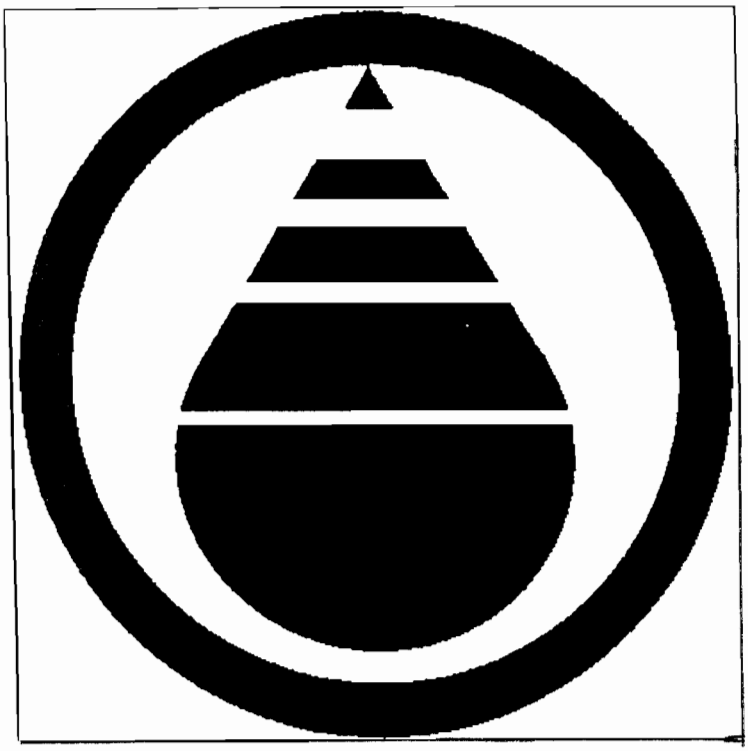
Standard Specifications



VIRGINIA DEPARTMENT OF HEALTH
OFFICE OF DRINKING WATER

APPROVED BY: _____
ENGINEERING FIELD DIRECTOR

DATE: 1/27/04

Henry County Public Service Authority

January 6, 2004

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD SPECIFICATIONS

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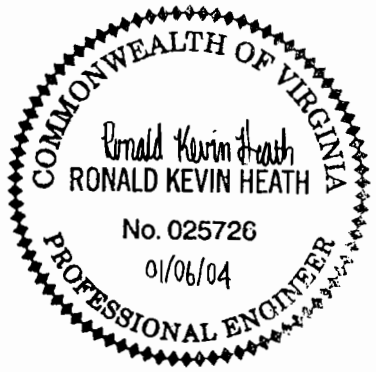


HENRY COUNTY PUBLIC SERVICE AUTHORITY
STANDARD SPECIFICATIONS

GENERAL REQUIREMENT-WATER FACILITIES

SECTION 3

3-01. GENERAL STATEMENT. Standard construction details, specifications, and materials standards approved by the Authority shall be followed unless specific deviation therefrom is authorized in writing by the Authority.

3-02. MINIMUM SIZES. Water lines shall be of sufficient size to convey peak design flows while maintaining a 20 psi minimum pressure at all points in the distribution system.

A. The minimum size pipe for water distribution systems shall be four inches in diameter. Pipe of lesser diameter may be used in the following instance:

1. When the run is less than 300 feet, two-inch used.

B. The minimum size pipe where fire protection is to be provided or required shall be six inches in diameter.

3-03. WATER LINE MATERIALS. Water lines 6-inch and larger shall be ductile iron as specified herein unless specific deviation therefrom is authorized in writing by the Authority. Other approved pipe materials may be used to repair existing pipelines of that material.

3-04. FIRE HYDRANTS. Fire hydrants shall be located only on those systems capable of supplying fire flows, and on lines at least 6-inch nominal size. In general, fire hydrants shall be located at street intersections and at the ends of streets. The maximum distance between fire hydrants shall be 800 feet as measured along the street centerline. Water distribution systems shall be designed to supply the magnitude of fire flows that are commensurate with fire hazards of the surrounding area. In residential areas fire flow shall be considered to be no less than 250 gallons per minute at any single fire hydrant while maintaining a minimum residual pressure of 20 psi at all points in the distribution system, including during peak domestic demand.

3-05. DEAD-ENDS. Dead-ends within a distribution system shall be minimized by looping of water mains. Where dead-ends do occur, a blowoff assembly or fire hydrant shall be installed at the end of said system.

3-06. VALVES. Valves within the distribution system shall be located as required by the Authority. At tees at least 2 valves shall be provided; at crosses at least 3 valves shall be provided; but in no case shall the distance between valves exceed 1,000 feet as measured along the pipeline.

Valves shall be AWWA C509 resilient seat gate valves and valves. All valves shall open left.

3-07. MINIMUM COVER. All pipe shall be installed with at least 36 inches minimum cover as measured from finished grade to the top of the pipe.

3-08. SEPARATION OF WATER LINES AND SANITARY SEWERS.

There shall be no physical connection between any part of the public or private potable water supply system to any sanitary or storm sewer facility. No portion of any water supply facility shall pass through or be in contact with any sewer manhole. The minimum horizontal distance between any water supply line and a septic tank shall be 10 feet, and 30 feet between any septic tank tile lines.

(A) Parallel Installation. Whenever possible, water lines shall be laid at least 10 feet horizontally, measured edge to edge, from any sewer or sewer manhole. When unusual local conditions prevent a horizontal separation of 10 feet, the water line may be laid closer provided that:

1. The bottom of the water line shall be at least 18 inches above the top of the sewer line.

2. Where 18 inches of vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe, pressure tested in place without leakage prior to backfilling.

3. The sewer manhole shall be of water-tight construction and tested in place.

(B) Crossings. Water lines crossing sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible. When unusual local conditions prevent a minimum vertical separation of 18 inches the following construction shall be used:

1. The sewer shall be constructed of AWWA approved water pipe, pressure tested in place without leakage prior to backfill.

2. Water lines passing under sewer lines shall, in addition, be protected by providing:

   (a) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line.

   (b) Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line.

   (c) That the length of the water line be centered at the crossing so that joint shall be equidistant and as far as possible from the sewer.

(C) Extenuating Circumstances Where extenuating circumstances will not allow application of the options stated above, the Contractor, Authority, Virginia Department of Health, Office of Water Programs, and any other appropriate agency will address these situations on a case by case basis. An agreement between all parties shall be made in writing prior to installation of said water or sewer line.

3-09. WATER SUPPLY INTERCONNECTIONS. All physical connections between any Henry County Public Service Authority water system and any private water supply system shall be reviewed and approved by the Virginia Department of Health prior to connection.

3-10. CROSS-CONNECTION AND BACKFLOW PREVENTION CONTROL DEVICES. Any cross-connection or backflow prevention control devices that are installed on or on lines connected to the distribution system shall be in accordance with the Authority's Cross-Connection and Backflow Prevention Control program.

3-11. SEPARATION OF WATER LINES AND GAS LINES. Water lines, fittings and appurtenances shall be laid no closer than 2 feet from any gas pipeline or appurtenances thereto. Any disturbance of the gas line facilities including scratching, marring, or damage of any kind of extent shall be reported to the Authority and the gas company prior to backfilling.

3-12. SURFACE WATER CROSSINGS. Surface water crossings, both over and under water, present special problems and should be discussed with the Virginia Department of Health, Office of Water Programs before final plans are prepared.

(A) Aerial crossings shall conform to Section 5.12 of these Standard Specifications.

(B) Water lines crossing underwater shall have easily accessible valves and permanent sample taps on each end of the crossing, as shown in the standard details. The valves and sample taps shall not be subject to flooding. Pipe for underwater crossing shall have flexible joints with intransigent joint restraint. See Standard Detail W-14.

3-13. STEEL CASING PIPE FOR RAILROAD, HIGHWAY, AND AERIAL CROSSINGS. Casing pipe shall be spiral welded steel pipe manufactured in accordance with ASTM Designation A-252, Grade 2. The minimum yield strength shall be 35,000 psi and the minimum tensile strength shall be 60,000 psi. Minimum wall thickness shall be 1/4 inch. With the exception being at railroad crossings the pipe shall be in accordance with ASTM Designation A-139, with a minimum wall thickness of 3/8 inch.

3-14. BLASTING The Contractor shall be responsible for obtaining any and all permits as required by all local, state, and federal agencies. All work shall be preformed in compliance with current requirements of all local, state, and federal agencies, particularly with regard to FIRE PREVENTION CODE OF HENRY COUNTY, Article I. Fire Code, Sections 9-100 through 9-112, and STATEWIDE FIRE PREVENTION CODE/1997, Chapter 30 of the SFPC, Sections F-3001.0 through F-3009.3, and any revisions or addendums thereto.

The Contractor shall be responsible for supplying a copy of the blasting records to the Authority. The records will contain, at a minimum, all the same information required by Chapter 30 of the SFPC, Section F-3009.12, and any revisions of addendums thereto.

SECTION 4

WATER MAIN PIPE, FITTINGS, AND ACCESSORIES

4-01. GENERAL REQUIREMENTS. Unless otherwise approved in writing by the Authority, or as specifically indicated on plans approved by the Authority, all pipe, fittings, and accessories used within water transmission and distribution systems shall be as defined in this section.

4-02. WATER MAIN PIPE MATERIALS.

(A) Ductile Iron Pipe. Ductile iron pipe shall be centrifugally cast and manufactured in accordance with ANSI/AWWA C151/A21.51. Ductile iron pipe and fittings shall be cement-mortar lined in accordance with ANSI/AWWA C104/A21.4. Both the interior and exterior of the pipe and fittings shall have a standard coating of bituminous material.

Joints for ductile iron pipe and fittings shall be one of the following:

1. Push-on Joints with Rubber Gaskets. Push-on joints and jointing materials shall comply with ANSI/AWWA C111/A21.11.

2. Mechanical Joints. Mechanical joints and jointing material shall comply with ANSI/AWWA C111/A21.11.

3. Locked Type Mechanical Joints. The locked type of mechanical joint shall only be used when integral joint restraint is required. No locking system involving set-screws or field welding shall be used when locked type of joint is the sole means of joint restraint.

4. Flanged Joints. Flanged joints shall be used in meter and valve vaults and where required by the Authority. Flanges and jointing materials shall comply with ANSI/AWWA C115/A21.15.

5. Gasket Lubricant. Gasket lubricant shall be a tasteless non-toxic, non bacterial supporting grease and meet NSF Standard 61 Certification. Gasket lubricant shall be supplied by the pipe manufacturer.

6. Gaskets. Gaskets shall be supplied by the pipe manufacturer. Transition gaskets shall be labeled with a "T" or the word, "Transition".

7. River Crossing Pipe. River crossing pipe shall be Griffin SNAP-LOK or equal, and manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51. Push-on joints for such pipe shall meet the requirements of ANSI/AWWA C111/A21.11, allow deflection of up to 15°, and shall have cement mortar lining and seal coating, where applicable, in accordance with ANSI/AWWA C104/A21.4

(B) Polyvinyl-Chloride Pipe. Polyvinyl-Chloride (PVC) pipe 12-inches in diameter and less and joint materials shall comply with AWWA C900. Polyvinyl-Chloride (PVC) pipe 14-inches in diameter through 36-inches in diameter and joint material shall comply with AWWA C905. PVC pipe shall have outside diameters equal to that of cast iron pipe. (C1) Class 100 pipe shall meet the requirements of DR25; Class 150 pipe shall meet the requirements of DR18; and Class 200 pipe shall meet the requirements of DR14.

PVC pipe shall have bell type joints. The bell shall consist of an integral wall section with a solid cross section elastomeric ring which meets the requirements of ASTM-D-1869 and F-477. PVC pipe shall be clearly marked with Class, Size, OD base, Manufacturer's name, and NSF-61. Jointing lubricant, shall be a tasteless, odorless, non-toxic, non-bacterial supporting lubricant and meet NSF Standard 61 Certification. Lubricants and gaskets shall be supplied by the pipe manufacturer. Solvent weld joints are prohibited.

(C) ASTM D2241 PVC Pipe. PVC pipe per ASTM D2241 shall be used only when approved by the Authority. When approved, the pipe shall conform to ASTM D2241 and D1784 and shall be Class 200 SDR 21 with integral bell joints. Pipe shall be clearly marked with Class, Size, Manufacturer's name, and NSF-61. Jointing lubricant shall be tasteless, odorless, non-toxic, and non-bacterial supporting and meet NSF Standard 61 Certification. Gaskets and lubricants shall be supplied by the pipe manufacturer. Solvent weld joints are prohibited.

NOTE: Items (B) and (C) above shall be bedded per the manufacturer's recommendations.

(D) Galvanized Steel Pipe. Galvanized steel pipe and fittings shall conform to ASTM A120, and the applicable section of AWWA C200, C206, C207, and C209.

(E) Brass Pipe. Brass pipe and fittings to be Red Brass Alloy, Type CDA 230, and shall conform to ASTM Specifications B43-91, B687-88, and MS51846. Threads to conform to NPT Screw Thread Standards for Federal Services Handbook H-28.

4-03. MAIN LINE FITTINGS. Tees, crosses, bends, reducers, sleeves, plugs, and caps shall have ANSI/AWWA C111/A21.11 mechanical ends. Fittings shall be manufactured of cast or ductile iron and shall comply with ANSI/AWWA C110/A21.10. Compact or short-body ductile iron fittings shall comply with ANSI/AWWA C153/A21.53. Fittings shall have the same interior and exterior coatings as ductile iron pipe.

4-04. SERVICE CONNECTION PIPING. In addition to water main pipe materials, the following shall be used.

(A) Copper Pipe. Copper pipe for service connections shall be at least Type K in accordance with ASTM B88 and shall be used with standard waterworks fittings.

(B) Polyethylene Tubing. Polyethylene tubing shall conform to AWWA C901 and ASTM D2737. Tubing shall have a uniform wall thickness and shall have outside diameters equal to that of copper tubing of equal nominal size. PE tubing shall be Class 200, PE2306, or PE3306, or PE3406. The tubing shall be clearly marked as to Class, Material, Size, Manufacturer's name and NSF-PW.

4-05. Valves.

(A) Two- Inch Gate Valves.

1. For non-buried installations, the gate valves shall be solid bronze, traveling stem, screwed ends (FIPT or MIPT), and shall be rated at minimum 250 psi working pressure. Valves shall open left.

2. For buried installation, gate valves smaller than two-inch shall not be used.

3. For buried installations two-inch gate valves shall be AWWA approved and shall be iron bodied, bronze mounted double disc, non-rising stem with dual O-ring seals. Valves shall open left and shall have a TEE-HEAD operating nut. Valves shall be rated at minimum 200 psi working pressure and shall have mechanical joint or threaded ends.

4. For buried installations bronze bodied gate valves with hand wheels or operating levers are prohibited.

(B) Gate Valves Four-Inch and Larger.

1. Buried gate valves three-inch and larger shall conform to AWWA C500 and shall be iron bodied, bronze mounted double disc, non-rising stem with dual O-ring seals. Valves shall open left and shall have a 2-inch square operating nut. Valves shall be rated at minimum 200 psi working pressure and shall have mechanical joint ends.

2. Non-buried gate valves three-inch and larger shall conform to AWWA C500 and shall be rated at minimum 200 psi working pressure. Valves shall be iron bodied, bronze mounted, outside screw and yoke with double disc and bronze stem. Valves shall open left.

(C) Resilient Seat Gate Valves. Resilient seat gate valves shall conform to AWWA C509 and shall be designed for bubble-tight closure (no-leakage) at minimum 200 psi working pressure. Buried valves shall have non-rising stems with 2-inch square operating nuts and mechanical joint ends. Non-buried valves shall have outside screw and yoke and flanged ends. Valves shall open left.

(D) Butterfly Valves. Butterfly valves shall be cast or ductile bodies with mechanical joint ends if in buried installations and flanged ends if non-buried. Butterfly valves shall be

rubber seated, bubble-tight closure Class 150B conforming to AWWA/ANSI C504. Valves shall be suitable for buried service and buried valves shall include traveling nut or worm gear operator shall be sealed, gasketed, and lubricated for underground service operator torque rating throughout entire travel.

(E) Ball Valves. All buried valves two-inch and smaller shall be bronze ball curb stops. The bronze shall conform to AWWA standards, have dual rubber 0-rings, and shall be keyed into the ball. The valves shall have tee-head operating nuts and female IPS threaded ends.

(F) Miscellaneous Valves. Miscellaneous valves such as air release valves, vacuum valves, combination air/vacuum valves, globe valves, check valves, automatic control valves, pressure relief valves, etc. shall be approved by the Authority.

(G) Valve Boxes. All buried valves shall be provided with an adjustable cast iron valve box with a flared base section of a size suitable for the valve on which it is to be used. The shaft of the box shall have a minimum diameter of 5.25 inches. The covers shall be round and have the word "WATER" cast upon it. Boxes shall be given a heavy bituminous coating.

4-06. FIRE HYDRANTS. Fire hydrants installed within the distribution system shall conform to AWWA C502 in every respect and shall be approved by the Virginia State Inspection Bureau and the National Board of Fire Underwriters. Hydrants shall be designed for 150 psi working pressure and 300 psi test pressure.

The hydrant main valves shall be removable from above ground. The hydrants shall be dry barrel, non-flooding, frost proof, and AWWA compression type with waste orifices for draining the barrel of water when the main valve is closed.

Hydrants shall be traffic models in which the barrels are equipped with a safety or breakaway flange and in which the stems are equipped with breakable stem couplings so that neither the shoe, stem, nor the barrel will break if struck by a vehicle. The safety flange and stem couplings shall be repairable and replaceable without having to unearth the hydrant.

Hydrants shall have 6-inch mechanical joint inlet shoes. Hydrants shall have two 2.5-inch hose nozzles and a 4.5-inch pumper nozzle. Nozzles shall have National Standard Hose Threads. Nozzle caps and hydrant operating nuts shall be standard 1.5-inch pentagons.

Hydrants shall open left and the direction of opening shall be cast on the hydrant. Hydrants shall have 5.25-inch main valve openings or able to meet the AWWA flow and pressure drop requirements for 5.25-inch valve openings. Hydrant valves shall be left in the open position upon completion of the project.

Hydrants exteriors shall be painted with one coat of zinc chromate primer and with two finishing coats of Yellow OSHA (Sherwin-Williams or Equal) Industrial Enamel. Hydrant caps to be color-coded per flow capacity. **Note: See Drawing W-3 for color code**. Neither the primer nor the paint shall foul nozzle threads, nozzle cap chains, or any lubrication fittings.

4-07. SERVICE CONNECTION MATERIALS. Service connection materials shall comply with the Uniform Statewide Building Code and with the following:

(A) Corporation Stops. Corporation stops shall be used at each service connection for sizes up to 2-inch. Corporation stops shall be made of either ground key or ball type valves. Inlet threads shall be CC (AWWA) threads. Corporation stops shall have straight couplings with MIPT or FIPT outlet threads for 2-inch stops and pack joints for stops less than 2-inch.

(B) Service Saddles. Service saddles for Ductile Iron pipe and 2-inch Taps shall be iron bodied saddle with double straps. Service saddles for PVC shall be bronze with single bronze strap. Service saddles shall have cemented in place neoprene gaskets and CC or IPT inlet threads. Saddles shall be used on all taps to PVC mains and for all 2-inch taps.

(C) Service Connection Piping. Service connection piping shall be as specified in Section 4-04 above.

(D) Copper Setters. Copper setters shall be as shown on the standard details.

1. For meters up to and including 1-inch nominal size, copper setters shall have a integral cut-off valve with lock wing on the inlet side of the meter.

2. For 2-inch meters, the setter shall have integral cut-off valves on the inlet and outlet side of the meter and shall have an integral valved meter bypass line. The inlet cut-off and the bypass valve shall have lock wings. Meter connections shall have elliptical flanges.

(E) Water Meters All water meters shall be Sensus Metering Systems with Touch Read Pit Lid (TR/PL). All meters shall have straight reading registers that read in U.S. Gallons. Meters shall be of a frost proof design, shall have low flow indicators, shall have an arrow on the case to indicate the direction of flow, and each meter shall have the manufacturer's serial number stamped on the register lid. Meters shall comply with the following AWWA standards as may be appropriate: C700 for positive displacement meters, C701 for turbine meters, C702 for compound meters, and C708 for multi-jet meters. Upon completion of a project the water meters shall be turned over to the Authority for installation and maintenance. Only Authority personnel or persons approved by the Authority shall install water meters. No water meter installation shall take place prior to an application being made through the Authority's Customer Service Department.

(F) Meter Boxes Meter boxes shall be the size, material, and the configuration as shown on the standard details.

SECTION 5

WATER LINE CONSTRUCTION

5-01. GENERAL REQUIREMENTS. The water lines shall be laid and maintained to the required lines and grades with all appurtenances set at the required locations as shown on the approved plans or the project or as directed by the Authority. All valves and fire hydrants shall be set plumb.

Whenever during the progress of the work obstructions or conditions not shown on the plans are encountered which interfere to such an extent that an alteration in the plans is required, the Authority shall be advised and approval given before such alterations are made.

All pipe shall be laid with a minimum cover of 36 inches measured from the finish grade to the top of the pipe.

All pipe and appurtenances shall be installed according to the manufacturer's recommendations and in accordance with AWWA C600.

5-02. WORK WITHIN HIGHWAY RIGHTS OF WAY. All work performed within or requiring utilization of any Virginia Department of Transportation's (VDOT's) rights of way shall comply in every respect with the latest edition of VDOT's Road and Bridge Specifications, the applicable subsections of Section 2. General Provisions of the VDOT's Land Use Permit, current edition, and with any special provisions attached to any VDOT's approved permit.

5-03. PROTECTION OF EXISTING UNDERGROUND FACILITIES. All work shall be performed in compliance with the "Underground Utility Damage Prevention Act", Title 56, Chapter 10.3, Sections 56-265.14 through 56-264.29 of the Code of Virginia, as amended.

5-04. DISRUPTION OF WATER SERVICES DURING CONSTRUCTION. Prior to any planned disruption of existing water service, the Authority shall be notified at least three full working days prior to the disruption. The Authority may require rescheduling of the disruption.

Should the Contractor encounter an unforeseen probable disruption, no disruption shall occur without the Authority's approval. The Authority may reschedule the disruption.

Should an accidental or unintentional disruption occur, the Authority shall be immediately notified. The Authority may issue specific instructions which the Contractor shall implement as required.

5-05 OCCUPATIONAL SAFETY AND HEALTH. All work shall be performed in accordance with the "Occupational Safety and Health Standards" and the "Construction Safety and Health Regulation" of the U.S. Department of Labor's Occupational Health and Safety Administration.

5-06 EXCAVATION. All Excavation shall be performed in a manner to minimize the effects of sedimentation and Erosion. The work shall be done in accordance with all applicable sedimentation and erosion control ordinances. The trench shall be excavated to the alignment, depth, and grade as shown on the plans or as required by the Authority. The maximum length that a trench can be opened including backfilled trenches which are not suitable for traffic shall

be 200 feet. Trench widths shall be sufficient to allow for proper jointing of the pipe, for proper installation of backfill and bedding, and for installation of valves or other appurtenances.

When conditions dictate, the trench shall be stabilized by sheeting, shoring, or bracing, or the width of the trench shall be increased in order to insure the safety of workmen, existing structures, and the surrounding area.

Ledge rocks, boulders, and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe an appurtenances. The specified minimum clearance is the minimum clear distance, which will be permitted between any part of the pipe or appurtenance and any projection or joint of any such rock, boulder or stone.

The bottom of the trench shall be at the required depth so as to provide a continuous and uniform bearing and support for the pipe. Bell holes shall be provided at each joint. Trenching below specified grade shall be backfilled with approved materials and shall be thoroughly compacted.

Excavated material shall be placed in a manner that will not obstruct the work nor endanger the workmen, obstruct nor endanger traffic, obstruct sidewalks, driveways, or other structures.

Discharge from any trench dewatering pump shall be conducted to natural drainage channels or storm sewers in such a manner not to create a nuisance or endanger traffic or workmen or cause property damage.

Should the trench pass over or thorough any previous or existing trench, the new trench bottom shall be sufficiently compacted to provide support equal to that of the native soil.

