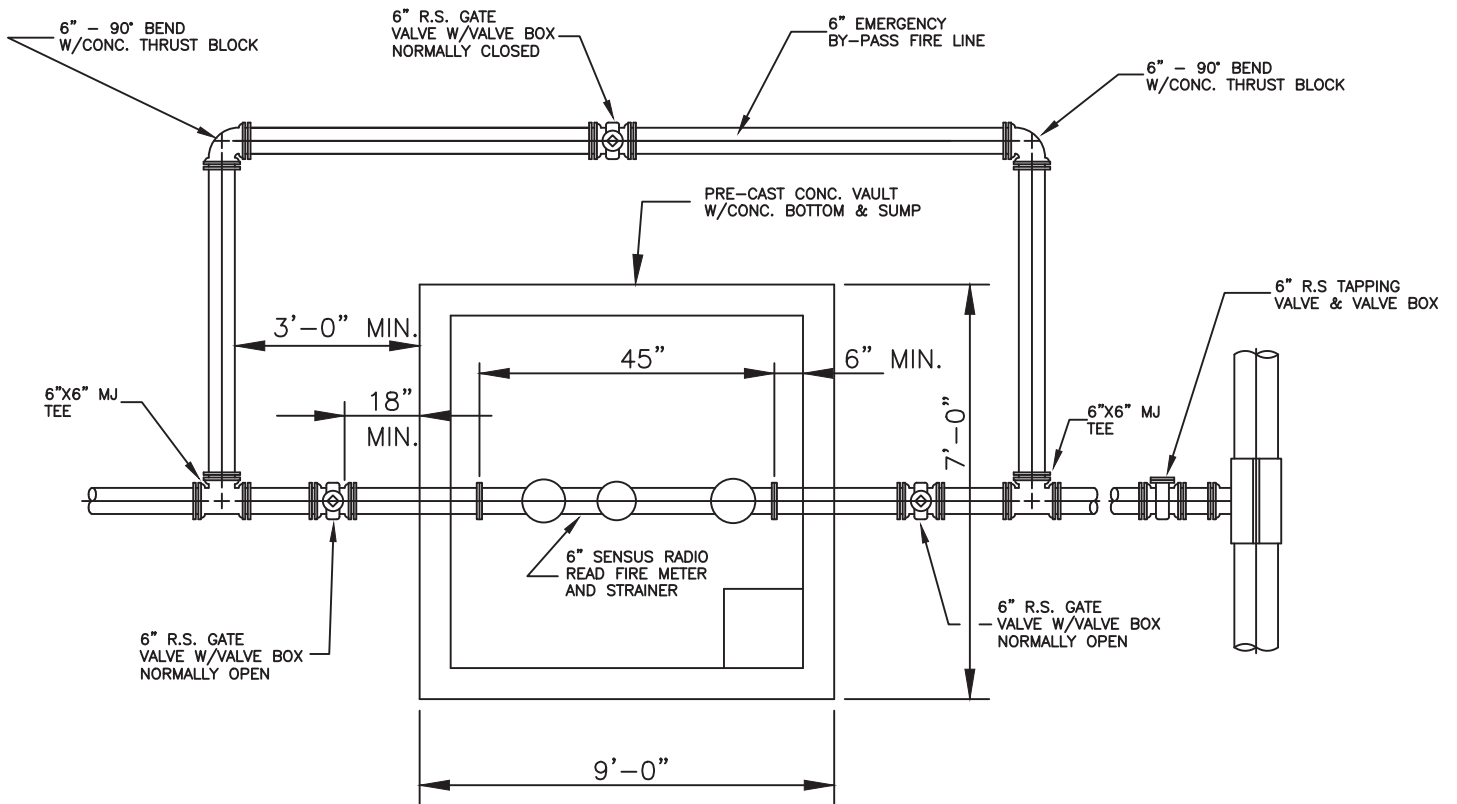
POINTS "A" SHOULD BE HIGHER THAN POINT "B".