When the subgrade is found to include unsuitable materials such as ashes, cinders, refuse, organic material, or other unsuitable material, the unsuitable material shall be removed as directed by the Authority and replaced with approved suitable backfill. Should the subgrade be found to be unstable and cannot be removed or replaced, then a suitable foundation for the pipe and appurtenances shall be provided as directed by the Authority.

Unless otherwise shown on the plans or otherwise required by the Authority bedding for pipe shall be AWWA C600 TYPE 1 for ductile iron pipe; all other pipe line materials for water mains shall be laid using the standard gravel bedding shown in the standard details.

Where pavement has to be excavated, the pavement shall first be cut with mechanical pavement cutting equipment along a straight line with a vertical face.

When the removal of ornamental trees or shrubs is required during the work, they shall be removed so as not to harm their viability, and shall be stored, relocated, or replanted as directed by the Authority.

5-07. BACKFILL. Unless bedding type dictates otherwise, backfill material shall consist of selected material from the excavation, and shall be free of large clods, cinders, ashes, refuse, vegetable or organic material, boulders, frozen or excessively wet soil, stone, rocks, or broken concrete rubble.

The backfill from the trench bottom to at least one foot over the top of the pipe shall be select fill as described in the previous paragraph. It shall be hand placed and thoroughly compacted in

layers not to exceed six inches in depth. Backfill from 1 foot over the top of the pipe to the original ground surface shall contain no stones larger than 5 inches in its largest dimension. The remainder of the backfill may be placed in one-foot layers and shall be thoroughly compacted by mechanical means.

Where excavation has been made through pavement, curbs, driveways, and sidewalks the backfill shall consist entirely of aggregate VDOT No.25/26 or other approved select backfill material shall be compacted in six inch layers to a minimum of 95% theoretical density at optimum moisture content.

Where excavation has been made in roadway shoulders or other traveled portions of the roadway which are not paved, the top 10 inches of trench shall be backfilled with good bank gravel or crusher-run stone with a capping of crusher-run material over the entire shoulder.

5-08. PIPE INSTALLATION. Pipe fittings, valves, hydrants and other accessories and appurtenances shall be loaded and unloaded by lifting with hoists or by skidding so as to avoid shock or damage. Under no circumstances shall these materials be dropped or skidded or rolled against any pipe already on the ground or already installed. Pipe and fitting shall be handled so that the coatings an linings shall not be damaged. No damaged pipe, fittings, valves, hydrants, or other accessories and appurtenances shall be installed.

All lumps, blisters, and excess coating shall be removed from the socket and plain end of each pipe and fitting. All jointing surfaces including gaskets shall be wiped clean and dry and shall be free of dirt, sand, grit any foreign material before the pipe of fitting is installed. Every precaution shall be taken to keep the interior of the pipe free of dirt, cement, or other foreign material. No debris, tools, clothing or other materials shall be placed in the pipe at any time.

With the installation of non-metallic water pipe, 14 gauge electrically conductive wire shall be installed in the trench, and connected to valves at all valve sites. Its purpose shall be for locating the water main.

During pipe laying the trench shall be kept free of water.

The pipe may be strung prior to installation if conditions allow and with approval of the Authority, subject to VDOT Use Permit.

As each length of pipe is placed in the trench each joint shall be assembled according to the manufacturer's recommendations and the pipe shall be brought to the specified line and grade. When hydraulic equipment is used to push the pipe a block of wood shall be placed between the pipe and pushing device to prevent damage to the pipe.

When pipe materials other than ductile iron are used, the use of lifting or hydraulic equipment to push the pipe is prohibited. Once the joint is made the pipe shall be secured in place with approved backfill material.

At times when the work is not in progress the open ends of pipes and fittings shall be closed by a water-tight plug.

Cutting of the pipe shall be done without damage to the linings of pipes, and shall be done only by experienced workmen. All cuts shall leave a smooth end and shall be made at right angles to the axis of the pipe. All cutting debris shall be removed from the pipe. Tapping bits, drills, and saws shall be type recommended by the manufacturers' for the type of pipe material being tapped.

When deflection of the pipe alignment in any plane is required the deflection shall not exceed that required for satisfactory jointing of the pipe, as specified by the manufacturer or by the appropriate AWWA standard.

Full circle repair clamps shall not be used to make any pipe joint.

5-09. VALVE, HYDRANT, AND FITTING INSTALLATION. Prior to installation valves, hydrants, and fittings shall be inspected for defects, direction of opening, number of turns to open, freedom of operation, tightness of pressure containing bolting and test plugs, and cleanliness of all valve ports and seating surfaces. Valves and hydrants shall be set plumb.

Valve operating nuts shall be at least one foot but no greater than three feet beneath finished grade. Stem extensions shall be installed if required. Valve boxes shall be set plumb, shall be centered over the valve operation nut, shall have the box lids flush with finished grade, and shall not be set so as to transmit shock or stress to the valve. In no case shall valves be used to bring misaligned pipe into alignment.

Until ready for use, hydrants which have been installed shall be securely covered with a burlap bag or other approved covering.

At tees and crosses, valves shall be rodded to the tees or crosses using 3/4 inch galvanized or bituminous coated all-thread rod or other approved restraining devices. Valves installed on dead-end lines shall be restrained by installing a suitable length of pipe beyond the valve , by rodding or restraining to a concrete anchor block, or by rodding or restraining to the pipe a suitable distance on the pressurized side of the valve.

All tees, plugs, caps, bends, tapping sleeves, and hydrants shall be suitably restrained to resist thrust forces by providing reaction backing as shown on the standard details, by rodding, or by using approved mechanically restrained joints.

Fire hydrant drains shall be drained to dry wells provided exclusively for this purpose. Drywells shall be a minimum of 2 foot x 2 foot x 2 foot and be backfilled with crushed stone.

5-10. TAPPING FOR SERVICE CONNECTIONS.

A. Wet Taps. For nominal tap sizes less than two-inch, ductile iron pipe in all classes may be directly tapped with standard corporation stops which shall have had two layers of 3-mil TFE tape applied to the inlet threads. For nominal tap sizes two-inch and larger, service saddles or mechanical joint tapping sleeves shall be used for all tap sizes. Direct and service saddle taps shall be located at either the ten o'clock or the two o'clock position on the pipe circumference.

1. After installation of the saddle, it shall be water tested at the saddle's working pressure for a minimum of ten minutes, prior to the actual tap being made.

B. Dry Taps. Dry taps shall be made as described above. Mechanical joint tees and valves conforming to Section 4 may be used in lieu of tapping sleeves and valves.

5-11. RAILROAD AND HIGHWAY CROSSINGS. Unless otherwise approved by the Authority, pipe lines crossing railroads or highways shall be installed by boring, jacking, or tunneling. The pipeline shall be installed within a casing of sufficient size to allow the unrestrained passage of the pipe bells and pipe skids or spiders through the casing. Within the casing the pipe shall be supported on pressure treated wooden skids or steel spiders so that the pipe shall not rest on the pipe joints or couplings. See Standard Detail W-7 for quantity and spacing requirements. Service line road crossings shall be encased in metallic casing pipe. Approved casing materials include galvanized steel, black-steel, or metallic electrical conduit. Nominal casing sizes shall be 1-1/2" diameter for ¾" service line and 2" diameter for 1" service line.

Care shall be taken to maintain the integrity of the pipe joints during the installation of the pipe in the casing, and in no cases shall pipe with non-locked joints be pulled by the pipe through the casing. The casing and skids or spiders shall be as shown on the standard details. Carrier pipelines 3-inch and larger nominal shall be as shown on the approved plans. On 3-inch and larger carrier pipelines having a joint or coupling within the casing, each protruding pipeline end shall be rodded to the end of the casing. Railroad and/or highway crossings shall be installed according to the requirements and permit provisions imposed by the applicable agency.

All boring, jacking and tunneling shall be completed prior to the construction of adjacent sections. Approved casing materials shall be used where required. On any oversize boring the cavity between the casing and the bore shall be pneumatically grouted as shall any unfinished boring. Within the casing, the water line shall be installed so as to preserve the integrity of the joints.

5-12. AERIAL CROSSINGS. Aerial crossings, where allowed, shall be adequately supported using hanging and supporting systems suitable for use with the structure supporting the pipeline and shall be reflected in the approved plans for the project. Pipelines attached to highway or railway structured shall be installed according to the requirements of the applicable agency. Aerial crossings shall be protected against freezing, shall be accessible for repair, and shall be located above the 100-year flood level. Aerial pipelines shall be ductile iron pipe with factory fabricated integral locking joints. Field welding and restraining systems using set screws are prohibited. All pipe joining systems, restraints, and expansion fittings are to be approved by the Authority.

5-13. RESTORATION. All areas within the construction limits or utilized during construction shall upon completion of the work within a section be completely restored to a condition equal or better than that which existed prior to construction. Restoration shall include, but not be limited to pavement, concrete, grassed plots, fences, signs, ornamental plantings, drainage structures or other public or private improvements. Roadway pavement restoration shall be in accordance with the Virginia Department of Transportation's Land Use Permit Requirements. Restoration shall be finished in a neat and uniform condition and within a schedule acceptable to the Authority. All restoration to be under a warranty period not to exceed a year from date of project completion.

5-14. PRESSURE AND LEAKAGE TESTING. After the pipe and appurtenances have been installed, all newly laid pipe or any valved sections shall be subjected to hydrostatic pressure and leakage test.

Tests shall be performed between each adjacent main line valve except at the tees and crosses, at which locations the test section shall include the tee or cross and the valve or valve beyond the tee or cross. The test shall be performed with fittings and service connections in place and with auxiliary hydrant line valves open. At no time shall any valve be operated in either direction, open or closed, at a pressure exceeding the valves' rated working pressure.

The test section shall be filled slowly with potable water and all air expelled through a hydrant or other appurtenance. Water for testing shall be supplied by the Authority at the nearest suitable location. The contractor shall be responsible for loading, hauling, and discharging said water.

After filling the test section shall be left undisturbed for 24 hours after which time the test pressure shall be applied.

The test pressure shall be al least 1.5 times the rated working pressure of the pipe at the test point and at least 1.25 times the rated working pressure of the pipe at the highest elevation within the test section, but the test pressure shall not exceed twice the rated pressure of closed hydrants and shall not exceed the rated pressure of closed resilient seat gate or butterfly valves when such hydrants and valves are on the pressure boundary.

The pressure shall be maintained for at least two hours and the test pressure shall not vary more than five psi from the test pressure. Water may be added to the line being tested to maintain the test pressure, so long as the amount added does not exceed the allowable leakage. The leakage shall be defined as that volume of water that must be added to maintain the test pressure for the test duration. The leakage shall not exceed that determined by the following formula:

$$L = \frac{S \times D \times \sqrt{P}}{133{,}200}$$

where: L= the allowable leakage in gallons per hour;
S= the length of pipe tested in feet;
D= the nominal pipe diameter in inches; and
P= the average test pressure in psi during the test

When testing against closed metal seated valves, an additional leakage per closed metal seated valve of 0.0078 gallons per hour per inch of nominal valve size shall be added.

If any test of pipe laid discloses leakage greater than that specified above, the Contractor shall at his expense, locate and make repairs as necessary to reduce the leakage to the specified allowance.

5-15. DISINFECTION. Before being placed into service, all newly installed mains, pump stations, fittings, appurtenances, and service connections shall be disinfected in accordance with

ANSI/AWWA C651. During the disinfection procedure all hydrants and valves including meter stops shall be operated. Prior to disinfection all lines shall be filled to eliminate air pockets and flushed to remove any particulate unless the Tablet method is used. The flushing velocity shall be at least 2.5 feet per second.

The chlorine shall be applied by one of the following methods:

(A) Continuous Feed Method. Potable water shall be introduced into pipe at a constant flow rate. Chlorine shall be added at a constant rate to this flow in such a manner that the water has a chlorine concentration of at least 50 mg/l. The chlorinated water shall remain in the pipe at least 24 hours, after which time the chlorine concentration shall be at least 10 mg/l.

(B) Slug Method. Potable water shall be introduced at a constant rate. This water shall receive a chlorine dosage which shall result in a chlorine concentration of at least 100mg/l in a "slug" of water. The chlorine shall be added long enough to insure that all portions of the pipeline are exposed to the 100 mg/l chlorine solution for at least three hours. The chlorine residual shall be checked at regular intervals not to exceed 2000 feet to insure that an adequate residual is maintained.

(C) Tablet or Granule Method. This method shall be used only if the pipeline and appurtenances have been kept clean and dry during construction and the water temperature is greater than 5°C(41°F). During installation of the pipeline or appurtenances calcium hypochlorite tablets or granules containing 65% available chlorine by weight shall be placed in the pipeline. Granules shall be places at the upstream end of the line, in the upstream end of each branch main, and at intervals of 500 feet. The quantity of granules at each placing shall be:

Pipe Diameter – Inches	Granules - Ounces
4	1.7
6	3.8
8	6.7
12	15.1
14 and larger	D^2 x 15.1

* D is the inside pipe diameter in feet D=d/12

Tablets (5g) when used shall be attached to the top of each joint of pipe. The tablets shall be attached with food-grade adhesive such as Permatex Form-a-Gasket No 2, Permatex Clear RTV Silicone Adhesive Sealant or approved equal. Tablets shall also be attached to or crunched in each appurtenance. The number of tablets required at each joint of pipe shall be:

Pipe Diameter In Inches	*Number of 5g Tablets per Section*	
	18 ft.	20 ft.
4	1	1
6	1	1

8	2	2
10	3	3
12	4	4
16	6	7
18	8	9

Potable water shall be introduced into the pipeline at a velocity of less than 1 ft./sec. The water shall remain in the line for at least 24 hours.

After the applicable retention period the chlorinated water shall be flushed from the line at a velocity of at least 2.5 ft./sec using potable water until the chlorine residual leaving the line is no higher than that generally prevailing in the system or is acceptable for residential use as determined by the Authority.

The heavily chlorinated disinfection water shall be disposed of in a manner acceptable to the Authority, and in such a manner as to prevent adverse environmental impacts, including but not limited to: erosion, damage to vegetation, damage to natural habitats, or water courses. Where in the Authority's opinion adverse environmental impact might be done, a reducing agent shall be used to neutralize the chlorine to safe levels prior to disposing of the disinfection water.

Where connections, appurtenances, or fittings are installed on existing lines, all fittings and the existing lines within three feet in all directions from the work shall be swabbed or sprayed with a 1% hypochlorite solution.

5-16. BACTERIOLOGICAL TESTING. After the pipeline has been disinfected and flushed, two bacteriological samples taken at least 24 hours apart, shall be collected at intervals not to exceed 2000 feet throughout the pipeline. These samples must be processed by a laboratory certified by the Division of Consolidated Laboratory Services (DCLS) to do this type of work. The results of these samples must indicate no coliform contamination before the pipeline is placed into service. If coliform contamination is present, then the disinfection procedure shall be repeated until no coliform contamination is indicated. Only written results supplied by the certified private laboratory will be accepted as proof of no coliform contamination.

5-17. BACTERIOLOGICAL SAMPLING. Bacteriological sampling shall take place on all new line construction projects, on all major rehabilitation projects, and for certain maintenance and repair situations as directed by the Authority. Contractor shall be responsible for collecting and paying for all bacteriological samples. Sampling locations must be clearly indicated on the samples associated paperwork. It shall be contractor's responsibility to transport the sample to their certified private laboratory.

SECTION 6

GENERAL REQUIREMENTS-SEWER FACILITIES

6-01. GENERAL STATEMENT Standard construction details, specifications, and materials standards approved by the Authority shall be followed unless specific deviation therefrom is authorized in writing by the Authority.

6-02. TYPE OF SEWER All sewer systems shall be designed and constructed to achieve total containment. Combined storm and sanitary sewers are prohibited.

6-03. MINIMUM SIZES The minimum nominal size for public sanitary sewers shall be eight-inch for gravity lines except that laterals serving up to six residential connections on cul-de-sacs or sidewalk collector lines may be six-inch nominal size; and four-inch for force mains excepting grinder pump discharge piping.

6-04. VELOCITY, SLOPE, AND ALIGNMENT Gravity sewers shall be designed for a minimum full-flow velocity of two feet per second. In those gravity sewers in which velocities in excess of 15 feet per second are expected, the pipe shall conform to ASTM or AWWA specifications which provide protection against internal erosion. Velocity in force mains shall be no less than two feet per second but no greater than eight feet per second.

Where a smaller sewer joins a larger one, the invert of the larger sewer shall be lowered to provide a continuous gradient through the manhole. Drop pipes shall be installed in manholes in which the inverts of incoming sewers are 24 inches or higher above the outlet invert.

Sewers with slopes of 20 percent or greater shall be securely anchored with concrete anchors or other approved methods. Anchorage shall be provided on maximum 36-foot centers for slopes 20 to 35 percent; maximum 24-foot centers for slopes 35 to 50 percent; and maximum of 13-foot centers for slopes exceeding 50 percent.

Gravity sewers shall be installed with straight horizontal alignment between manholes. All gravity sewers shall be designed and constructed with continuous and uniform slope or grade between manholes.

The following minimum slopes shall be provided; however, greater slopes are desirable:

Size	Slope	Size	Slope	Size	Slope
8	0.40	10	0.28	12	0.22
14	0.17	15	0.15	16	0.14
18	0.12	21	0.10	24	0.08

Velocities in force mains shall be 2 feet per second minimum, and have a maximum velocity of 8 feet per second.

6-05. MINIMUM COVER All sewers and force mains shall have 3 feet of minimum cover from the top of the pipe to the finished grade.

6-06. MANHOLE AND CLEANOUT LOCATIONS Manholes shall be installed at every change in pipe size, slope, or alignment, and no distance between manholes shall be greater than 400 feet for sewers up to 15-inch nominal size, and 500 feet for sewers greater than 15-inch nominal size. A cleanout shall be installed at the end of a cul-de-sac or sidewalk collector line as described in Section 6-03 above.

6-07. LOCATION OF SEWERS Sewers shall be located within public rights-of-way or within permanent easements not less than 10 feet in width for collectors and not less than 20 feet in width for interceptors.

6-08. SEPARATION BETWEEN SEWERS AND POTABLE WATER FACILITIES Separation between water lines and sanitary sewers shall be as described in Section 3-08 of these Construction Specifications and Standards. The minimum separation between a sewer line or sewer lateral and a Class I or II well shall be 50 feet. In addition to the minimum separation between wells of lesser class and any sewer line or lateral of 50 feet, no manhole shall be located within 100 feet of such wells and any sewer within 100 feet of such wells shall be constructed of an AWWA approved water pipe which shall be pressure tested in place with zero leakage.

6-09. LOCATION OF SEWERS IN RELATION TO STREAMS AND LAKES Sewers shall be designed to remain fully operational during 25 year recurrence interval floods. Within the 25 year flood plain, manholes shall have watertight frames and covers. Ventilation of sewers shall be provided for continuous watertight sections 1000-feet in length or greater. Vents shall be at least 4-inches in diameter, and shall be screened. Vent openings shall have openings above the 100 year recurrence interval flood level. Sewers and their appurtenances located along streams or lakes shall be protected against the 100 year recurrence interval flood.

6-10. MANHOLE RING & COVERS. Manhole rings & covers shall be as approved by the Authority. See Standard Details S-4 through S-7.

SECTION 7

SEWERAGE FACILITIES MATERIALS

7-01. GENERAL REQUIREMENTS Unless otherwise approved in writing by the Authority, or specifically indicated on plans approved by the Authority, all pipe, fittings, and accessories used within sewerage systems shall be as defined in this herein.

7-02. PIPE Pipe specifications shall be as noted herein unless otherwise specifically addressed on plans approved by the Authority or contract documents approved by the Authority. Specific type, size, class shall be shown on Authority approved plans or bid documents.

(A) Ductile Iron Sewer Pipe Ductile iron sewer pipe shall be Tyton Joint Pipe SewperCoat Lined or approved equal. The pipe shall be manufactured to conform to ANSI/AWWA C151/A21.51 and ASTM A 746.* The thickness of the pipe shall be determined by considering the trench load and internal pressure separately in accordance with ANSI/AWWA C150/A21.50.

1. Outside Coating The outside coating shall be a minimum of I mil bituminous paint according to ANSI/AWWA C151/A21.51 Section 4.3. Prior to lining, the exterior and interior of the spigot end, including the spigot face, shall be coated with a minimum of 8 mils of epoxy.

2. Inside Coating Before lining, the inside of the socket, including a portion of the gasket cavity and a portion of the pipe barrel, shall be coated with a minimum of 8 mils of epoxy.

3. Lining The pipe lining shall be SewperCoat as manufactured by Lafarge Calcium Aluminates or approved equal, and shall meet all quality requirements of ANSI/AWWA C104/A21.4.* The thickness of the lining shall be a minimum of 0.125" for 6" through 12" and 0.1875" for 14" through 24". The lining thickness may taper to less than the specified minimum at the ends of the pipe, in accordance with ANSI/AWWA C104/A21.4 Sec. 4-7.3. A. seal coat shall be applied to the lining.

4. Fittings Fittings shall be ductile iron at least Class 54 Thickness and in accordance with the requirements of either ANSI/AWWA C153/A21.53 or ANSI/AWWA C110/A21.10.* Mechanical Joints shall conform to ANSI/AWWA C111/A21.11.* Fittings shall be SewperCoat lined and coated with bituminous paint.

* Exclusive of the Portland cement lining that is replaced by the high performance SewperCoat lining.

5. Flanged Joints Flanged joints shall be used only as directed by the Authority. When required flanges and jointing material shall comply in all respects with ANSI/AWWA C115/A21.15.

6. Gaskets Gaskets shall be supplied by the pipe manufacturer. Transition gaskets shall be labeled with a "T" or the word "Transition".

7. Gasket Lubricant Gasket lubricant shall be a tasteless, non-toxic, non-bacterial supporting grease. Gasket lubricant shall be supplied by the pipe manufacturer.

(B) Polyvinyl Chloride Pipe (PVC)

1. Gravity Sewer Pipe shall meet the requirements of SDR 35 and shall be manufactured in accordance with ASTM D3034 or F679.

2. Force Main Pipe shall be in total accord with AWWA C900 or C901 and shall conform to iron pipe outside diameter. Class 100 pipe shall meet the requirements of DR25; Class 150 shall meet the requirements of DR18; and Class 200 shall meet the requirements of DR14. A force main's minimum diameter shall be 2 inches if grinder pumps are used, and minimum 4 inches without grinder pumps.

3. Joints Joints shall consist of an integral wall section with a solid cross section rubber gasket conforming to ASTM D3212 and F477.

4. Service Laterals Service laterals shall be Schedule 40 PVC and shall be in accord with ASTM D2665 and D1785. Solvents shall be in accord with ASTM 1784.

5. Fittings Fittings for PVC pipe shall be in accord with ASTM D3034 or ASTM F679 and shall meet the requirements for SDR 35.

6. Bedding Pipe shall be bedded per the manufacturers's recommendations.

(C) Reinforced Concrete Pipe Reinforced concrete pipe shall be Class IV, wall C and shall be manufactured in accordance with ASTM C76. The pipe shall be manufactured from Type II Portland cement concrete which shall have a 28-day compressive strength of 6000 psi. Each joint shall be longitudinally reinforced with at least six 3/8-inch smooth bars per cage. The pipe shall have bell and spigot joints with sewage compatible "0"-ring gaskets which shall be furnished by the pipe manufacturer and installed in accord with the manufacturer's recommendations. The joints shall conform to ASTM C443 or C361.

1. Fittings Fittings for reinforced concrete pipe shall be in accordance with ASTM C76.

(D) Clay Pipe Clay pipe shall be extra strength, unglazed with bell and spigot ends and shall conform to ASTM C700. The pipe shall have compression gasket joints with "O"-ring

fabricated rubber gaskets which shall be furnished by the pipe manufacturer. The joints shall be in accordance with ASTM C425.

1. Fittings Fittings for clay pipe shall be in extra strength and shall be in accord with ASTM C700.

7-04 MANHOLES AND CLEANOUTS

GENERAL REQUIREMENTS On a given project manholes shall be of the same construction and all cleanouts shall be of the same construction.

MATERIALS

(A) Concrete All concrete work shall be in accordance with Section 9 of these specifications.

(B) Brickwork Brick and masonry units shall be used only to form inverts or to provide vertical spacing or adjustment between the highest precast section or spacer and the manhole frame.

1. Common bricks shall be machine made, clean and unused and shall conform to ASTM C32, Grade MA. Common bricks shall have square edges and be of uniform size.

2. Concrete masonry units or segmental concrete manhole block shall conform to ASTM C139.

3. Mortar for parging masonry walls below grade, brick masonry, concrete masonry units, and for bedding cast iron frames in masonry shall conform to Type M or ASTM C270, mixed in the proportions of 1 part Portland cement and 3 parts clean, dry sand.

4. Masonry shall be laid at temperatures above 40°F, and shall not be subjected to freezing temperatures for a period of 48 hours after and during installation.

(C) Precast Concrete Manholes Precast concrete manhole base sections, risers, flat top eccentric taper units, and grade rings shall be constructed of reinforced concrete in accordance with ASTM C478. Manholes shall be set on a layer of crushed stone with a minimum thickness of 6 inches.

The base section shall be the extended type and shall be cast monolithic with the first riser section. All sections shall have a minimum wall thickness of 5 inches. Joints shall be tongue and groove with an "O" ring rubber gasket or Bitumastic 50 sealing material or approved equal, conforming with ASTM C443.

Pipe openings in the manhole wall shall be as shown on the approved plans and shall be provided with flexible watertight connector sleeves conforming to ASTM C923. The connector sleeves shall be cast in as a permanent, integral part of the monolithic base casting and shall be fitted with stainless steel pipe locking bands.

All manhole surfaces shall be smooth and exhibit no honeycombing or other deterioration. All lifting holes shall be filled flush with mortar.

(D) Inverts Invert channels shall be smooth and semicircular and shall be constructed of brick and mortar or concrete. Invert channels shall conform to the inside of the adjoining sewer pipe. Transitions in channel size and direction shall be gradual. The bench shall be smooth and slope toward the invert at a slope of one to two inched per foot.

(E) Accessories

1. Frames, Covers and Lids Frames, covers and lids shall be cast to the size, thickness, and shape as shown on the standard details or approved plans and shall be cast of the best quality gray iron in accordance with ASTM A48. The castings shall be sound, true to form, machined on all bearing and mating surfaces and sand blasted clean of all rust and scale and shall be coated with one coat of black asphaltum paint.

2. Steps Manhole steps shall be integrally cast in and shall consist of No.4 rebar with polypropylene coating.

(F) Sealing of Frame Sealing of the frame to either a concrete or masonry manhole shall be accomplished by using Bitumastic 50 sealing material or approved equal.

SECTION 8

SEWER LINE CONSTRUCTION

8-01. GENERAL REQUIREMENTS The sewer line shall be laid and maintained to the required lines and grades with all appurtenances set at the required locations as shown on the approved plans for the project or as directed by the Authority.

Whenever during the progress of the work obstructions or conditions not shown on the plans are encountered which interfere to such an extent that an alteration in the plans is required, the Authority shall be advised and approval given before such alterations are made.

All pipe shall be laid with a minimum cover of 36 inches measured from the finish grade to the top of the pipe.

All pipe and appurtenances shall be installed according to the manufacturer's recommendations.

8-02. WORK WITHIN HIGHWAY RIGHTS OF WAY All work performed within or requiring utilization of any Virginia Department of Transportation's (VDOT) rights of way shall comply with Section 5-02 above.

8-03. PROTECTION OF EXISTING UNDERGROUND UTILITIES All work shall be performed in compliance with Section 3-09 and 5-03 above.

8-04. DISRUPTION OF WATER SERVICE DURING CONSTRUCTION Water service disruption during sewer construction shall comply with Section 5-04 above.

8-05 OCCUPATIONAL SAFETY AND HEALTH All work shall be performed in compliance with Section 5-05 above.

8-06. CLEARING AND GRUBBING Where clearing and grubbing is required, the Contractor shall clear the required work area of all trees, shrubs, brush, rubbish, and other materials. Only those areas in which the work is to be performed and those areas which must be utilized to gain access to the work shall be cleared. The contractor shall make every effort to minimize the area to be cleared and grubbed and explosives shall not be used during the clearing. The debris from the clearing and grubbing operations shall be removed from the site or disposed of in an approved manner.

Where ornamental trees, or shrubs, domestic fruit trees, or other cultivated or tended trees, bushes, or shrubs are encountered during the work such vegetation shall be uprooted so as not to harm their viability and shall be stored or replanted as directed by the Authority.

All clearing and grubbing shall be performed in a manner to minimize the effects of sedimentation and erosion. The work shall be done in accordance with all applicable sedimentation and erosion control ordinances.

8-07. EXCAVATION The trench shall be excavated to the alignment, depth, and grade as shown on the plans or as required by the Authority. The maximum length that a trench can be open including backfilled trenches which are not suitable for traffic shall be 200 feet. Trench widths shall be sufficient to allow for proper jointing of the pipe, for proper installation of backfill and bedding, and for installation of manholes or other appurtenances.

Where conditions dictate, the trench shall be stabilized by sheeting, shoring, or bracing or the width of the trench shall be increased in order to insure the safety of workmen, existing structures, and the surrounding area.

Ledge rocks, boulders, and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe and appurtenances for pipes up to 24-inch nominal size. The specified minimum clearance is the minimum clear distance which will be permitted between any part of the pipe or appurtenance and any projection or joint of any such rock, boulder or stone.

The bottom of the trench shall be at the required depth so as to provide a continuous and uniform bearing and support for the pipe. Bell holes shall be provided at each joint. Trenching below specified grade shall be backfilled with approved materials and shall be thoroughly compacted.

Excavated material shall be place in a manner that will not obstruct the work nor endanger the workmen, obstruct nor endanger traffic, obstruct sidewalks, driveways or other structures.

Discharge from any trench dewatering pump shall be conducted to natural drainage channels or storm sewers in such a manner not to create a nuisance or endanger traffic or workmen or cause property damage.

Should the trench pass over or through any previous or existing trench, the new trench bottom shall be sufficiently compacted to provide support equal to that of the native soil.

When the subgrade is found to include unsuitable materials such as ashes, cinders, refuse, organic material of other unsuitable material, the unsuitable material shall be removed as directed by the Authority and replaced with approved suitable backfill. Should the subgrade be found to be unstable and cannot be removed or replaced, then a suitable foundation for the pipe and appurtenances shall be provided as directed by the Authority.

Where pavement has to be excavated, the pavement shall first be cut with mechanical pavement cutting equipment along a straight line with a vertical face.

8-08. BACKFILL Unless bedding type dictates otherwise, backfill material shall consist of selected material from the excavation, and shall be free of large clods, cinders, ashes, refuse, vegetable or organic material, boulders, frozen or excessively wet soil, stones, rocks, or broken concrete rubble.

The backfill from the trench bottom to at least one foot over the top of the pipe shall be free of earth clods or stones greater than one inch in diameter and shall be hand placed and thoroughly compacted in layers not to exceed six inches in depth. The remainder of the backfill may be placed in one foot layers and shall be thoroughly compacted by mechanical means and shall be free of rocks or stones larger than 5 inches in their greatest dimension.

Where the excavation has been made through pavement, curbs, driveways, and sidewalks the backfill shall consist entirely of graded aggregate VDOT No. 25/26 or other approved select backfill material and shall be compacted in six-inch layers to a minimum of 95% theoretical density at optimum moisture content.

The area around manholes shall be backfilled in a like manner.

8-09. PIPE INSTALLATION Unless otherwise shown on the plans or otherwise required by the Authority, sewers shall be laid using the standard gravel bedding shown in the standard details unless otherwise directed in writing by the Engineer.

Pipe fittings, an other accessories and appurtenances shall be loaded and unloaded by lifting with hoists or by skidding so as to avoid shock or damage. Under no circumstances shall these materials be dropped or skidded or rolled against any pipe already on the ground or already installed. Pipe and fittings shall be handled so that the coatings and linings shall not be damaged. No damaged pipe, fittings, or other accessories and appurtenances shall be installed.

The pipe may be strung prior to installation if conditions allow and with approval of the Authority. The sewer pipe shall be installed with bells upstream and such that the completed pipe shall have a smooth invert.

Precaution shall be taken to keep the interior of the pipe free of dirt, cement, or other foreign material. As each length of pipe is placed in the trench each joint shall be assembled according to the manufacturer's recommendations, all jointing surfaces including gaskets shall be wiped dry and clean before the pipe or fitting is installed. When hydraulic equipment is used to push home the pipe, a block or wood shall be placed between the pipe being pushed and the pushing device to prevent damage to the

pipe. When pipe materials other than ductile iron are used, the use of lifting or hydraulic equipment to push home the pipe is prohibited. Once the joint is made the pipe shall be secured in place with approved backfill material.

8-10. MANHOLE INSTALLATION. Manholes shall be installed according to the locations, depths, and heights as shown on the approved plans. The base sections shall be installed on a 6-inch bed of crushed stone.

Each section shall be carefully set in place above the previously installed section. All lifting holes shall be patched flush with mortar upon completion of setting of the manhole.

Where allowed, brick or masonry unit components shall be constructed in accordance with the dimensions shown in the standard details. Bricks and masonry units shall be laid in a full mortar bed with joints 1/2-inch thick and shall be laid only at temperatures greater than 40°F, and shall be protected from freezing for 48 hours. Invert channels, benches, and pipe holes shall be constructed as described in Section 7-03.F above. The interior and exterior shall be parged with 1/2-inch thick mortar.

Pipe connections to existing manholes and new manholes set over existing sewers shall be made so as to conform as nearly as possible to the essential applicable requirements for new manholes.

Manholes on the discharge ends of force mains shall have an interior coating of bituminous paint or other acid resistant liner.

Force mains shall enter manholes through saxophone bends as shown in the Standard Details.

8-11. SERVICE CONNECTION OR LATERALS. Laterals shall be installed as indicated on Drawing S-2 of the attached Standard Details. Connections shall be made to the main sewer by means of wyes of the same material as the main, or by using approved strapped sewer service saddles.

When sewer saddles are used, the hole in the main sewer shall be cut using hole saws and the hole shall not be made by chipping the wall section out with a hammer.

The recommended minimum grade on a lateral shall be 1/4-inch per foot and each service connection shall terminate with a cleanout to be located at the easement boundary or property line. Each service connection shall be capped or plugged as directed by the Authority.

8-12. HIGHWAY AND RAILROAD CROSSINGS. Unless otherwise approved by the Authority, sewers crossing highways shall be installed by jacking, boring, or tunneling in accordance with requirements of the Virginia Department of Transportation.

Railroad crossings shall be installed according to the requirements and permit provisions imposed by the Railroad Company.

All boring, jacking and tunneling shall be completed prior to the construction of adjacent sections. Approved casing materials shall be used where required. On any oversize borings the cavity between the casing and the bore shall be pneumatically grouted as shall any unfinished borings. Within the casing, the sewer shall be installed so as to preserve the integrity of the joints.

8-13. BURIED STREAM CROSSINGS. Buried stream crossings shall be installed using mechanical joint ductile iron pipe with a nominal size equal to that of the adjoining sewer pipe, or the next larger nominal size if equal sizes are not available. The crossing shall be tested in place and shall exhibit zero leakage. The ductile iron pipe shall extend at least 10 feet beyond each bank and shall be installed with concrete anchors as required by the Authority. The tops of all sewers entering or crossing streams shall be at least 3 feet below the bottom of the stream bed. Should 3 feet of cover not be obtainable, the sewer shall be encased in concrete.

8-14. AERIAL CROSSINGS. Aerial crossings of any kind shall consist of a carrier sewer installed within a bituminous coated continuously welded steel casing pipe which is properly supported.

8-15. RESTORATION. Restoration of disturbed areas shall be in accordance with Section 5-13 above.

8-16. ACCEPTANCE TESTING OF GRAVITY SEWERS. Infiltration, Exfiltration, air, or deflection testing will be performed as directed by and in the presence of the Authority. Should any section of pipe fail any required test, that section shall be repaired or replaced as directed by the Authority.

(A) Exfiltration Test. The inlet to the lower manhole in the test section shall be plugged, and the upper manhole shall be filled with water to the top of the manhole or 4 feet above the crown of the outlet pipe which ever is the lesser. Leakage from the sewer including manholes shall not exceed 100 gallons per inch diameter per day per mile for any section between adjoining manholes. Maximum leakage for any section of pipe, including manholes, shall be no greater than 2,400 gallons per day per mile of pipe(regardless of pipe diameter).

(B) Air Testing. Where required by the Authority, the Contractor shall provide all equipment, material and labor to perform an air test. The air test shall be performed in accordance with ASTM C828-98. The air testing equipment and air hose configuration shall be subject to approval by the Authority.

Prior to air testing the pipe section, pneumatic plugs with sealing lengths equal to or greater than the pipe diameter shall be tested by setting the plugs on each end of a joint of pipe. The plugs shall then be air pressurized to 25 psig, then the pipe to 5 psig. The plugs shall withstand this test procedure without movement or bracing.

Each pipe section between manholes shall be tested by installing a tested plug on each end of the section being tested and pressuring the plugs to 25 psig. The pipe section shall then be pressurized with low pressure air until the air pressure inside the pipe is 4 psig greater than the hydrostatic pressure of any water standing over the pipe. After the pressure has been stabilized to at least 3.5 psig greater than the hydrostatic pressure, the air supply to the control panel shall be disconnected and the time over which a one psig pressure loss occurs shall not be less than given in Table No. 8-1.

(C) Deflection Testing. Sewers constructed of PVC Pipe shall be subjected to a deflection test throughout their entire length using a go, no-go mandrel. Testing shall be performed after all other work is completed, including filling, compaction, testing grading, concreting, restoration, and the placement of any superimposed dead or live loads.

The deflection of the pipe after all external loading has been applied shall not exceed 5% of the pipes average inside diameter + or - manufacturer's tolerances.

The pull through device shall be a nine arm mandrel with a proving ring sized at 5% less than the inside dimension of the pipe as shown be ASTM D3034 for SDR 35 PVC Pipe. Said mandrel shall be approved by the Authority prior to its use for testing.

The mandrel shall be pulled through the pipe and shall pass freely through each joint of pipe. If the mandrel fails to pass freely through said pipe then the section with excess deflection shall be replaced and retested as required by the Authority.

TABLE 8-1

	Nominal Size (inches)				
Test Length (feet)	4	6	8	10	12
	Time (minutes, seconds)				
25	0:04	0:10	0:18	0:22	0:27
50	0:09	0:20	0:35	0:45	0:53
75	0:13	0:30	0:53	1:07	1:20
100	0:18	0:40	1:07	1:29	1:47
125	0:22	0:50	1:29	1:51	2:14
150	0:26	1:00	1:47	2:14	2:40
175	0:31	1:10	2:05	2:36	3:07
200	0:35	1:20	2:22	2:58	3:34
225	0:40	1:30	2:40	3:20	4:00

250	0:44	1:40	2:58	3:43	4:27
275	0:48	1:50	3:16	4:05	4:54
300	0:53	2:00	3:34	4:27	5:21
325	0:57	2:10	3:52	4:49	5:47
350	1:02	2:20	4:09	5:12	6:14
375	1:06	2:30	4:27	5:34	6:41
400	1:19	2:40	4:45	5:50	7:07

	Nominal Size (inches)			
Test Length (feet)	15	18	21	24
		Time (minutes, seconds)		
25	0:31	0:36	0:45	0:53
50	1:03	1:12	1:29	1:47
75	1:34	1:48	2:14	2:40
100	2:05	2:24	2:58	3:34
125	2:37	3:00	3:43	4:27
150	3:08	3:36	4:26	5:21
175	3:39	4:12	5:12	6:14
200	4:10	4:48	5:57	7:07
225	4:42	5:25	6:42	8:07
250	5:13	6:01	7:96	8:54
275	5:44	6:37	6:11	9:48
300	6:16	7:13	8:55	10:41
325	6:47	7:49	9:40	11:34
350	7:18	8:25	10:25	12:28
375	7:50	9:01	11:09	13:21
400	8:21	9:37	11:54	14:15
425	8:52	10:13	12:39	15:08
450	9:23	10:49	13:23	16:01
475	9:55	11:25	14:06	16:55
500	10:26	12:01	14:52	17:48

A warranty period deflection test may be performed by the Authority just prior to the end of the one year warranty period. Should the pipe deflection exceed 5%, the contractor shall be required to replace the section of pipe with excess deflection in accordance with the project specifications.

(D) Vacuum Testing of Manholes.

Each manhole shall be tested after assembly (Preferably prior to backfilling) using an approved vacuum tester.

All lift holes shall be plugged with an approved non-shrink grout.

All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manhole.

The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations.

A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if time is greater than the values in the table below:

MIN TIME ELAPSED FOR A DROP OF 1 INCH IN A COLUMN OF MERCURY

MANHOLE DEPTH	DIAMETER OF MANHOLE 48"DIA.	60"DIA.	72"DIA.
10 FT OR LESS	60 SEC	75 SEC	90 SEC
>10 FT BUT <15 FT	75 SEC	90 SEC	105 SEC
>15 FT BUT <25 FT	90 SEC	105 SEC	120 SEC

If a manhole fails the initial test, necessary repairs shall be made with a suitable non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

8-17. ACCEPTANCE TESTING OF FORCE MAINS.

(A) Main piping shall be filled slowly from the low point in the force main with air expelled from the high point as filling proceeds. Once the force main is filled and all air is dispelled, the pipe shall be left for 24 hours. At the end of this period, a hydrostatic pressure equal to the rated working pressure of the pipe--i.e., 150 or 200 psi--shall be induced. This pressure shall be maintained for two hours. Leakage shall not exceed the amount given by:

$$L=\frac{SxDx\sqrt{P}}{133,200}$$

Where L is allowable leakage in gallons per hour;
S is the length of pipe tested in feet
D is the pipe diameter in inches;
P is the test pressure in psi.

(B) Repairs. If the flow of water is in excess of the allowable limits, or if leaks of appreciable size are encountered, the Contractor shall repair or rebuild, at his expense, those portions of the piping which are faulty. These tests will be repeated until the work is deemed acceptable in accordance with the allowable limits.

(C) Test Water. Water for testing purposes will be supplied by the Owner at the nearest source to this project. Pumping, if necessary, loading, hauling, and discharging of the water shall be the Contractor's responsibility.

(D) Extent of Test. Force main shall be tested from just outside of pumping station to just outside of discharge manhole.

(E) Testing Restraints. The Contractor shall be responsible for making sure that each end of the force main is securely restrained prior to test pressures being applied.

SECTION 9

CONCRETE

9-01. GENERAL REQUIREMENTS Unless otherwise approved in writing by the Authority, or as specifically indicated on plans approved by the Authority, all concrete work shall conform to this section and to the latest edition Building Code Requirements for Reinforced Concrete, ACI 318.

9-02. MATERIALS

(A Concrete Concrete for structures shall be proportioned and mixed in accordance with the Road and Bridge Specifications, Virginia Department of Transportation, Current Edition, General Use Concrete, Class A3, Table II-15, Section 219. Concrete for miscellaneous purposes such as fill concrete, thrust blocks, concrete encasement, etc., shall have a 28 day compressive strength of 2500 psi. The mix proportions and test data for this concrete shall be submitted to the Authority for approval.

(B) Cement Cement shall be Type II Portland cement manufactured in accordance with ASTM C150.

(C) Steel Reinforcement Reinforcement bars shall be deformed new billet steel conforming to ASTM A615-40. Bars shall be formed to the dimensions indicated on the approved drawings. The Contractor shall submit shop drawings to the Authority or its Engineer for approval.

(D) Wire Reinforcement Welded wire fabric shall conform to ASTM A185.

(E) Curing Compound Curing compound shall conform to ASTM C309 Type 2.

(F) Joint Filler Expansion joint material shall be preformed and shall conform to AASHTO M213.

(G) Joint Sealant All concrete joints shall be prepared as shown on the approved drawings and sealed with an approved joint sealant compound.

(H) Waterstops Flexible waterstops shall be manufactured from virgin polyvinyl-chloride compound which conforms to the Corps of Engineers' Specifications CRD-C572. Waterstops shall be capable of withstanding a head of water equal to the depth of installation or 30 feet, whichever is greater.

(I) Admixtures and Coatings Where indicated on the approved plans, approved admixtures and coatings shall be used

9-03 Slump Slump shall be from 2 to 4 inches and will be determined in accordance with ASTM C 143. Samples for slump shall be taken from the concrete during placement in the forms.

9-04 TESTING The 28 day compressive strengths will be verified during the progress of the work by testing standard concrete cylinders. Three cylinders shall be required from each item of work or from each 50 cubic yards of concrete placed. The Authority shall determine when concrete cylinders shall be taken. The Contractor shall furnish the necessary labor and facilities for taking the samples and handling and storing the cylinders at the work site. The Authority will mold, ship and provide for the testing of cylinders. The making, curing and testing of the specimens will be in accordance with ASTM C31 and C39. For the first 24 hours after molding, the cylinders shall be kept moist in a storage box constructed and located so that its interior air temperature will be between 60^0 and 80^0 F.

Should the concrete specimens fail to meet the required compressive strengths, the Authority may require sample cores to be cut from the suspect concrete, load testing per ACI 318, or the installation of additional support or remeasure work, all at the Contractor's expense.

9-05. FORMS All concrete shall be formed. Forms shall be true to line and grade and shall be mortar-tight. All exposed joints, edges and external corners shall have 3/4 inch chamfer. Forms shall be of wood, plywood or steel. Form design shall be approved by the Authority, but adequacy of ties, supports, etc. shall remain the responsibility of the Contractor. Embedded wall ties shall be set 1.5 inches from exposed concrete surfaces. In conventional thickness walls, the heights of forms for each vertical lift shall not exceed 10 feet. Forms for continuous surfaces shall be fitted over the completed surface to assure accurate alignment and to prevent leakage of mortar. All forms shall be constructed to allow the forms to be removed without damage to the concrete. Prior to the placing of concrete, the contact surfaces of forms shall be cleaned and coated with a non-staining oil.

Forms for columns, walls, sides of beams and other members not supporting the weight of concrete may be removed 36 hours after placement of the concrete. Forms for beams, girders and slabs shall remain in place until the concrete has obtained its required 28 day strength. Reshoring of such members will only be permitted for just cause and after review and approval by the Authority's Engineer.

9-06. PLACING REINFORCEMENT Steel reinforcement bars shall be placed in accordance with the approved plans or shop drawings and shall be supported by concrete blocks or metal chairs and shall be securely held in place to prevent dislocation during concrete placement. Reinforcement shall be free from loose rust, mill scale, oil or grease or other material that would destroy proper concrete bond.

9-07 .DELIVERY OF CONCRETE Concrete mixing equipment and methods shall be subject to approval. Each truck load of ready-mixed concrete shall be accompanied by a ticket indicating mix design, mix starting time, and batch weights. No concrete that has been in the ready mix truck longer than two hours when the temperature is less than 80° F. shall be placed.

9-08. CONCRETE PLACEMENT Concrete placing equipment and methods shall be subject to approval. Poor quality subgrades which would contaminate the concrete shall be covered with building paper or other approved material. All surfaces upon which concrete is to be placed shall

be thoroughly cleaned and dampened. At contact surfaces between old and new concrete, a one inch layer of cement-sand grout 1:3 by weight shall be placed. The maximum free fall of concrete during placement shall be 6 feet. Chutes, slides or other approved methods shall be used for greater heights. Concrete shall be placed in 12 to 18-inch horizontal layers as near as possible to its ultimate position and shall be worked around the reinforcement and embedded fixtures and into the corners or forms with care being taken to avoid segregation. Cold joints between successive layers shall be avoided. Concrete shall be placed in the dry and placement will not be permitted during adverse weather conditions. Concrete shall not be placed under water. Without specific authorization, concrete shall not be placed when the air temperature is less than 40 ^{0}F.

9-09. VIBRATION All concrete shall be properly consolidated using internal mechanical vibrators supplemented by hand tamping and spading. Vibrators shall have vibratory elements with a frequency of at least 7000 impulses per minute when submerged in the concrete. Vibrators shall not be used to transport concrete in the forms. Vibration of forms and reinforcement shall not be permitted. Where concrete is placed in more than one lift, the vibrator shall penetrate into the previous lift to prevent formation of cold joints.