PROPER PLACEMENT OF A FILTER BARRIER IN A DRAINAGE WAY

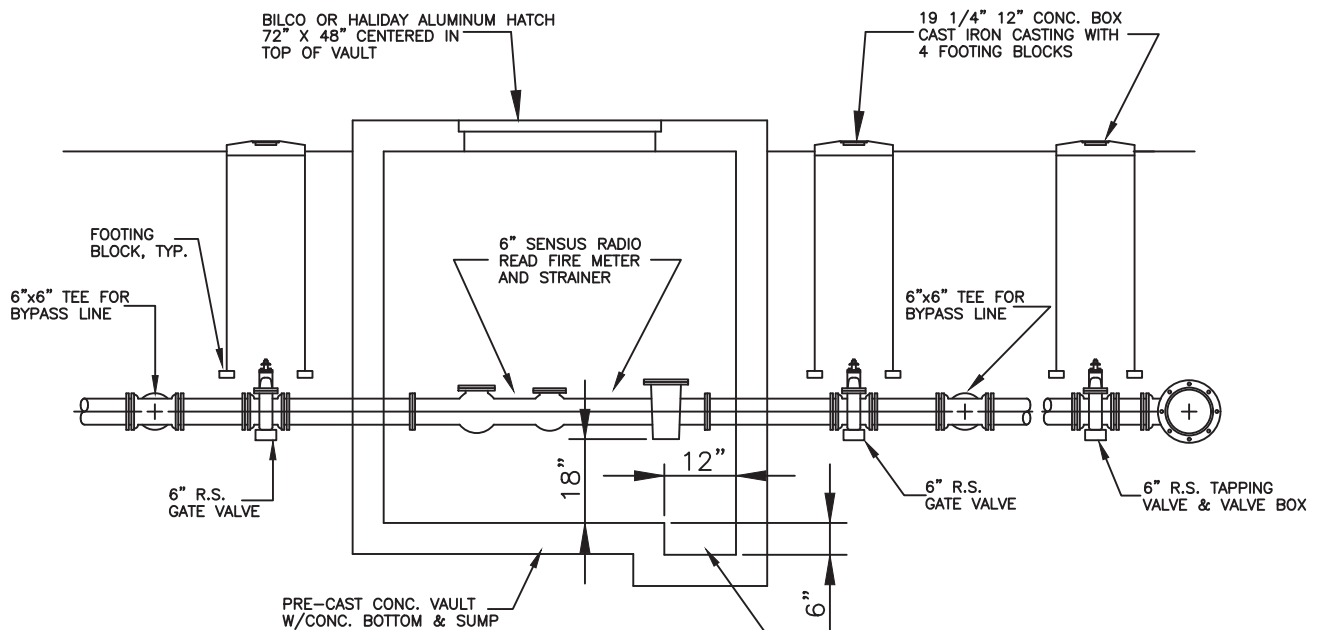
SILTATION FENCE



REDUCED PRESSURE BACKFLOW PREVENTION DEVICE-OUTDOOR INSTALLATION  
NOT TO SCALE



**PLAN**



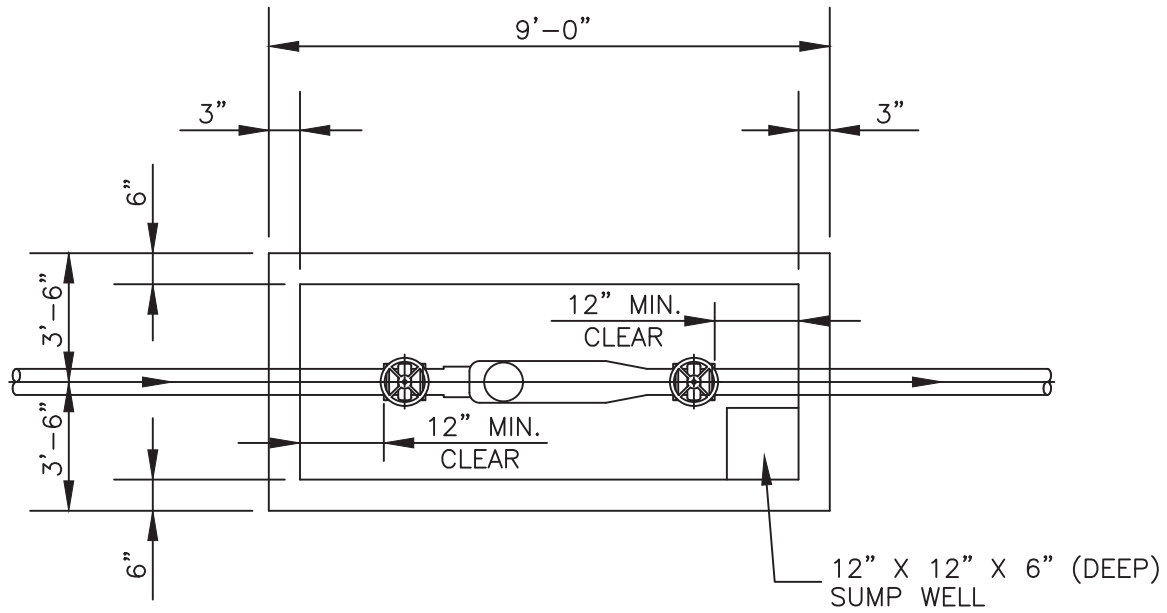
**ELEVATION**

VAULT SHALL BE 108"L X 84"W X 72"D  
OUTSIDE DIMENSIONS FOR 4", 6", AND 8"  
METERS.