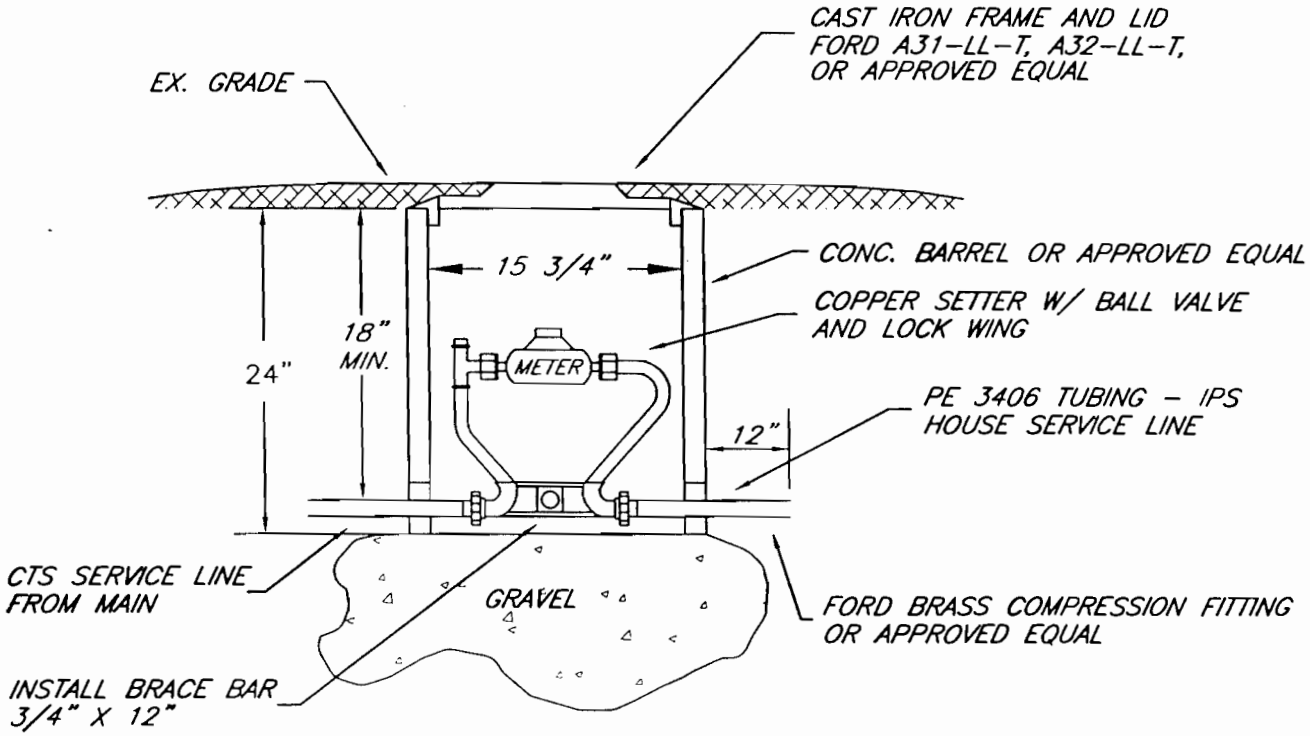
9-10. CONSTRUCTION JOINTS Construction joints shall be provided where indicated on the approved plans, but in no case shall construction joints on wetted surfaces be located within two feet of design water level. Construction joint surfaces shall be thoroughly cleaned prior to concrete placement. All laitence, coatings, stains, debris and other foreign material shall be removed from the surface, and the surface shall be broomed with neat Portland cement grout immediately prior to placing new concrete.

Waterstops and shear keys shall be provided at construction joints where indicated. Joints in metal waterstops shall be brazed, soldered or welded. Joints in rubber waterstops shall be vulcanized. Waterstops shall be installed so as to form a continuous watertight seal in each joint. Shear keys shall be installed for ease of removal of the form. Blockouts for pipe sleeves, if approved by the Authority, shall be provided with keyway and waterstops and shall be detailed as a plug.

9-11. SURFACE FINISHING Surface defects shall be repaired immediately after form removal. Honeycombed and other defective concrete shall be removed to sound concrete. Form ties, tie wire and other loose hardware shall be removed from the concrete surface and tie holes and all damaged surfaces shall be cleaned, dampened and patched with an approved fast setting non-shrink patching mortar. Patched surfaces shall be water cured and patches shall be flush with adjacent concrete surfaces. Finishing of exposed surfaces shall be as required by the Authority.

9-12. PROTECTION AND CURING Concrete shall be protected adequately from injurious action by the sun, rain flowing water, frost, and mechanical injury, and shall be accomplished by water curing or by application of curing compound, except that compound shall not be used on surfaces to be rubbed or where its appearance would be objectionable or where coverings are to be bonded to the concrete. Vertical wall forms shall be kept continuously wet while the forms are in place.

WATER



(NOT TO SCALE)

ALL METERS SHALL BE SENSUS SRII WITH
TOUCH READ PIT LID (TRPL)
AND MINIMUM 6' SIGNAL CORD (5/8"X3/4" METERS)

ALL METERS SHALL BE SENSUS SRII WITH
TOUCH READ PIT LID (TRPL)
AND MINIMUM 6' SIGNAL CORD (1" METERS)

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

METER SETTINGS FOR 3/4" AND 1" METERS

JANUARY 2004	DRAWING W - 1

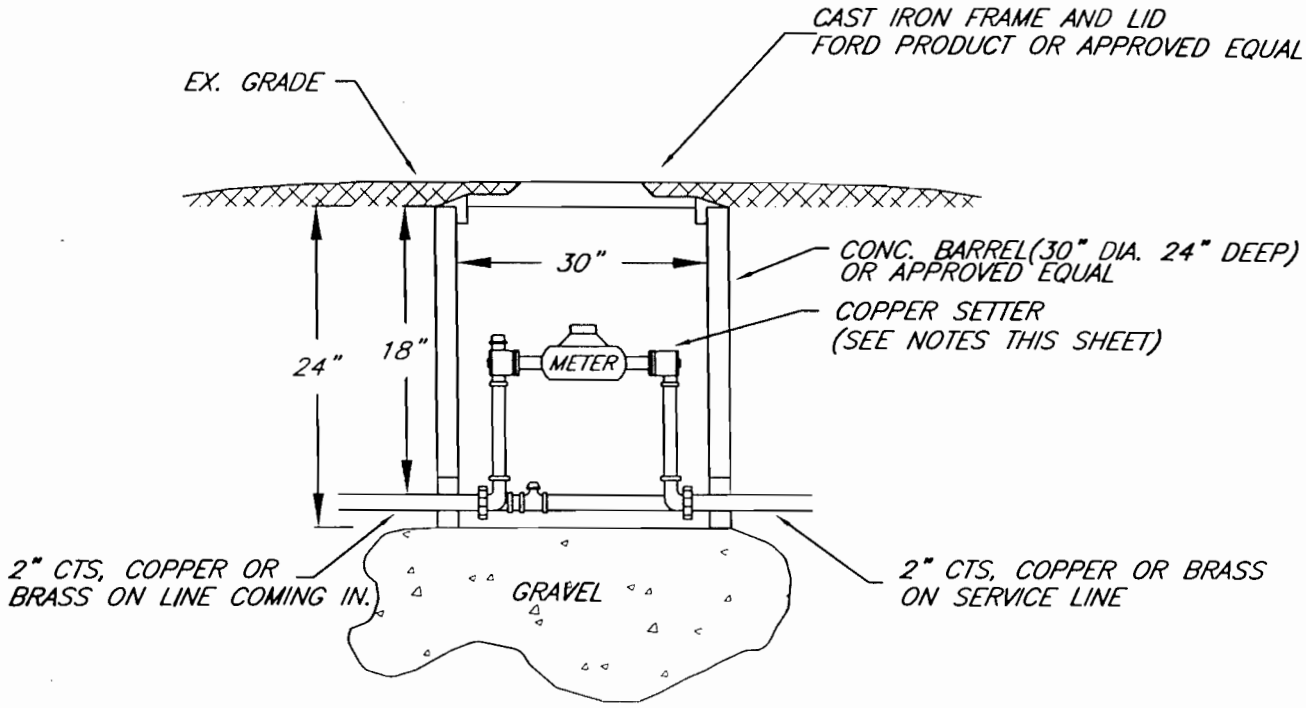
NOTES :

INLET VALVE SHALL BE FLANGED ANGLE BALL VALVE.

OUTLET OPTIONS MUST INCLUDE A FLANGED ANGLE DUAL CHECK VALVE

BY-PASS SHALL INCLUDE A BALL VALVE WITH PADLOCK WINGS

BRACE PIPE EYELETS ARE STANDARD – BRACE PIPE MUST BE INCLUDED



(NOT TO SCALE)

COMPOUND METERS: 2" SENSUS SRH WITH TOUCH READ PIT LID (TRPL) WITH MINIMUM CORD LENGTH OF 6'

TURBO METERS: 2" SENSUS TURBO WITH TOUCH READ PIT LID (TRPL) WITH MINIMUM CORD LENGTH OF 6'

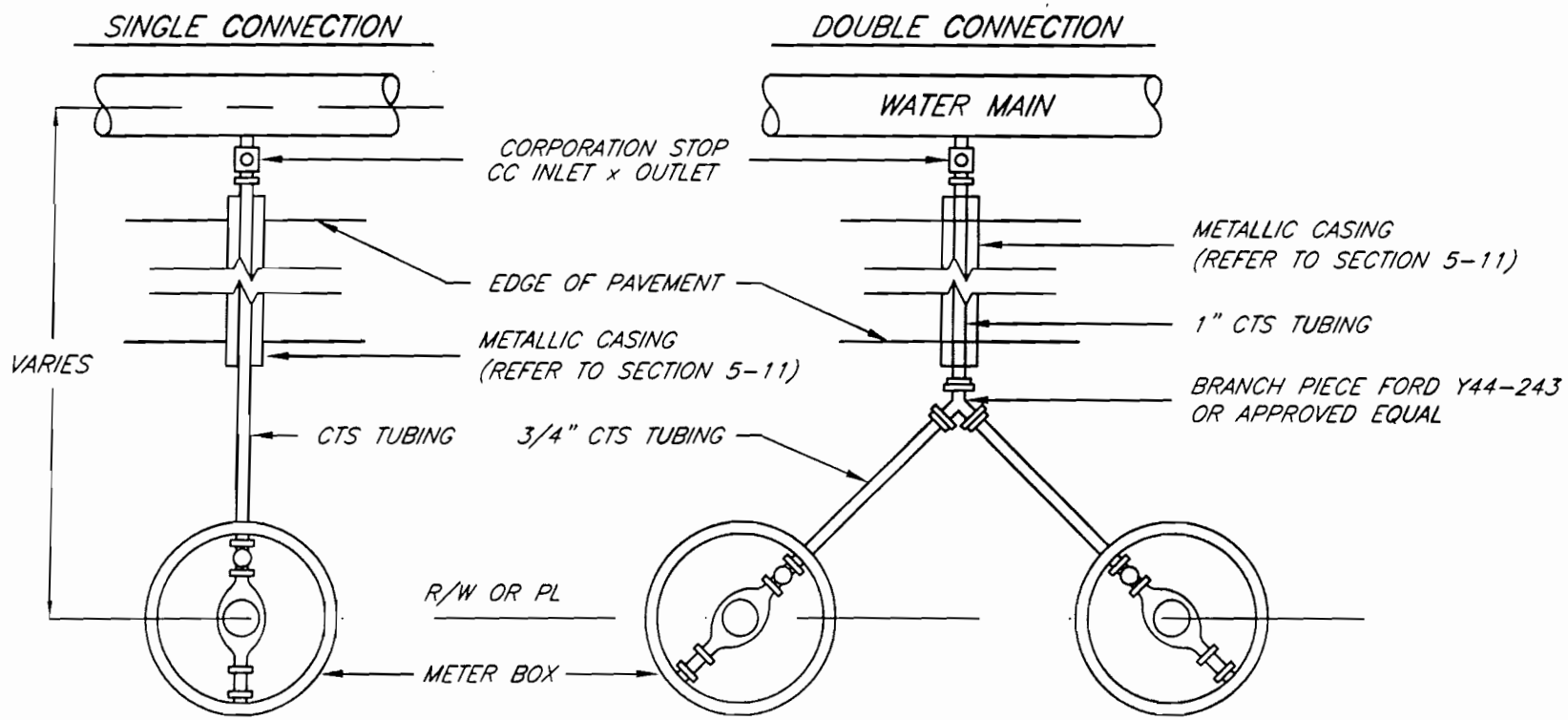
METER TYPE, COMPOUND VS. TURBO, SHALL BE APPROVED BY PSA ON A CASE BY CASE BASIS.

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

METER SETTINGS FOR 2" METERS

JANUARY 2004	DRAWING W – 1A



1. CORPORATION STOPS SHALL BE FORD F1000 RATED @ 100 PSI OR FB1000 RATED @ 300 PSI OR APPROVED EQUAL CC INLETS FOR ALL SIZES

SIZE - (IN)	OUTLET
3/4	PACK JOINT
1	PACK JOINT
2	MIPT OR FIPT

2. SERVICE SADDLES SHALL BE USED ON ALL TAPS TO ASBESTOS CEMENT, PVC PIPE AND FOR ALL 2" TAPS.

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

WATER SERVICE CONNECTIONS FOR SIZES UP TO 2 - INCHES

JANUARY 2004	DRAWING W - 2

FIRE HYDRANTS SHALL BE PAINTED WITH SHERWIN-WILLIAMS INDUSTRIAL ENAMEL

NOZZLE CAP COLOR CODE:
BLUE - 1500GPM OR MORE
GREEN - 1000GPM-1499GPM
ORANGE - 500GPM-999GPM
RED - 250GPM-499GPM
BLACK - LESS THAN 250GPM

PSA MAINTAINED FIRE HYDRANTS SHALL HAVE A BASE COLOR OF YELLOW

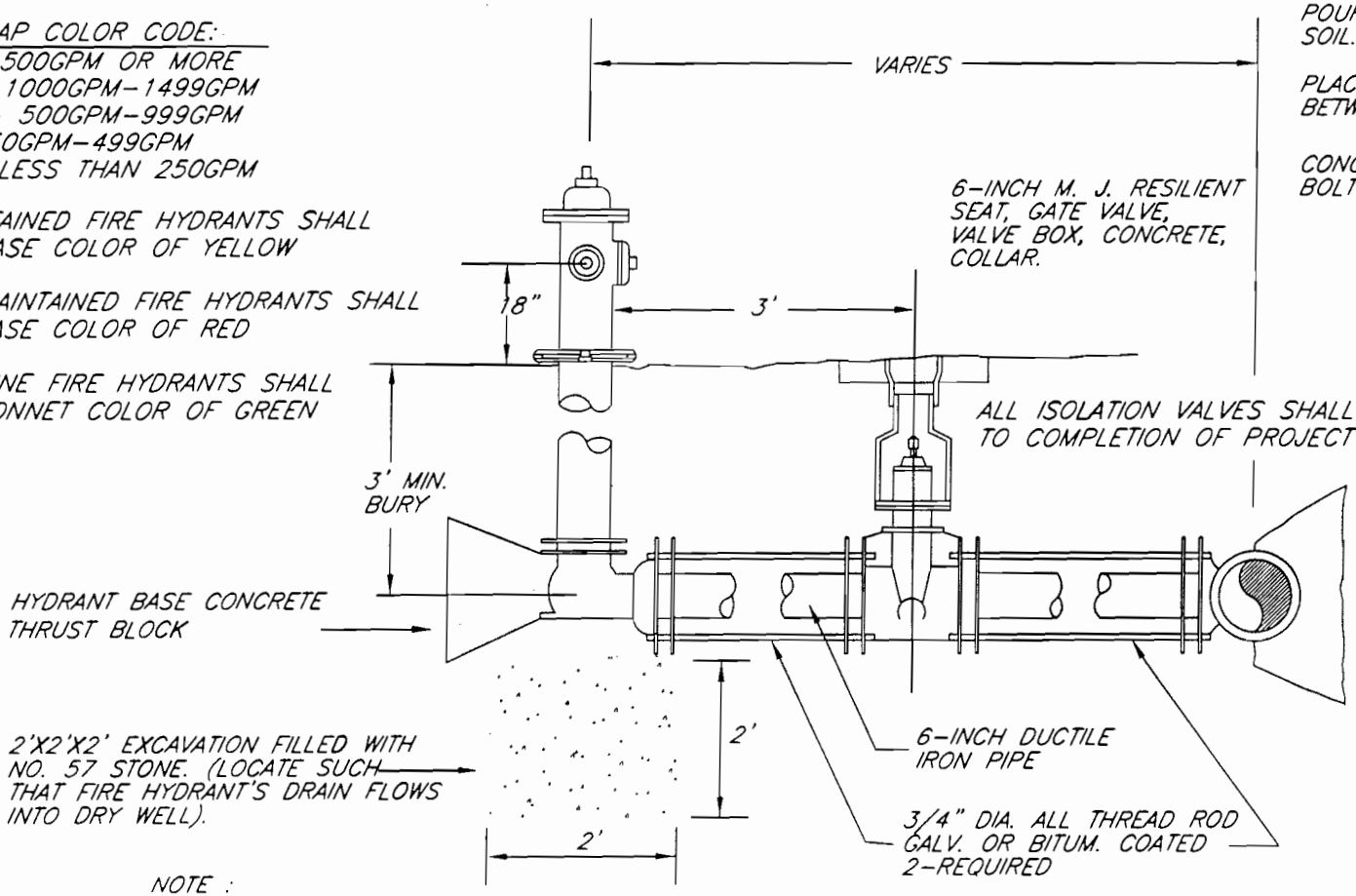
PRIVATE MAINTAINED FIRE HYDRANTS SHALL HAVE A BASE COLOR OF RED

END OF LINE FIRE HYDRANTS SHALL HAVE A BONNET COLOR OF GREEN

THRUST BLOCKS SHALL BE POURED AGAINST UNDISTURBED SOIL.

PLACE CONSTRUCTION PAPER BETWEEN FITTINGS AND CONC.

CONCRETE SHALL NOT COVER BOLTS OR DRAIN HOLES.



(NOT TO SCALE)

NOTE :

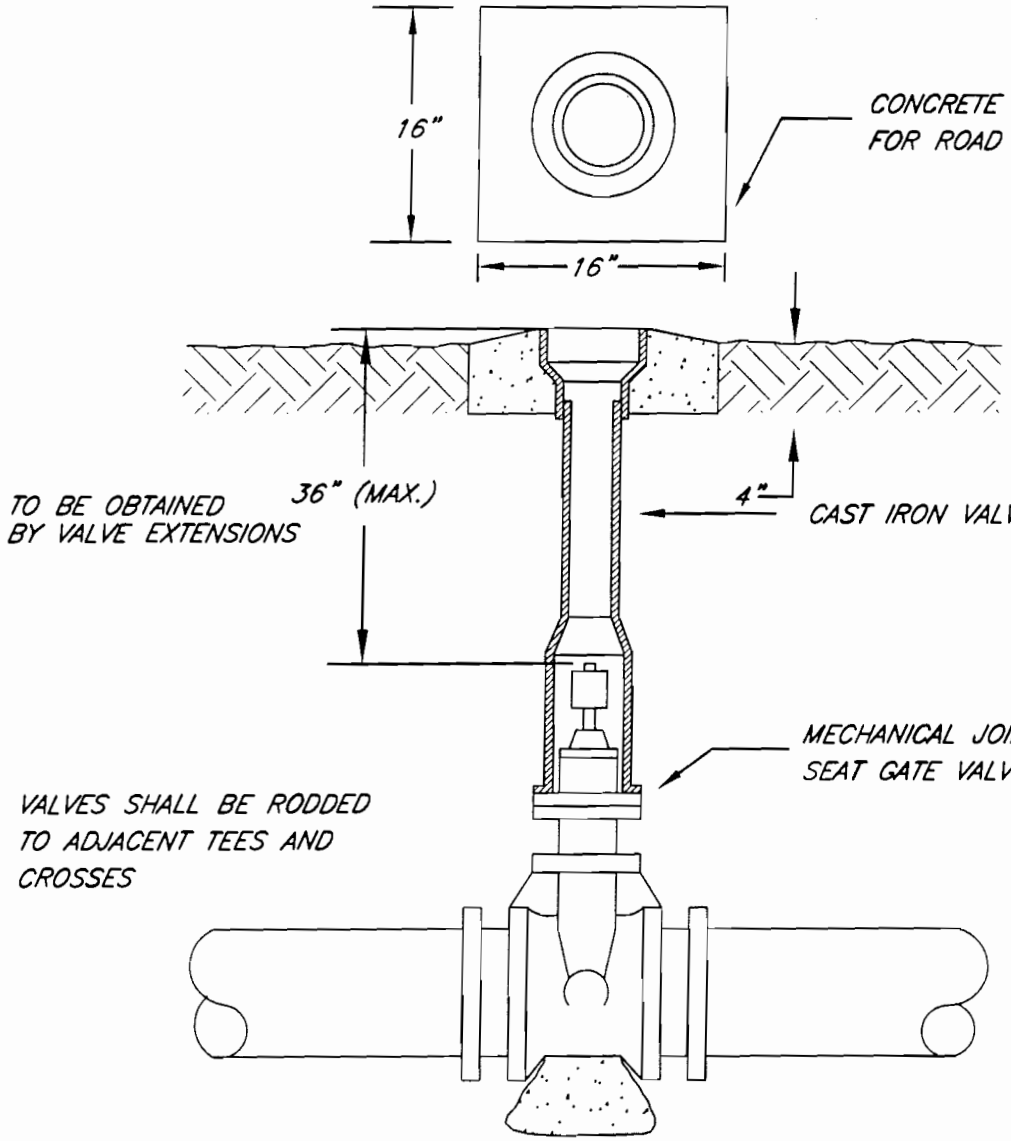
JOINT RESTRAINTS (I.E. MEGALUGS) OR GRIP RINGS MAY BE USED IN PLACE OF CONCRETE THRUST BLOCKS OR ALL THREADED ROD. THE NUMBER OF JOINT RESTRAINTS REQUIRED SHALL BE DETERMINED ON A CASE BY CASE BASIS.

HYDRANT WEEPHOLES SHALL BE PLUGGED WHEN LOCATED WHERE SATURATED SOIL EXISTS AND AREA SUBJECT TO FLOODING.

HENRY COUNTY PUBLIC SERVICE AUTHORITY

FIRE HYDRANT ASSEMBLY

JANUARY 2004	DRAWING W - 3



(NOT TO SCALE)

NOTE :

JOINT RESTRAINTS (I.E. MEGALUGS) OR GRIP RINGS MAY BE USED IN PLACE OF CONCRETE THRUST BLOCKS OR ALL THREADED ROD. THE NUMBER OF JOINT RESTRAINTS REQUIRED SHALL BE DETERMINED ON A CASE BY CASE BASIS.

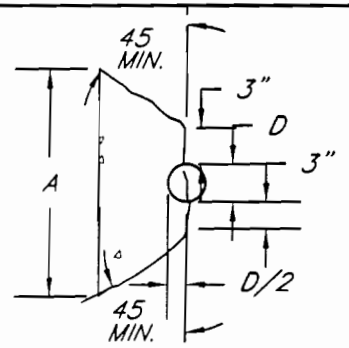
HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

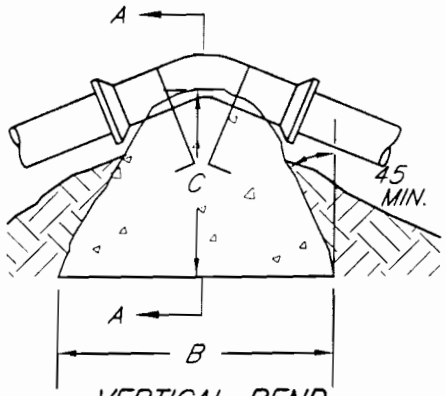
VALVE BOX INSTALLATION AND VALVE SETTING

JANUARY 2004	DRAWING W – 4

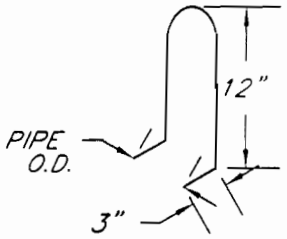
PIPE SIZE	TEE OR DEAD END			90 DEGREE BEND			45 DEGREE BEND			22 1/2 & 11 1/4 BENDS		
	A	B	C	A	B	C	A	B	C	A	B	C
6"	2'-0"	3'-0"	1'-6"	2'-6"	3'-0"	2'-0"	1'-6"	2'-6"	1'-6"	1'-6"	2'-6"	1'-6"
8"	3'-0"	4'-0"	3'-0"	4'-0"	4'-0"	3'-0"	3'-0"	3'-0"	3'-0"	2'-0"	3'-0"	3'-0"
10"	3'-0"	4'-5"	3'-0"	4'-0"	5'-0"	3'-0"	3'-0"	4'-0"	3'-0"	2'-6"	3'-0"	3'-0"
12"	4'-0"	6'-0"	3'-0"	6'-0"	6'-0"	3'-0"	4'-0"	5'-0"	3'-0"	3'-0"	3'-0"	3'-0"
16"	6'-0"	7'-0"	4'-0"	8'-0"	8'-0"	4'-0"	6'-0"	6'-0"	3'-0"	4'-0"	4'-0"	3'-0"
18"	7'-0"	7'-6"	4'-6"	8'-6"	9'-0"	4'-6"	6'-0"	7'-0"	3'-6"	4'-0"	5'-0"	3'-0"
20"	8'-0"	8'-0"	5'-0"	9'-0"	10'-0"	5'-0"	6'-0"	8'-0"	4'-0"	4'-0"	6'-0"	3'-0"



SECTION A-A



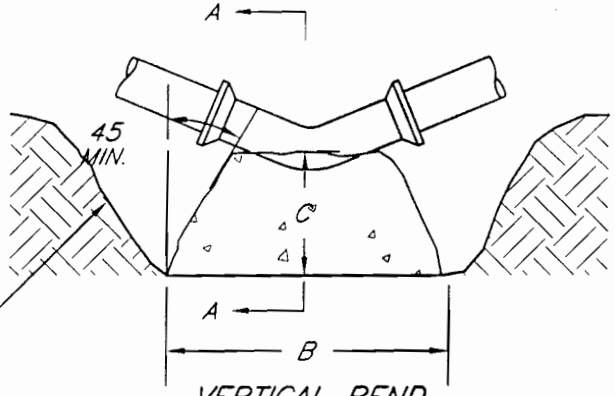
VERTICAL BEND



NO. 6 REBAR

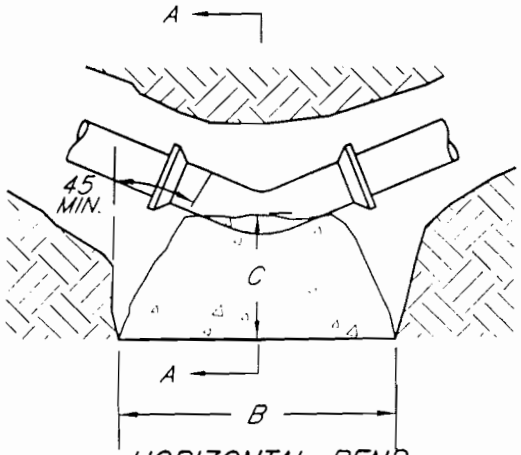
UNDISTURBED SOIL

2500 P.S.I. CONCRETE, TYPICAL

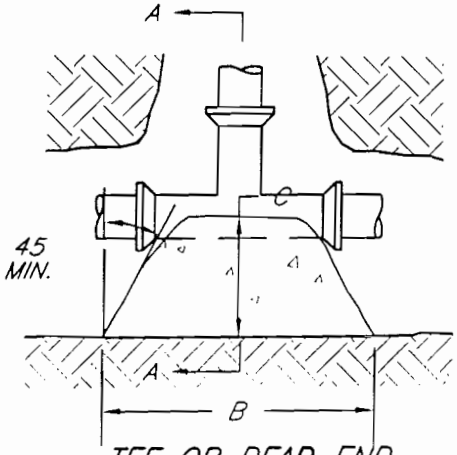


VERTICAL BEND

NOTE: WRAP FITTINGS WITH BUILDING PAPER. CONCRETE SHALL NOT INTERFERE WITH FITTING JOINTS.



HORIZONTAL BEND



TEE OR DEAD END

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

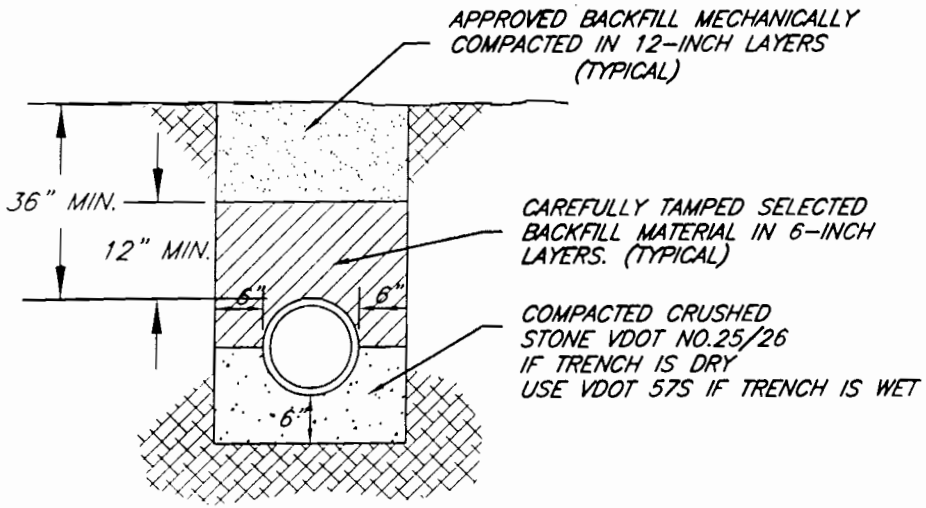
CONCRETE THRUST BLOCK

JANUARY 2004

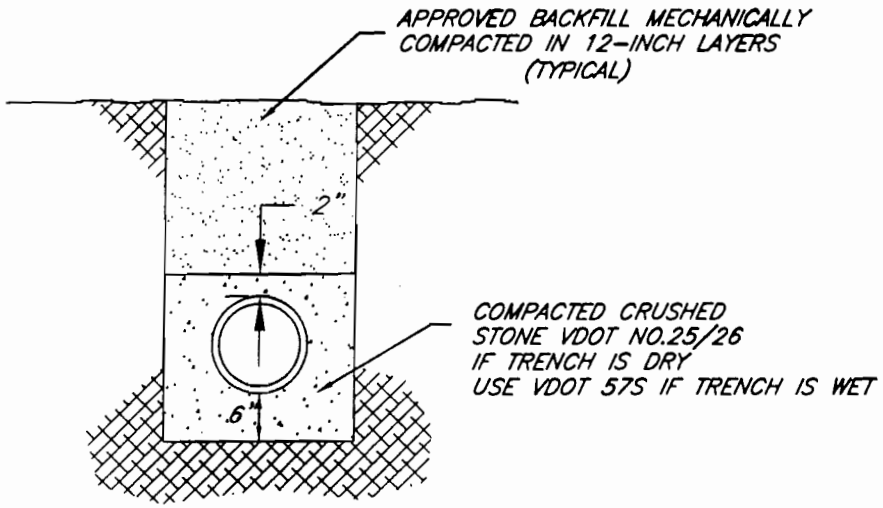
DRAWING W - 5

AWWA C900 OR SDR35

TYP. FOR PVC WATER OR SEWER LINES



0'-6' DEPTHS

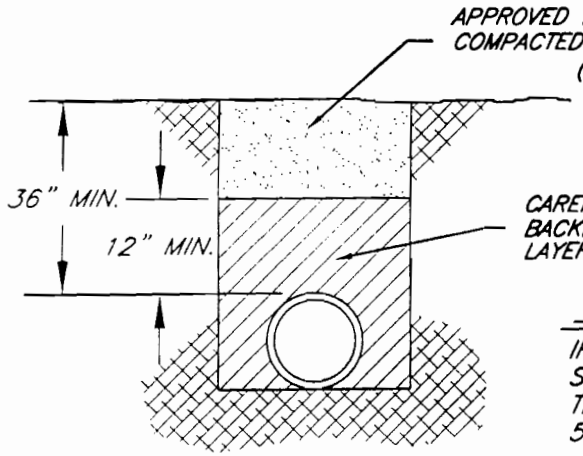


6'-14' DEPTHS

DEPTHS OVER 14' REQUIRE DUCTILE IRON

AWWA C600

TYP. FOR D.I. WATER OR SEWER LINES



NOTE :

IF SUBGRADE IS ROCK, DITCH SHALL BE OVERCUT 6" AND THEN BACKFILLED WITH VDOT 57S.

NOTES :

1. DIG TRENCH TO PROVIDE FOR PIPE BELLS.
2. DEPTHS GREATER THAN 14' REQUIRE DUCTILE IRON PIPE.

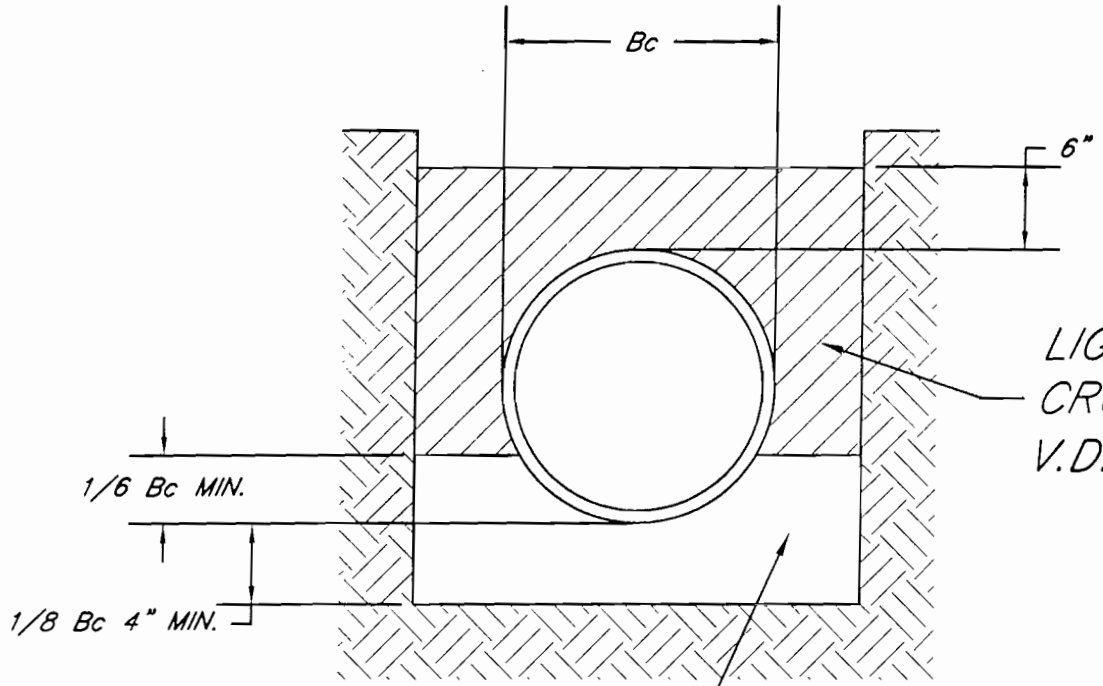
HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

PIPE BEDDING

JANUARY 2004

DRAWING W - 6



LIGHTLY COMPACTED
CRUSHER RUN
V.D.O.T. SIZE No. 25/26

UNDER BARREL

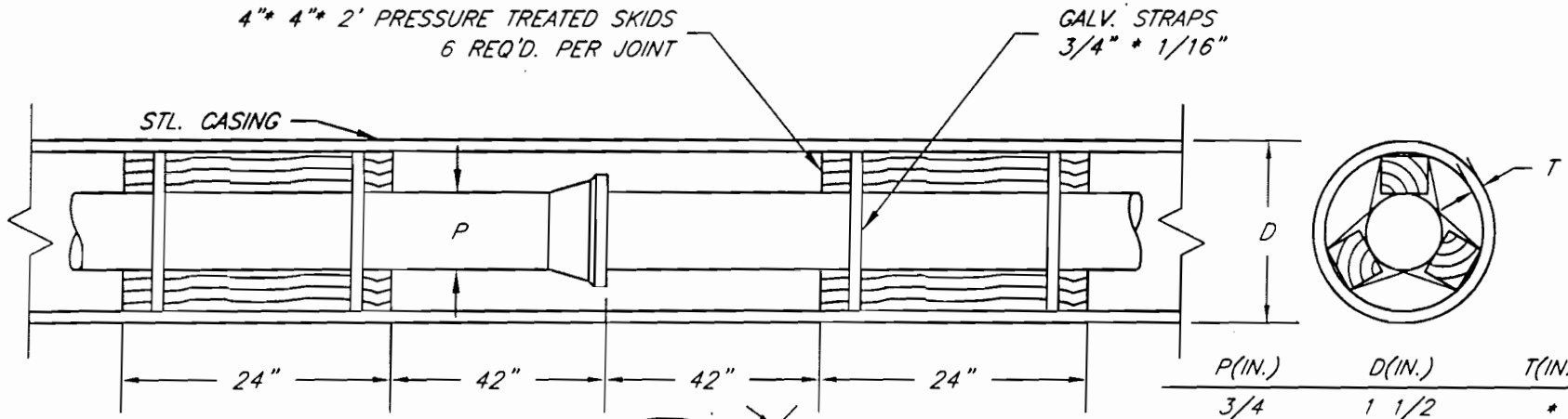
COMPACTED
CRUSHER RUN
V.D.O.T. SIZE No. 25/26

HENRY COUNTY PUBLIC SERVICE AUTHORITY

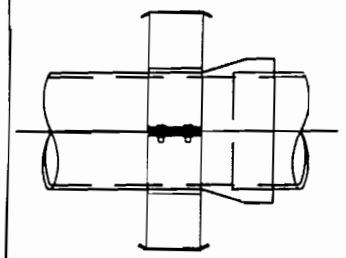
STANDARD DETAIL

REINFORCED CONCRETE PIPE
AND CLAY PIPE BEDDING DETAIL

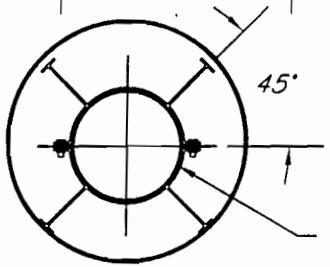
JANUARY 2004	DRAWING W – 6A



P(IN.)	D(IN.)	T(IN.)
3/4	1 1/2	*
1	2	*
2	4	
4	12	
6	16	1/4"
8	18	
10	20	
12	24	
16	30	
20	36	5/16"

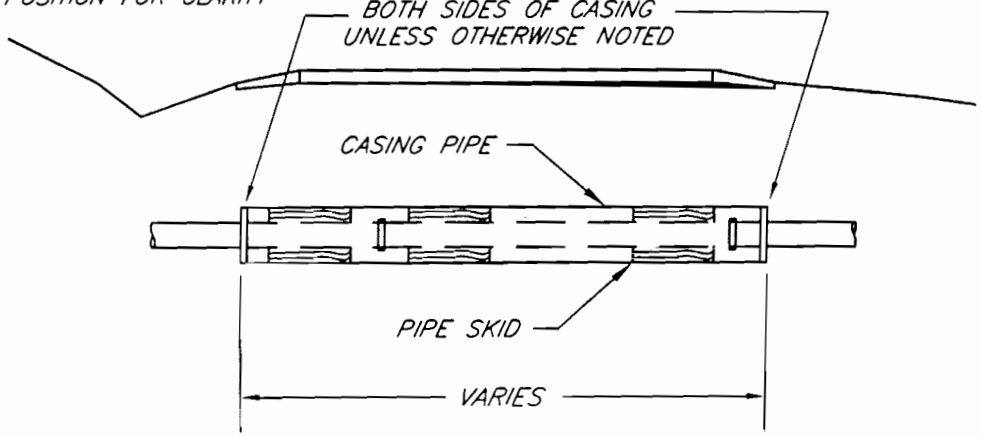


ALTERNATE STEEL SPIDER BY COLLINS UNDERGROUND CONSTRUCTION OR APPROVED EQUAL



NOTE
LEGS ROTATED OUT OF POSITION FOR CLARITY

* GALVANIZED STEEL, BLACK STEEL, OR EMT



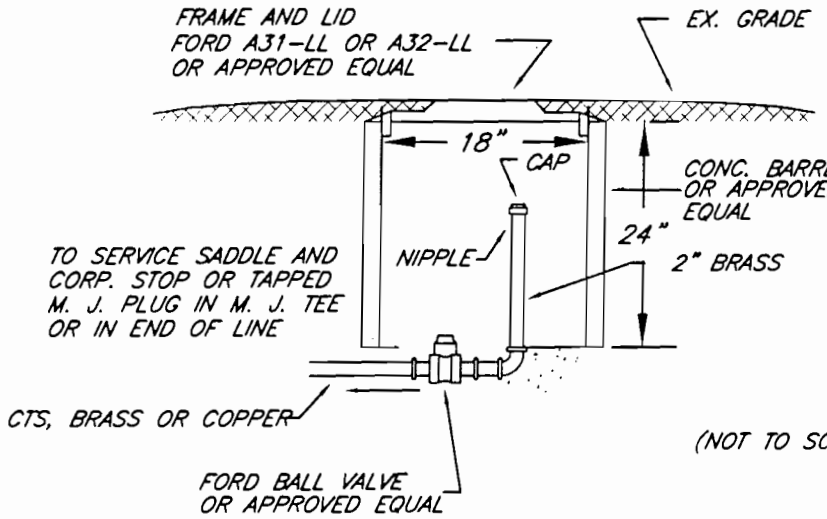
HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

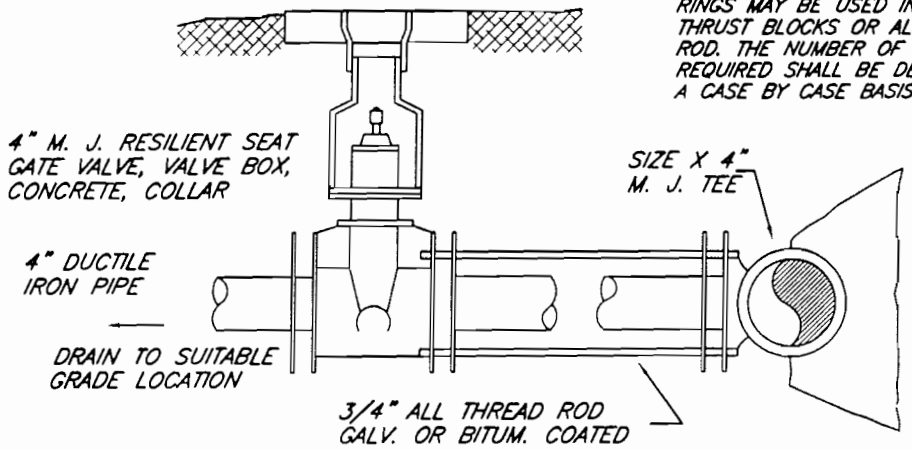
BORED AND CASED
ROAD CROSSING

JANUARY 2004

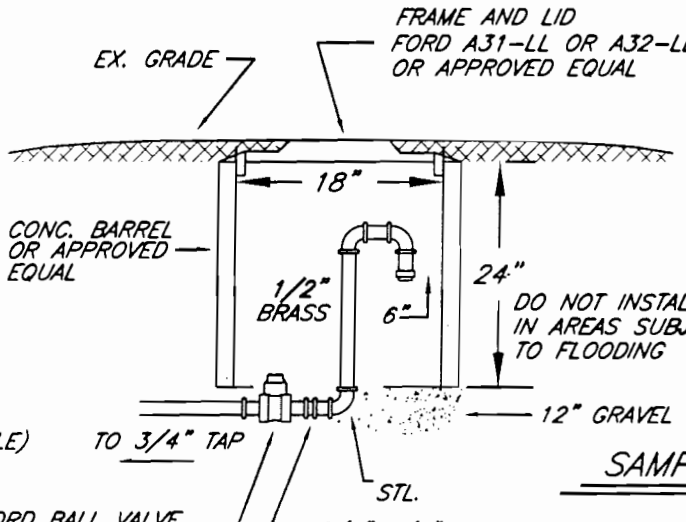
DRAWING W – 7



BLOW-OFF ASSEMBLY FOR WATER LINES UP TO 8" NOMINAL SIZE



BLOW-OFF ASSEMBLY FOR WATER LINES 10" AND LARGER



(NOT TO SCALE)

SAMPLE TAP

THRUST BLOCKS SHALL BE POURED AGAINST UNDISTURBED SOIL.

PLACE CONSTRUCTION PAPER BETWEEN FITTINGS AND CONCRETE

NOTE :

JOINT RESTRAINTS (I.E. MEGALUGS) OR GRIP RINGS MAY BE USED IN PLACE OF CONCRETE THRUST BLOCKS OR ALL THREADED ROD. THE NUMBER OF JOINT RESTRAINTS REQUIRED SHALL BE DETERMINED ON A CASE BY CASE BASIS.