CONTRACTOR SHALL INSTALL SUMP PUMP AND  
ELECTRICAL WIRING FOR PUMP OPERATION AS PART OF  
VAULT.

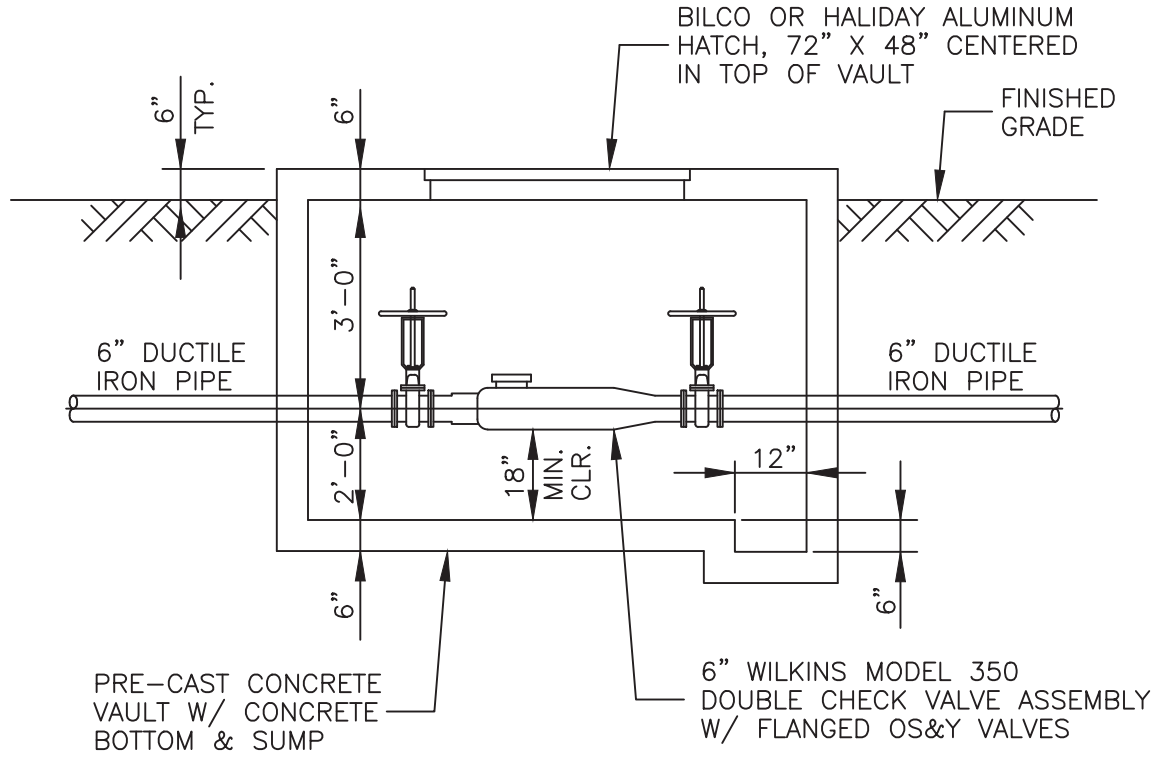
**FIRE METER & BYPASS DETAIL**

NOT TO SCALE



PLAN

VAULT SHALL BE 108"L X 84"W X 72"D  
 OUTSIDE DIMENSION FOR 4", 6" AND 8"  
 DOUBLE CHECKS.



ELEVATION

DOUBLE CHECK VALVE ASSEMBLY VAULT DETAIL  
 NOT TO SCALE