NOTE :

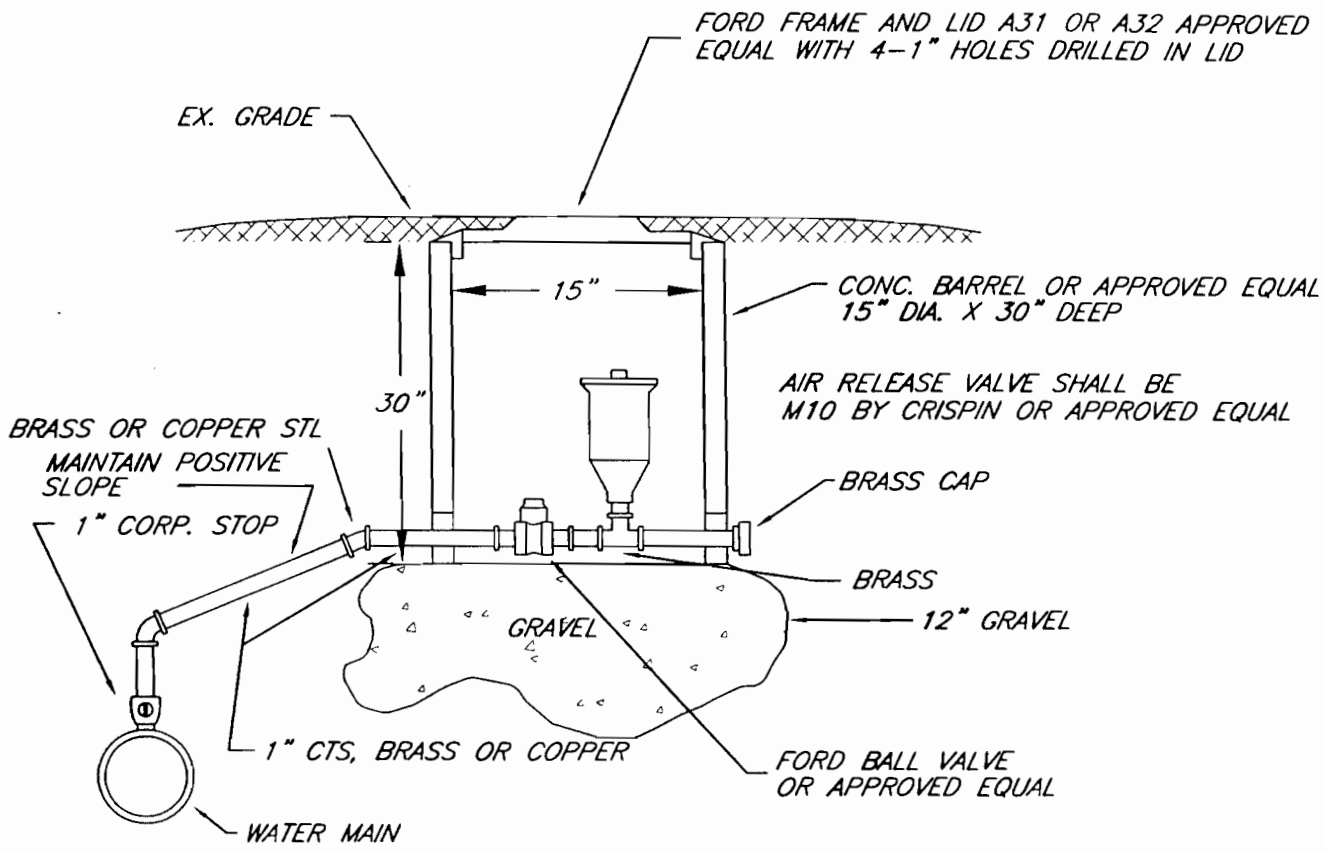
GIL AQUARIUS MODELS GH & GHS PRE-MANUFACTURED BLOW-OFFS ARE APPROVED EQUALS

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

BLOW-OFF AND SAMPLE TAP ASSEMBLLIES

JANUARY 2004	DRAWING W - 8



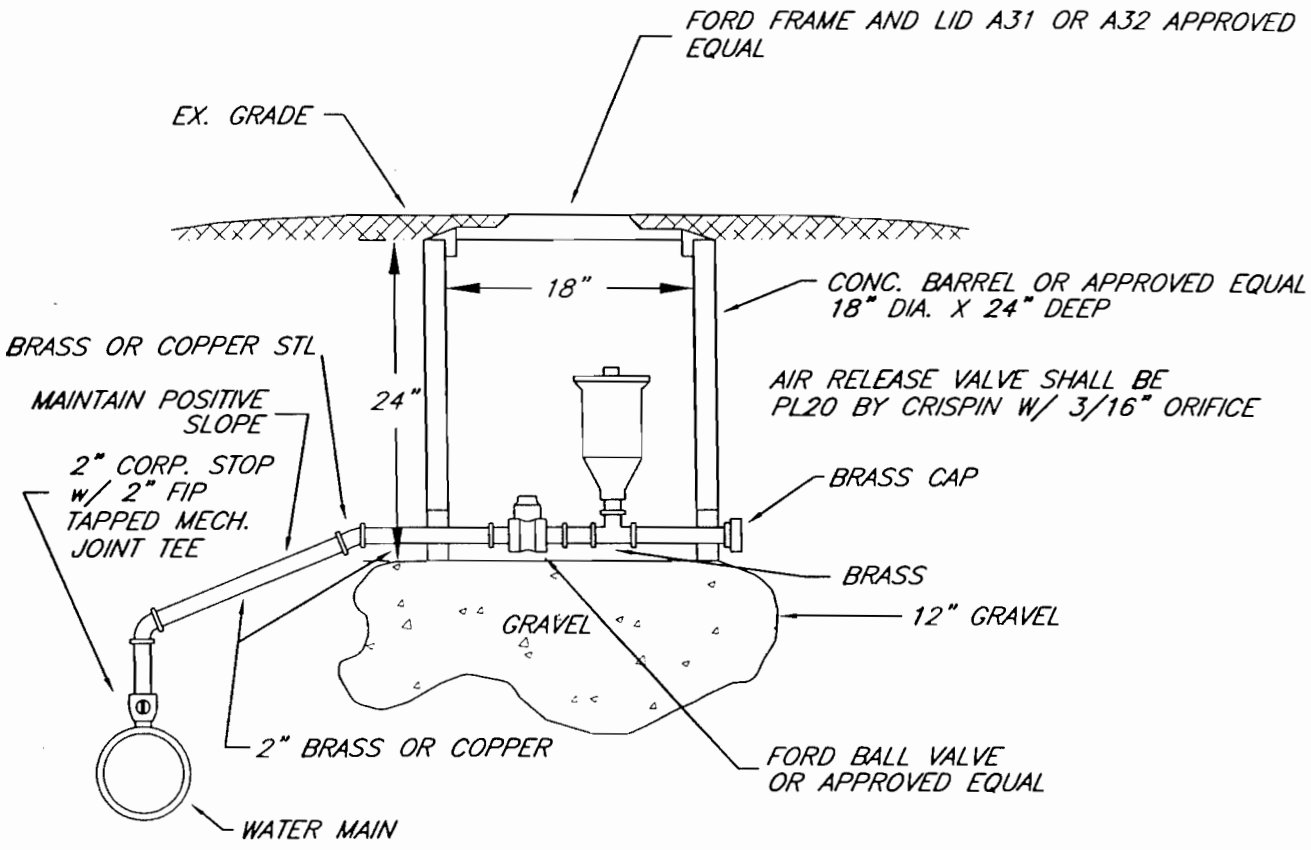
(NOT TO SCALE)

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

1" AUTOMATIC AIR RELEASE ASSEMBLY

JANUARY 2004	DRAWING W – 9



(NOT TO SCALE)

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

2" AUTOMATIC AIR RELEASE ASSEMBLY

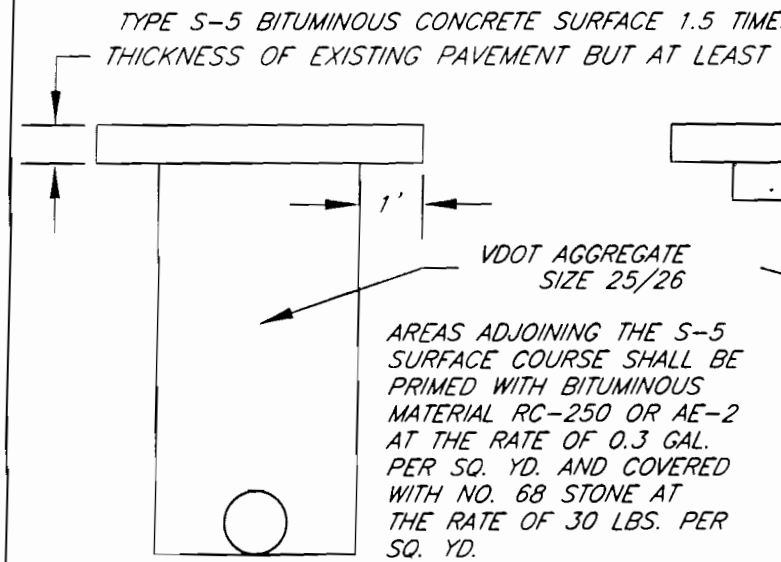
JANUARY 2004	DRAWING W – 9A

1. ALL PAVEMENT CUTTING AND RESTORATION SHALL BE PERFORMED TO THE SATISFACTION OF THE VIRGINIA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION.

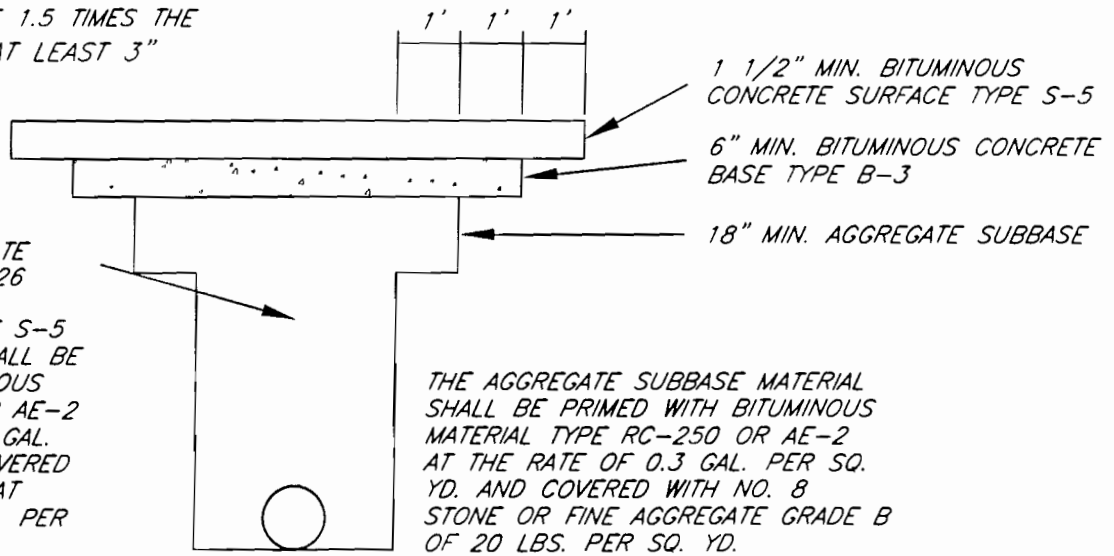
2. PAVEMENT SHALL BE CUT ONLY WHERE INDICATED ON THE PLANS, OR WITH THE APPROVAL OF THE VDOT.

3. WHEREVER ANY PORTION OF PAVED ROADWAY IS EXCAVATED, THE PAVEMENT SHALL FIRST BE CUT WITH A MECHANICAL PAVEMANT CUTTER TO YIELD A UNIFORM STRAIGHT LINE CUT WITH VERTICAL FACES.

4. ALL TRENCH BACKFILL MATERIAL WITHIN ROADWAY PAVEMENT SHALL BE VDOT AGGREGATE SIZE NO. 25/26 BACKFILLED IN 6" LAYERS COMPACTED TO 95% DENSITY.



BITUMINOUS SURFACE TREATED PAVEMENT RESTORATION

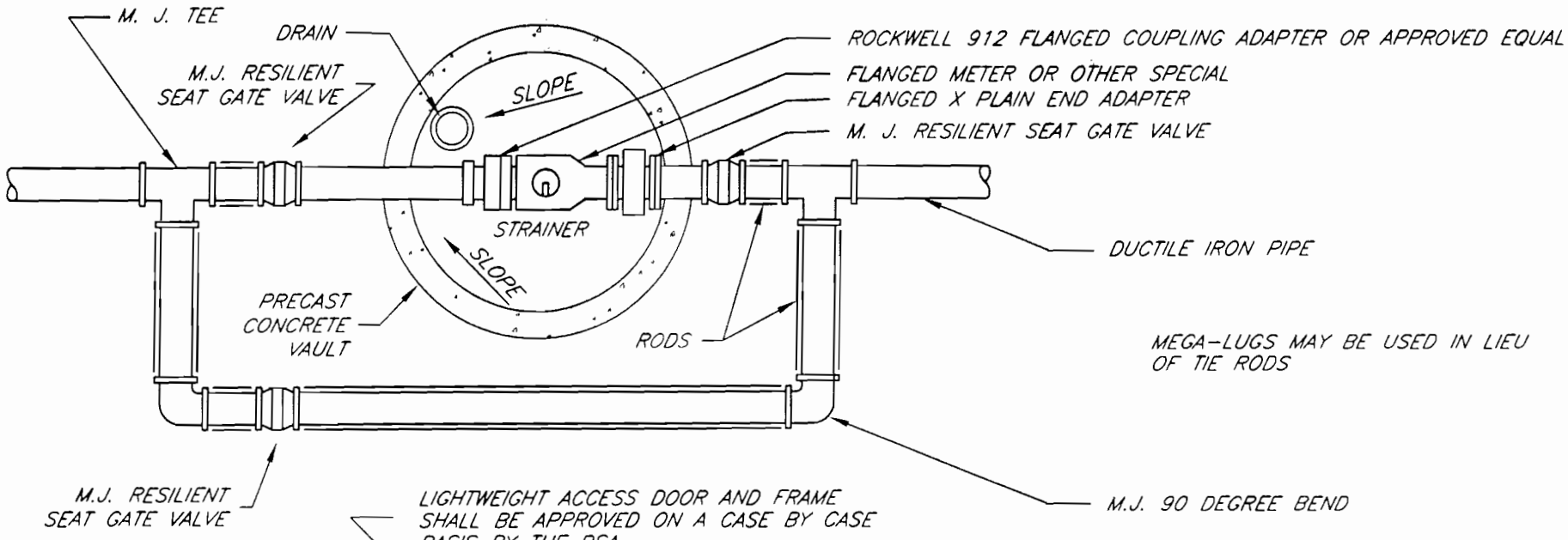


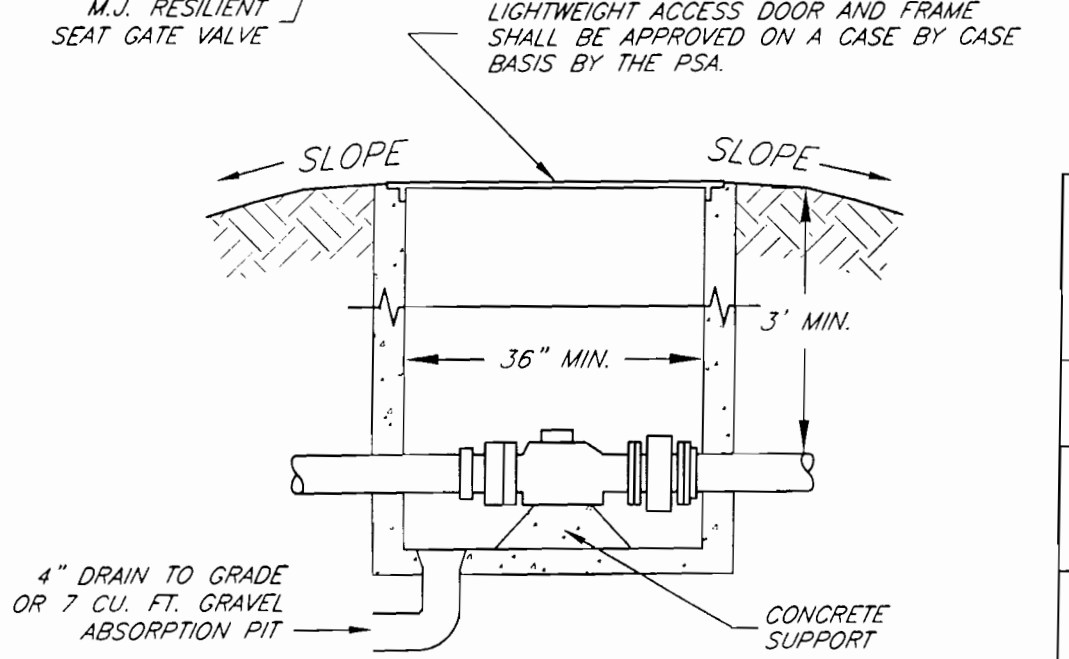
BITUMINOUS CONCRETE PAVEMENT RESTORATION

HENRY COUNTY PUBLIC SERVICE AUTHORITY

PAVEMENT RESTORATION

JANUARY 2004 | DRAWING W – 10



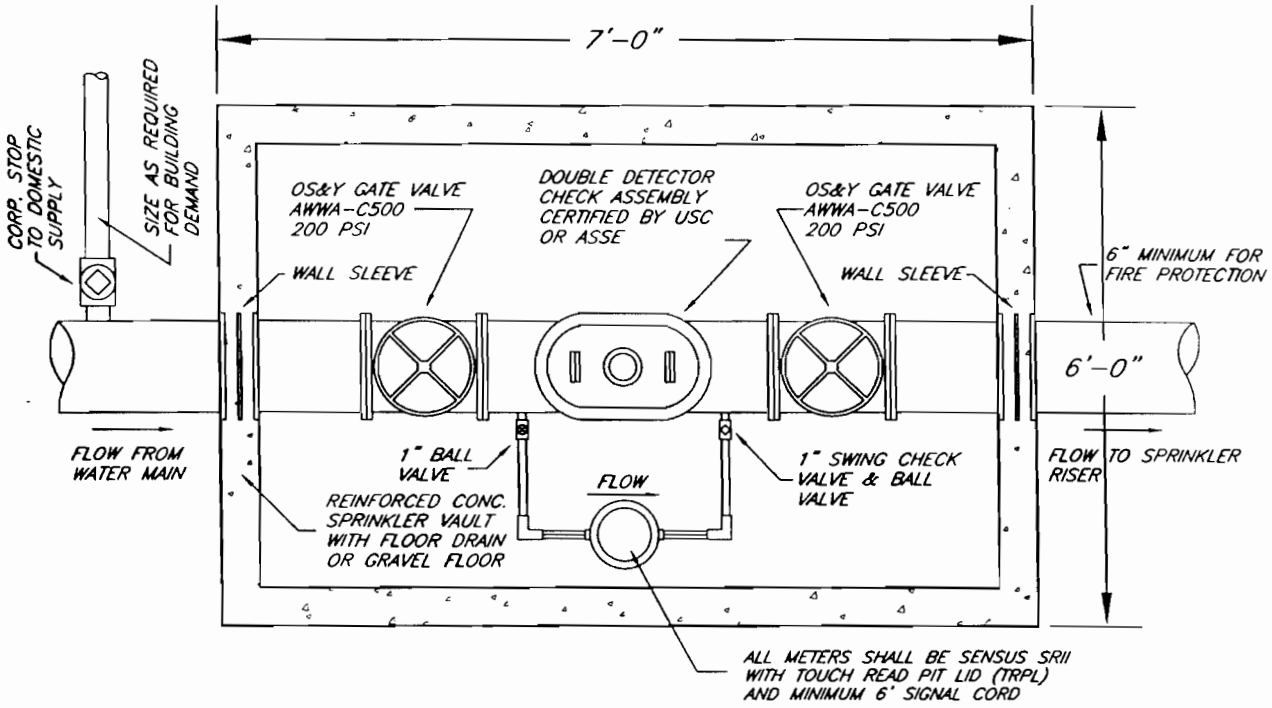


HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

METER SETTING FOR
METERS AND SPECIAL DEVICES
3 – INCH AND GREATER

JANUARY 2004	DRAWING W – 11



PLAN – DOUBLE DETECTOR CHECK VAULT

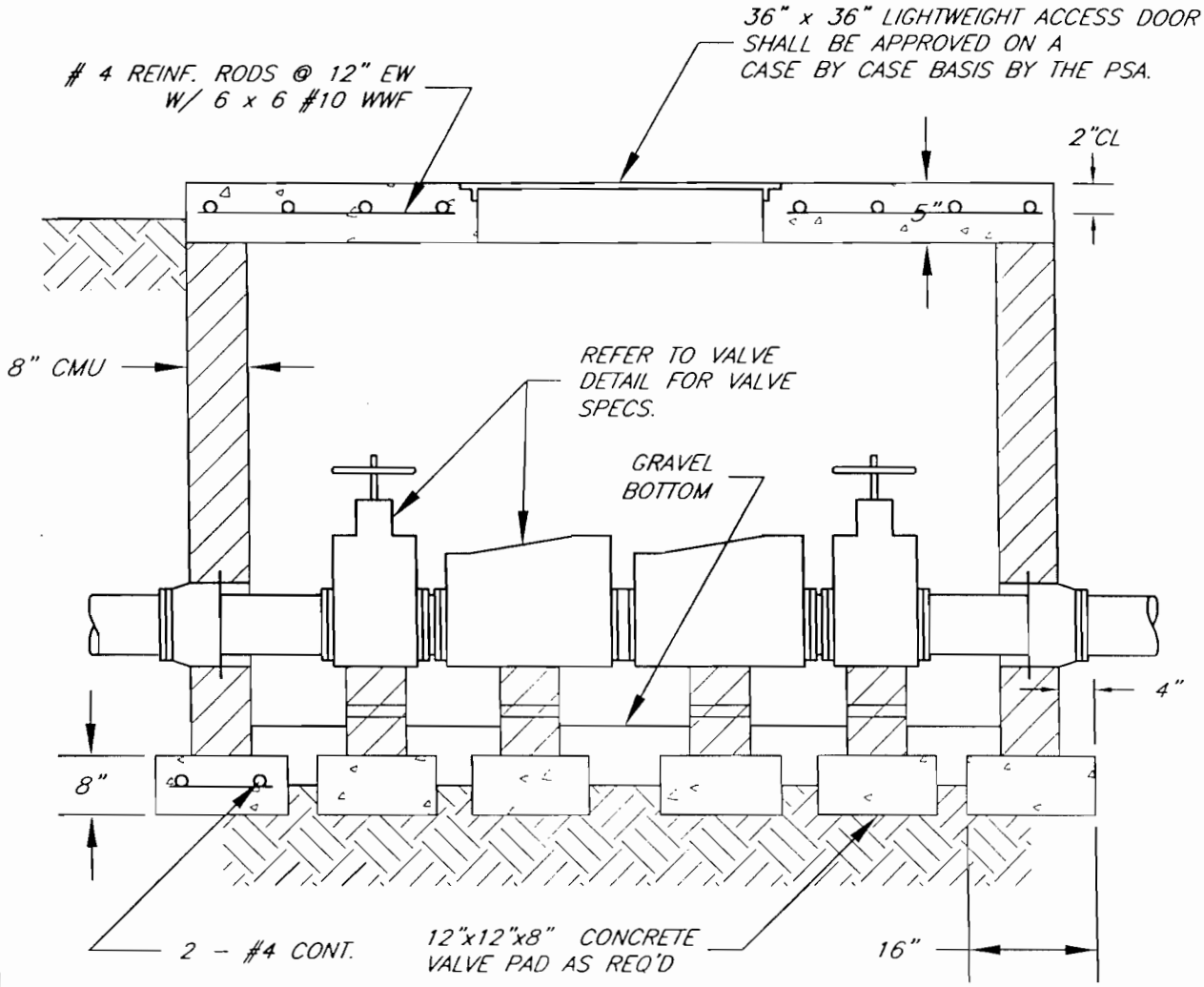
(NOT TO SCALE)

- REFER TO NFPA 13 & NFPA 24
- VAULT TO BE INSTALLED AT LEAST 40' FROM BUILDING
- METER TO BE ACCESSIBLE TO METER READERS
- VALVE AND METER SIZES WILL VARY ACCORDING TO DEMAND
- SIAMESE CONNECTION REQUIRES ADDITIONAL SWING CHECK VALVE ON MAIN
- ALL INSTALLATIONS SHALL BE SUBMITTED IN PLAN FORM AND APPROVED IN WRITING PRIOR TO INSTALLATION
- DOUBLE DETECTOR CHECK VALVE DEVICE SHALL BE CERTIFIED BY EITHER USC (UNIVERSITY OF SOUTHERN CALIFORNIA) OR ASSE

HENRY COUNTY PUBLIC SERVICE AUTHORITY

DOUBLE DETECTOR CHECK VALVE ASSEMBLY DETAIL

JANUARY 2004	DRAWING W – 12



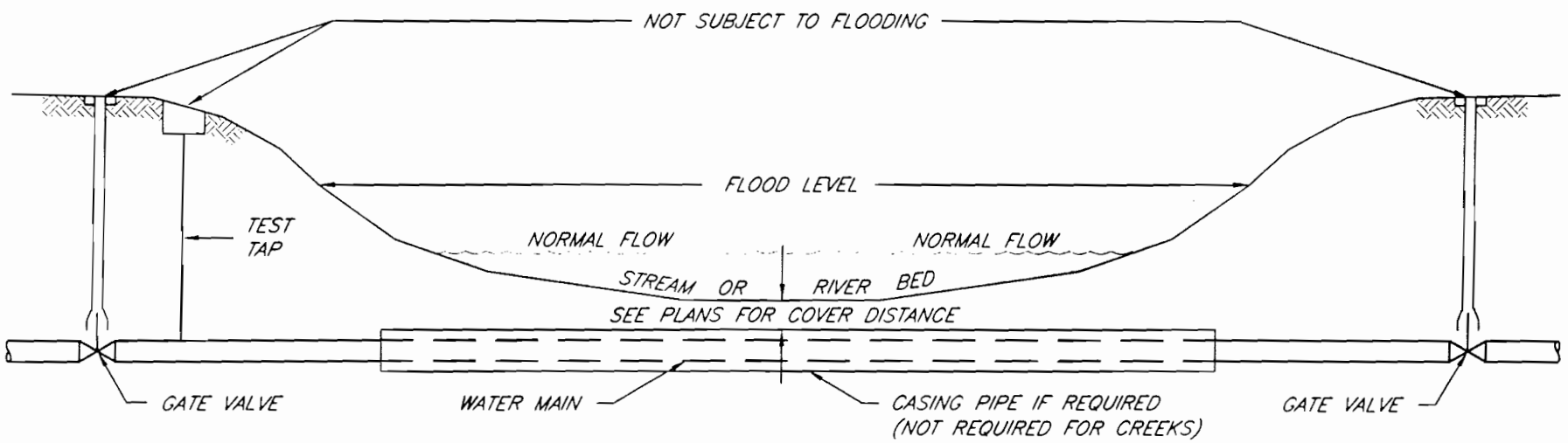
VAULT DETAIL

1. STEEL SHALL CONFORM TO ASTM 615-60.
2. LADDER MAY BE REQUIRED IF VAULT EXCEEDS 36" DEPTH.
3. CONCRETE TOP SHALL BE 3500 PSI @ 28 DAYS.
4. CONCRETE AT FOOTINGS SHALL BE 3000 PSI @ 28 DAYS.

HENRY COUNTY PUBLIC SERVICE AUTHORITY

VAULT DETAIL

JANUARY 2004	DRAWING W - 13



NOTE: SEE DRAWING W-8 FOR SAMPLE TAP DETAIL AND DRAWING W4 FOR VALVE DETAIL.

NOTES

1. THE PIPE SHALL BE OF SPECIAL CONSTRUCTION, HAVING FLEXIBLE WATERTIGHT JOINTS.
2. VALVES SHALL BE PROVIDED AT BOTH ENDS OF THE WATER CROSSING SO THAT THE SECTION CAN BE ISOLATED FOR TESTS OR REPAIR; THE VALVES SHALL BE EASILY ACCESSIBLE AND NOT SUBJECT TO FLOODING.
3. SAMPLE TAPS SHALL BE AVAILABLE AT EACH END OF THE CROSSING AND AT A REASONABLE DISTANCE FROM EACH SIDE OF THE CROSSING AND NOT SUBJECT TO FLOODING.
4. PERMANENT TAPS SHALL BE MADE FOR TESTING AND LOCATING LEAKS.

HENRY COUNTY PUBLIC SERVICE AUTHORITY

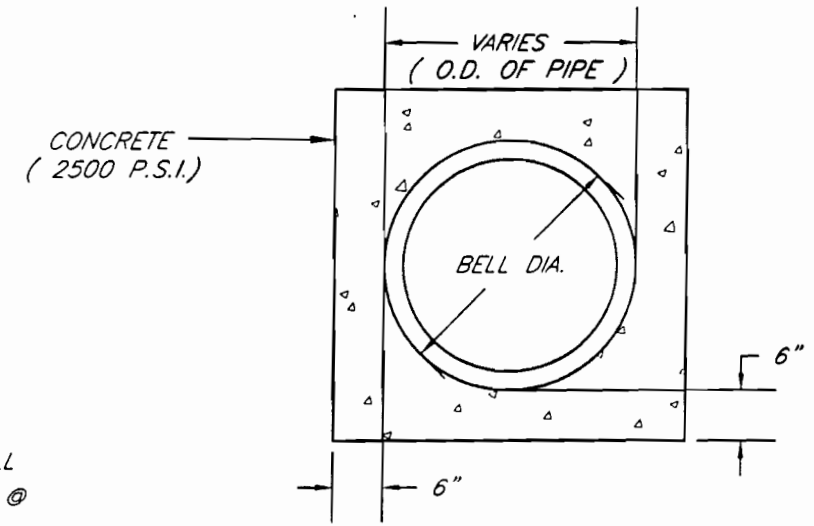
STANDARD DETAIL

SUBSURFACE WATER CROSSING

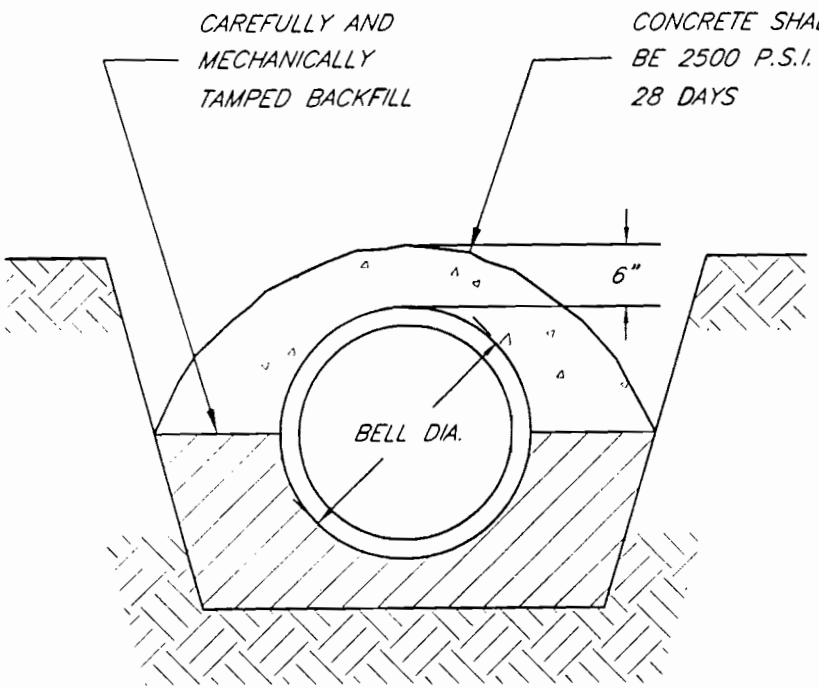
JANUARY 2004	DRAWING W – 14

SEWER

REFER TO DETAIL W6 FOR BEDDING REQUIREMENTS



CONCRETE ENCASEMENT



CONCRETE CAP

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

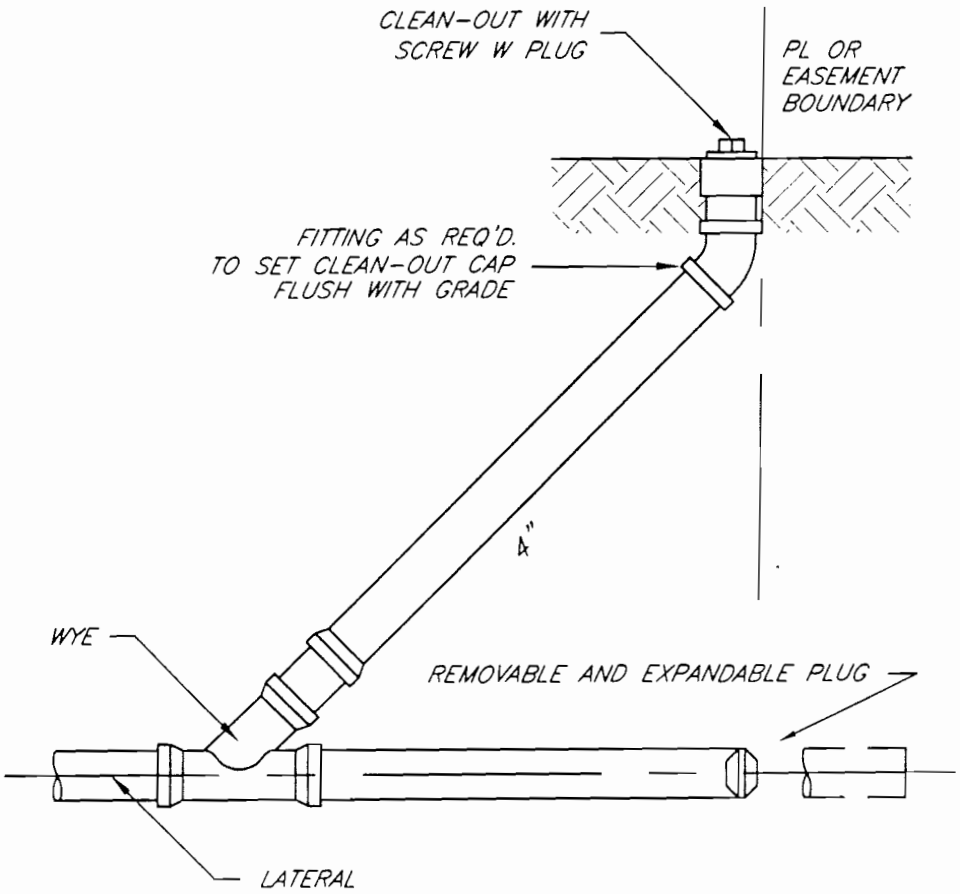
SEWER PIPE BEDDING,
CONCRETE ENCASEMENT,
CONCRETE CAP

JANUARY 2004	DRAWING S – 1

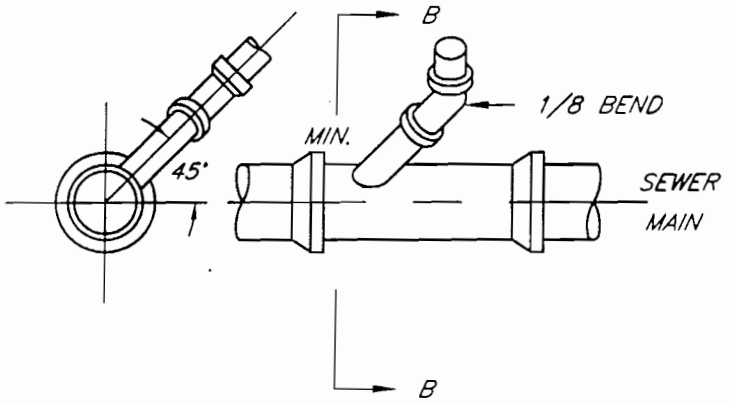
NOTES :

HOUSE CONNECTIONS SHALL BE MADE WITH 4" PIPE.

APPROVED STRAPPED SADDLE WYES MAY BE USED WHERE APPROVED BY THE AUTHORITY.



HOUSE CONNECTION TO BE INSTALLED BY PROPERTY OWNER



SECTION B-B

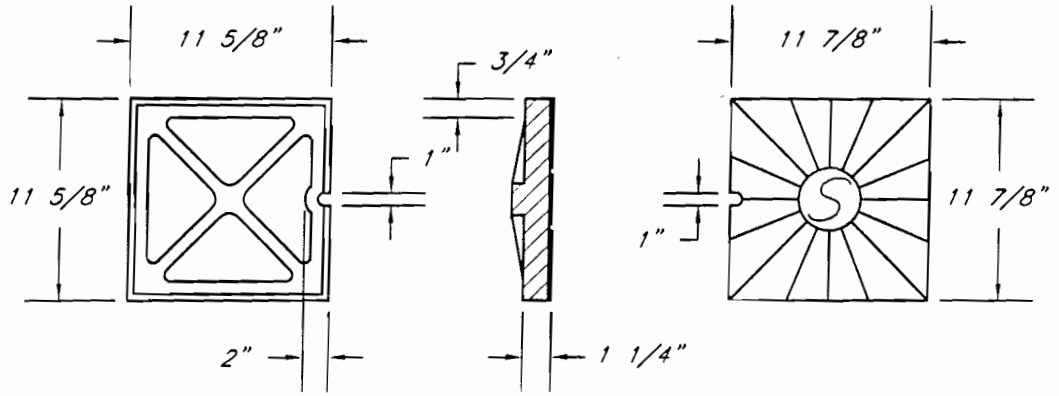
WYE BRANCH

HENRY COUNTY PUBLIC SERVICE AUTHORITY

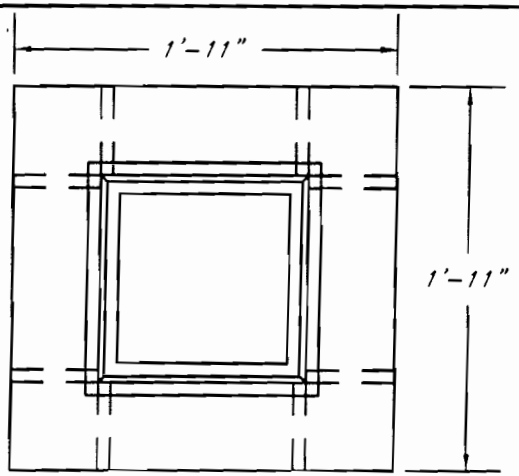
STANDARD DETAIL

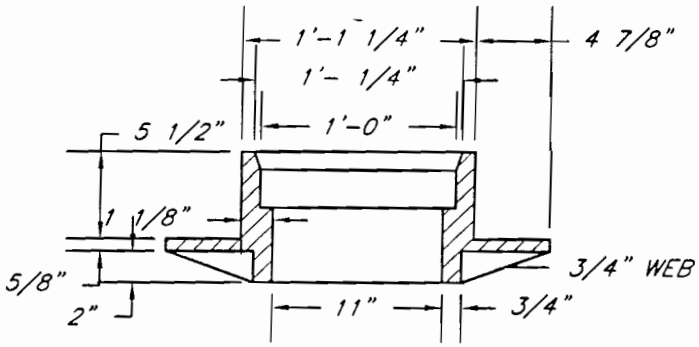
SEWER SERVICE CONNECTIONS AND CLEAN-OUT

JANUARY 2004	DRAWING S - 2

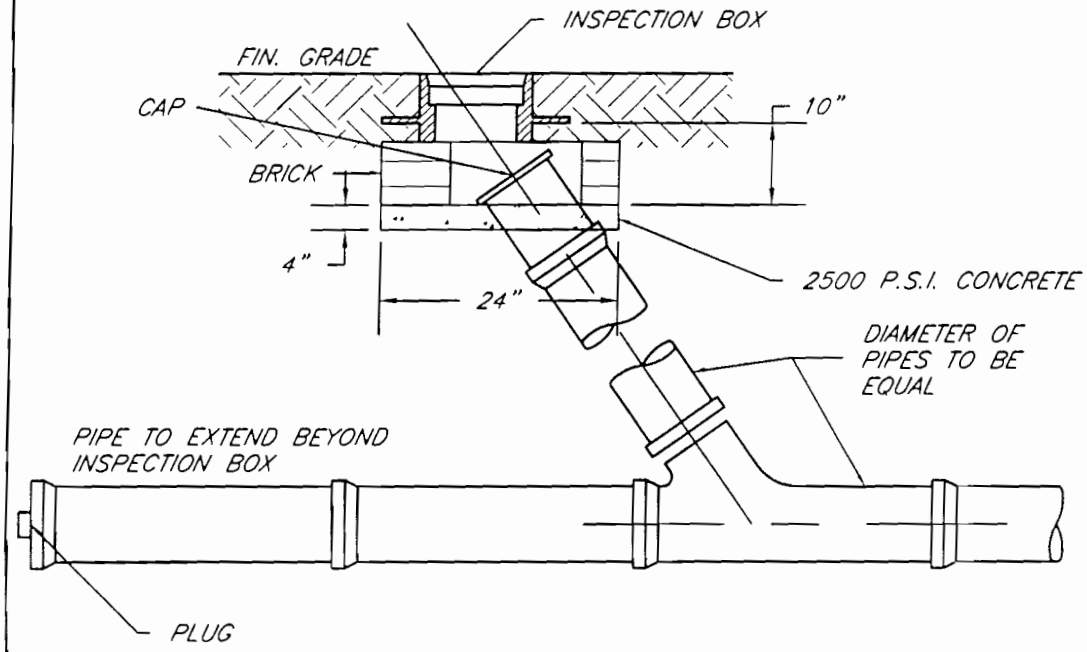


INSPECTION BOX COVER





INSPECTION BOX FRAME

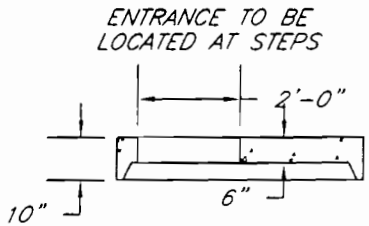


HENRY COUNTY PUBLIC SERVICE AUTHORITY

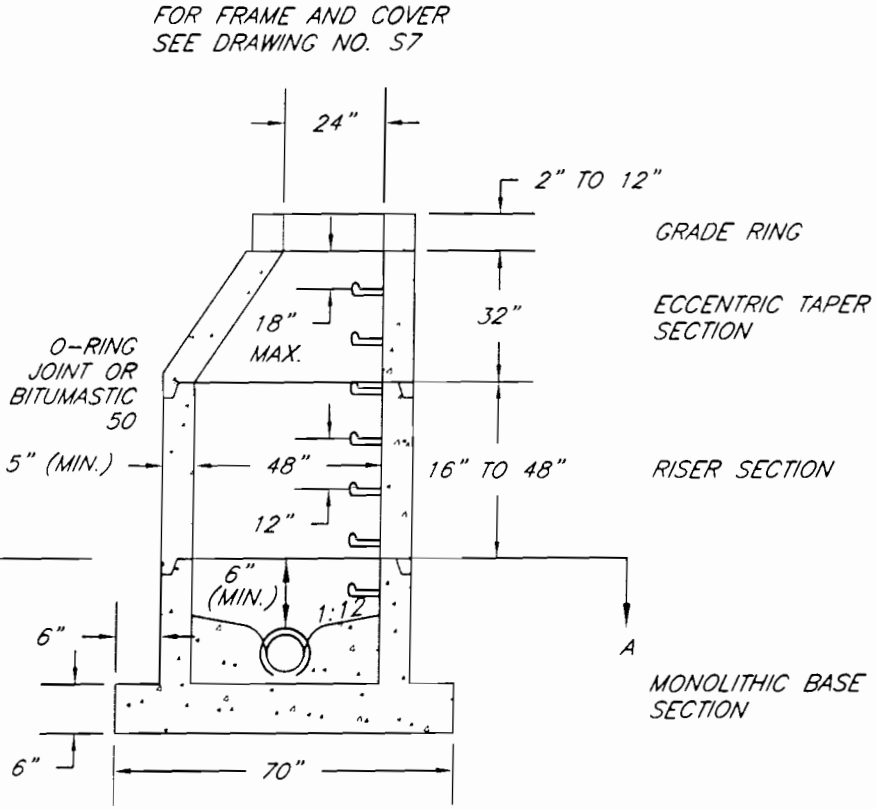
STANDARD DETAIL

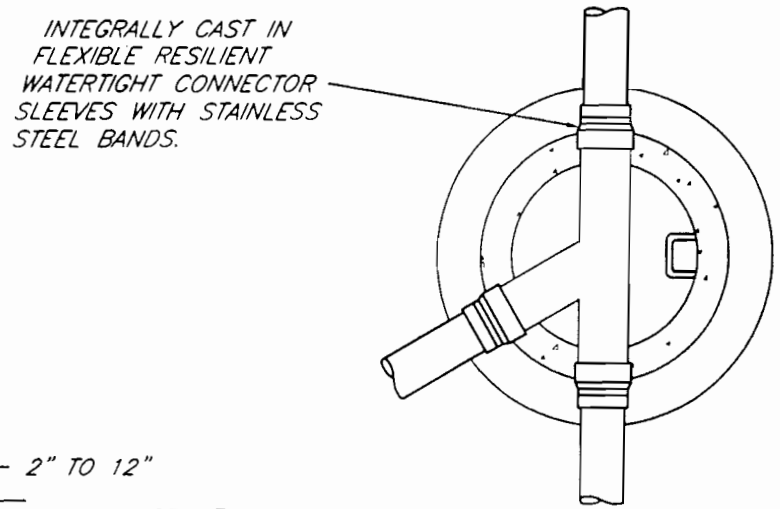
TERMINAL CLEAN-OUT
FOR
SEWER MAINS

JANUARY 2004	DRAWING S - 3



ALTERNATE FLAT TOP





SECTION A–A

NOTES

INVERT CHANNELS SHALL BE SMOOTH, SEMI–CIRCULAR AND SHALL PROVIDE A CONTINUOUS INVERT THROUGH THE MANHOLE.

NON PREFORMED INVERT CHANNELS SHALL BE FORMED WITH BRICK SURFACED WITH CEMENT MORTAR.

TRIBUTARIES CHANNELS SHALL JOIN WITH A SMOOTH TRANSITION.

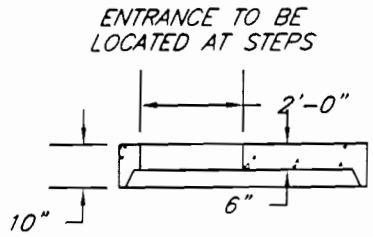
STEPS SHALL BE INTEGRALLY CAST IN AND SHALL CONSIST OF NO. 4 REBAR WITH POLYPROPYLENE COATING.

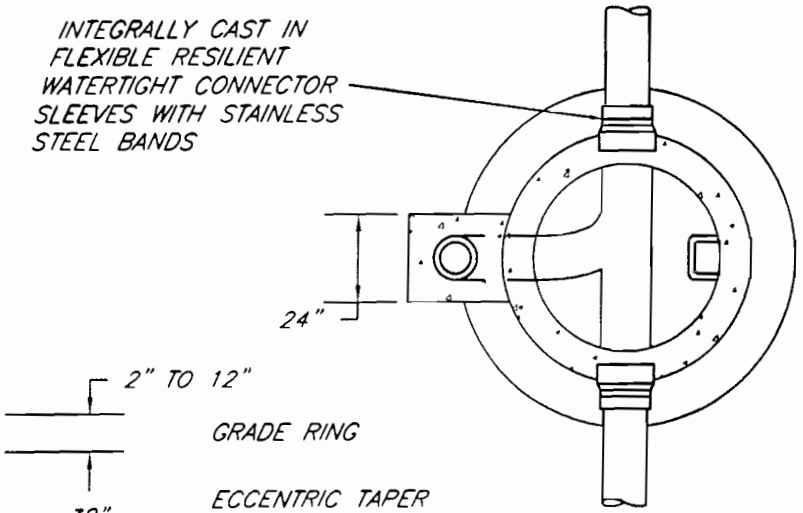
HENRY COUNTY PUBLIC SERVICE AUTHORITY

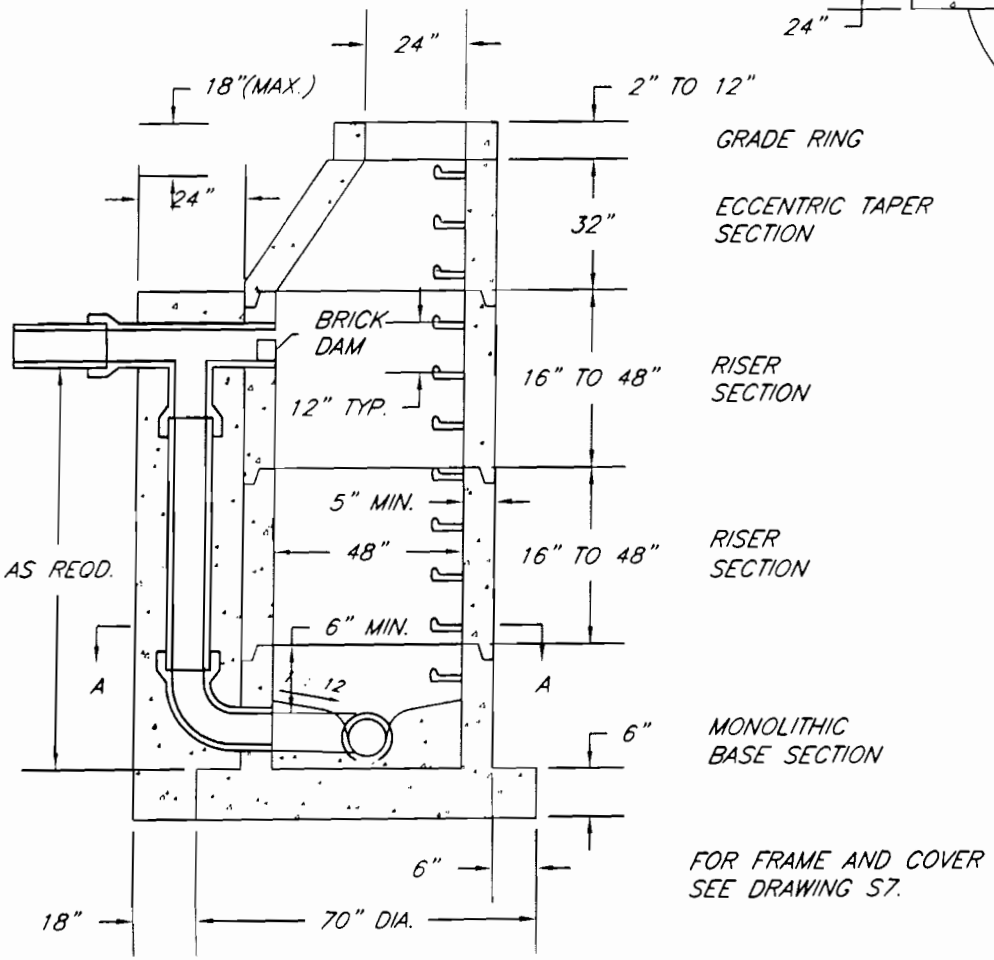
STANDARD DETAIL

STANDARD MANHOLE
TYPE A

JANUARY 2004	DRAWING S – 4







NOTES

INVERT CHANNELS SHALL BE SMOOTH, SEMI-CIRCULAR AND SHALL PROVIDE A CONTINUOUS INVERT THROUGH THE MANHOLE.

NON PREFORMED INVERT CHANNELS SHALL BE FORMED WITH BRICK SURFACED WITH CEMENT MORTAR.

TRIBUTARIES CHANNELS SHALL JOIN WITH A SMOOTH TRANSITION.

STEPS SHALL BE INTEGRALLY CAST IN AND SHALL CONSIST OF NO. 4 REBAR WITH POLYPROPYLENE COATING.

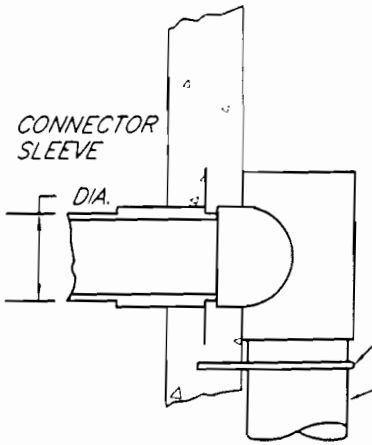
BRICK DAM SHALL BE AT LEAST 2/3 OF THE PIPE DIAMETER.

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

STANDARD OUTSIDE DROP MANHOLE TYPE B

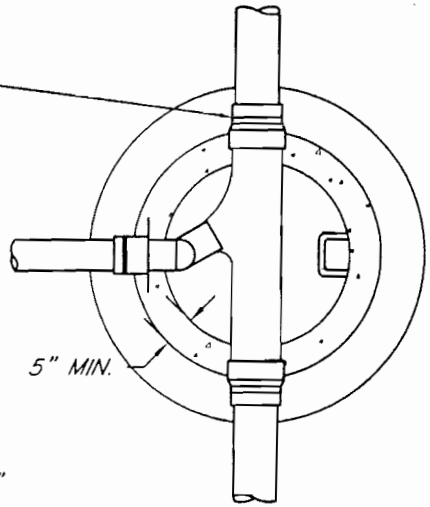
JANUARY 2004	DRAWING S - 5



INTEGRALLY CAST-IN NO. 3 REBAR WITH POLYPROPYLENE COATING. 1 PER PRECAST SECTION.

SCH 40 PVC PIPE

INTEGRALLY CAST IN FLEXIBLE RESILIENT WATERTIGHT CONNECTOR SLEEVES WITH STAINLESS STEEL BANDS.



SECTION A-A

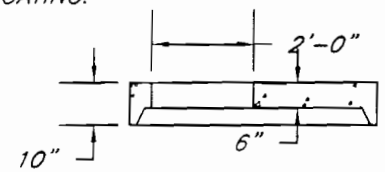
NOTES

INVERT CHANNELS SHALL BE SMOOTH, SEMI-CIRCULAR AND SHALL PROVIDE A CONTINUOUS INVERT THROUGH THE MANHOLE.

NON PREFORMED INVERT CHANNELS SHALL BE FORMED WITH BRICK SURFACED WITH CEMENT MORTAR.

TRIBUTARIES CHANNELS SHALL JOIN WITH A SMOOTH TRANSITION.

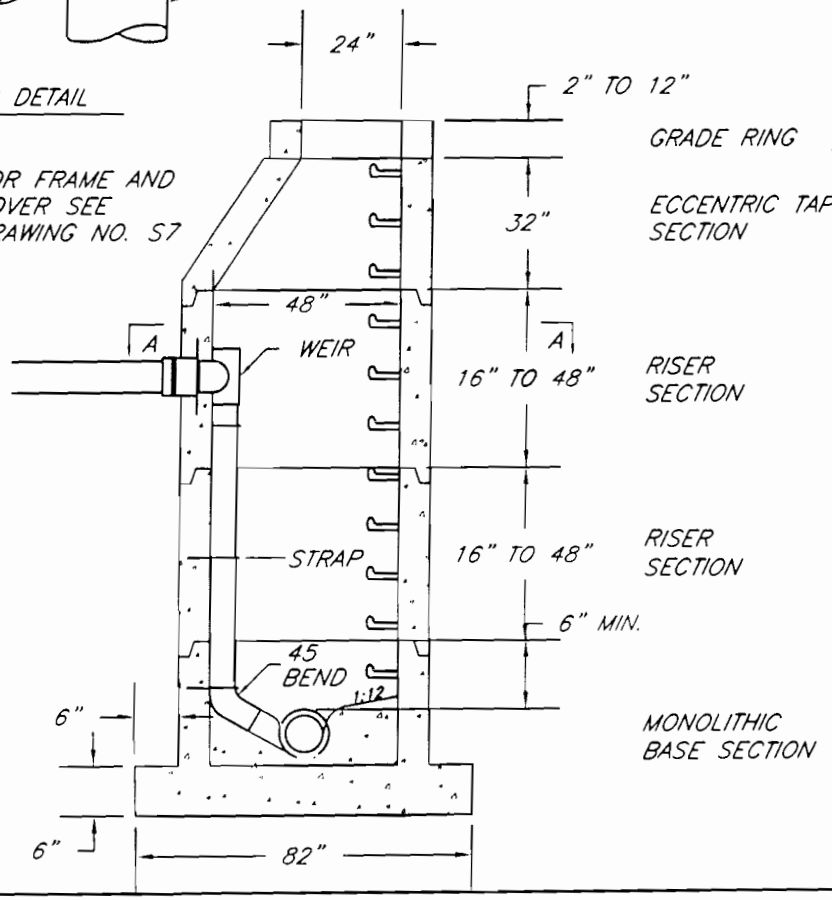
STEPS SHALL BE INTEGRALLY CAST IN AND SHALL CONSIST OF NO. 4 REBAR WITH POLYPROPYLENE COATING.



ALTERNATE FLAT TOP

ENTRANCE TO BE LOCATED AT STEPS

WEIR DETAIL



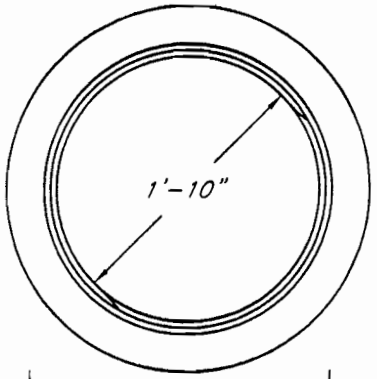
HENRY COUNTY PUBLIC SERVICE AUTHORITY

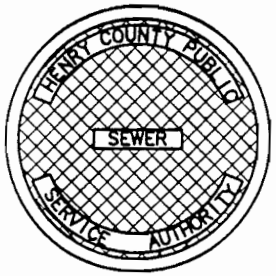
STANDARD DETAIL

STANDARD INSIDE DROP MANHOLE TYPE C

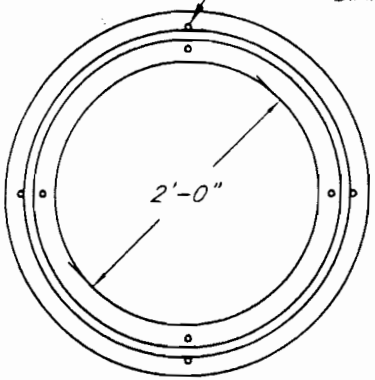
JANUARY 2004	DRAWING S – 6

NOTE : WATER TIGHT MANHOLES SHALL BE BOLTED, SHALL HAVE NO VENTS, SHALL HAVE INTEGRAL LIFTING LOOPS, AND SHALL HAVE GASKETS BETWEEN THE COVER AND FRAME AND BETWEEN THE FRAME AND THE TOP MANHOLE SECTION.

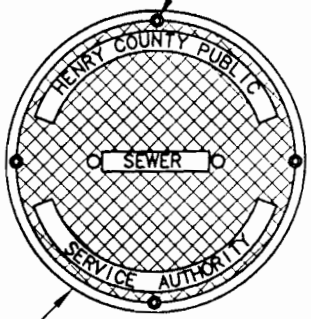




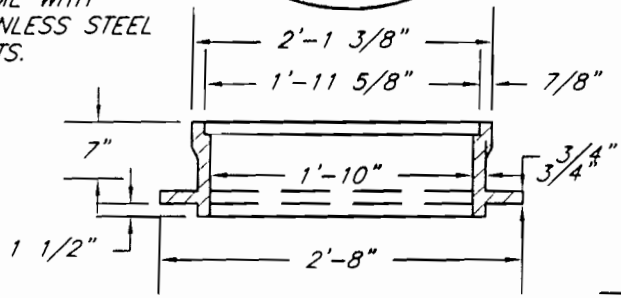
NOTE : MANHOLE FRAME SHALL BE FASTENED TO MANHOLE WITH A MINIMUM OF 4- 1/2" DIA. BOLTS.

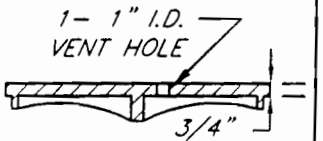


NOTE : MANHOLE COVER SHALL BE FASTENED TO FRAME WITH STAINLESS STEEL BOLTS.



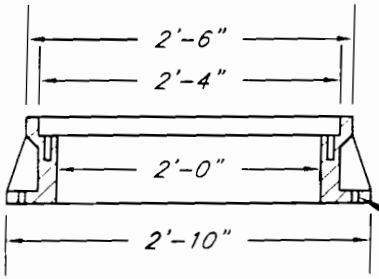
SOLID COVER

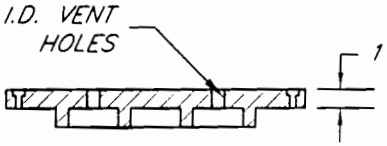




NON-BOLTED

NON-BOLTED FRAMES AND COVERS SHALL BE SUPERCAST CORP. DESIGN NO. 3000 OR APPROVED EQUAL.





HOLE FOR 1/2" DIA. BOLTS, TYPICAL. SEE ABOVE NOTE.

BOLTED

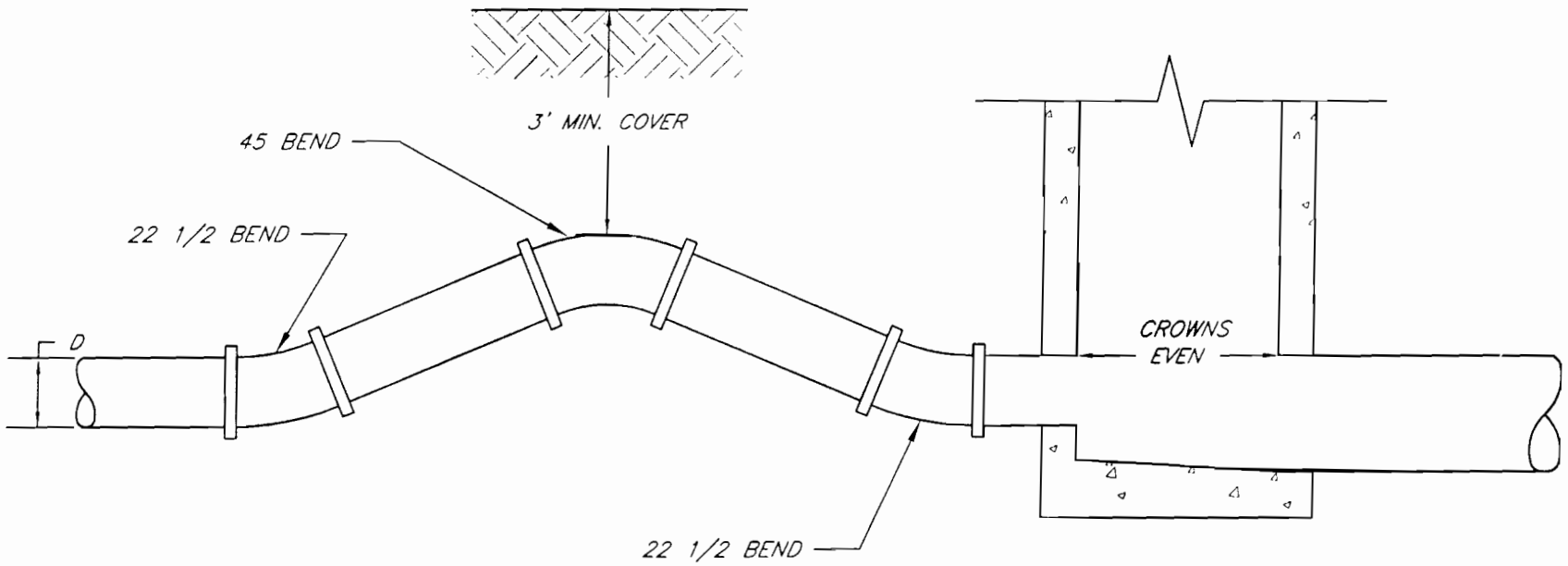
BOLTED FRAMES AND COVERS SHALL BE SUPERCAST CORP. DESIGN NO. 3000-W OR APPROVED EQUAL.

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

MANHOLE FRAMES AND COVERS

JANUARY 2004	DRAWING S - 7

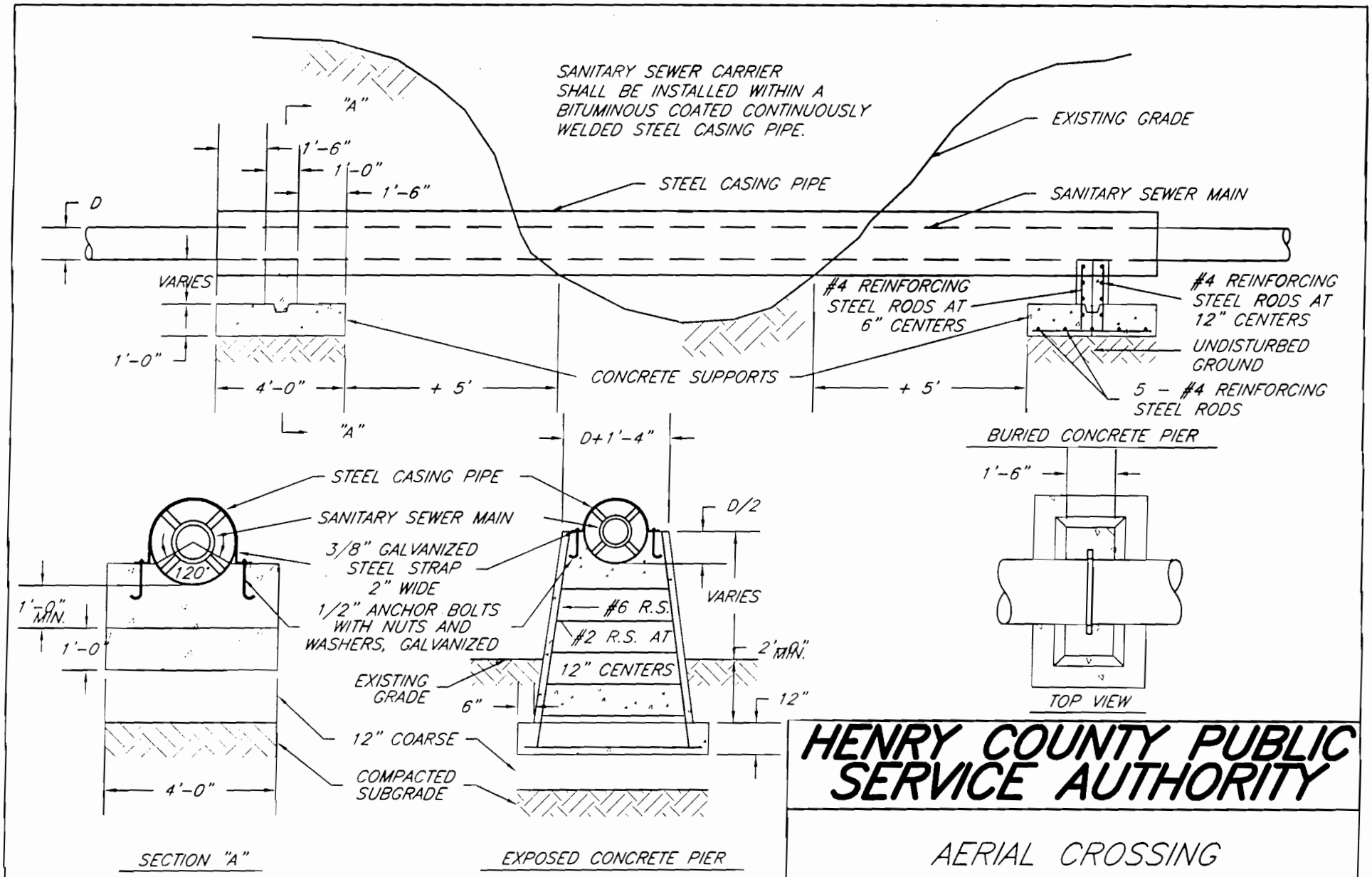


HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

SAXOPHONE BEND

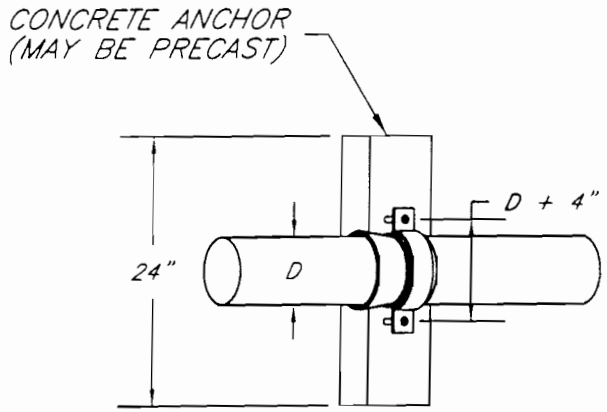
JANUARY 2004	DRAWING S – 8



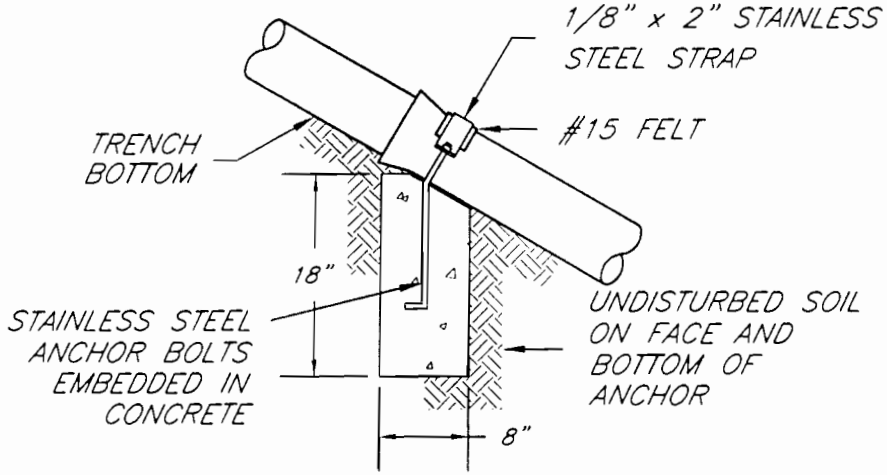
HENRY COUNTY PUBLIC SERVICE AUTHORITY

AERIAL CROSSING

JANUARY 2004 | DRAWING S - 9



TOP VIEW



SIDE VIEW

NOTE:

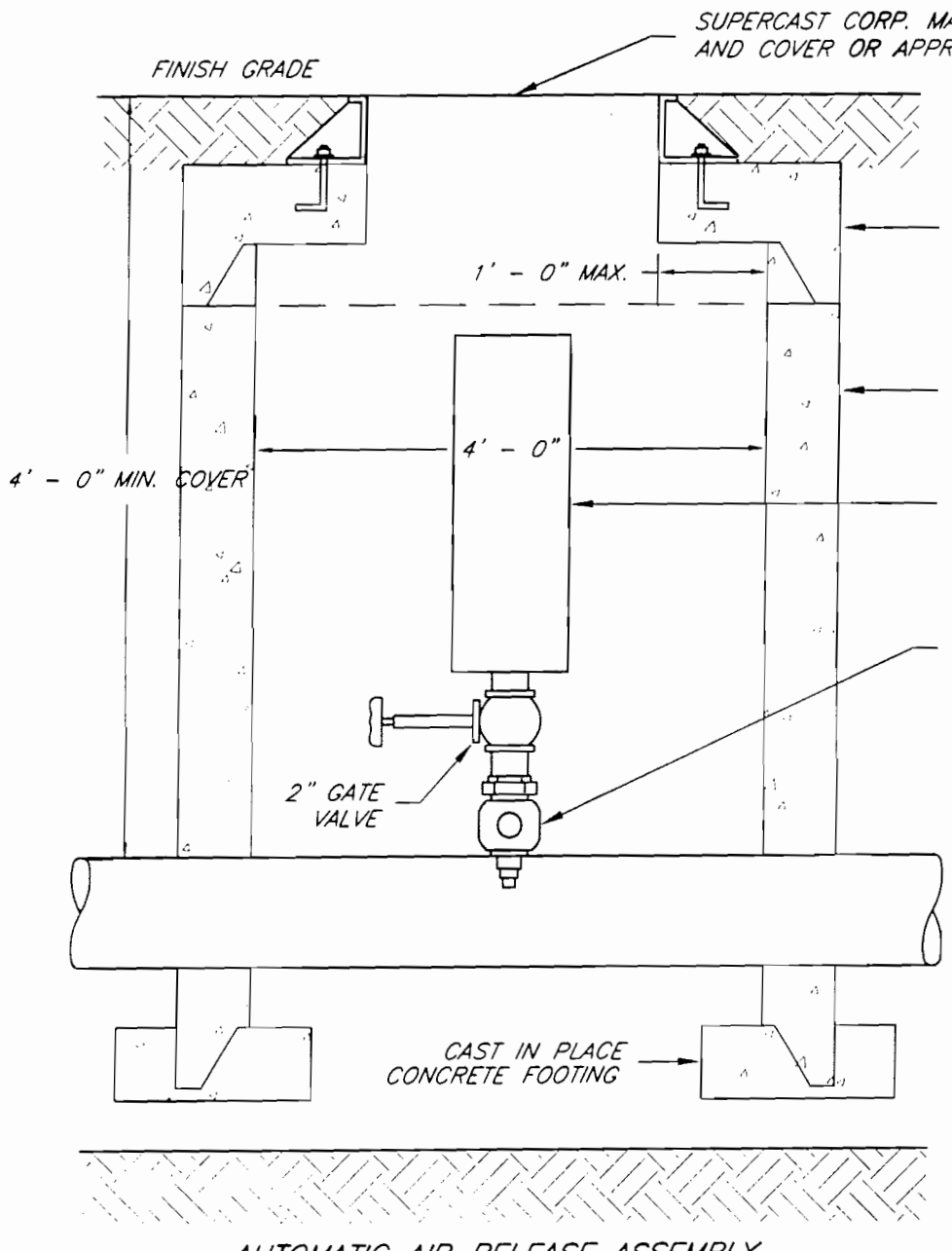
SEWERS WITH SLOPES OF 20% OR GREATER SHALL BE SECURELY ANCHORED WITH CONCRETE ANCHORS OR OHTER APPROVED METHODS. ANCHORAGE SHALL BE PROVIDED ON MAXIMUM 39-FOOT CENTERS FOR SLOPES 20 TO 35%; MAXIMUM 26-FOOT CENTERS FOR SLOPES 35 TO 50%; AND MAXIMUM OF 13-FOOT CENTERS FOR SLOPES EXCEEDING 50%

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

SLOPE ANCHOR (TYP.)

JANUARY 2004	DRAWING S – 10



AUTOMATIC AIR RELEASE ASSEMBLY

HENRY COUNTY PUBLIC SERVICE AUTHORITY

STANDARD DETAIL

FORCE MAIN AIR
RELEASE VALVE

JANUARY 2004	DRAWING S - 11