

1. SCOPE OF WORK

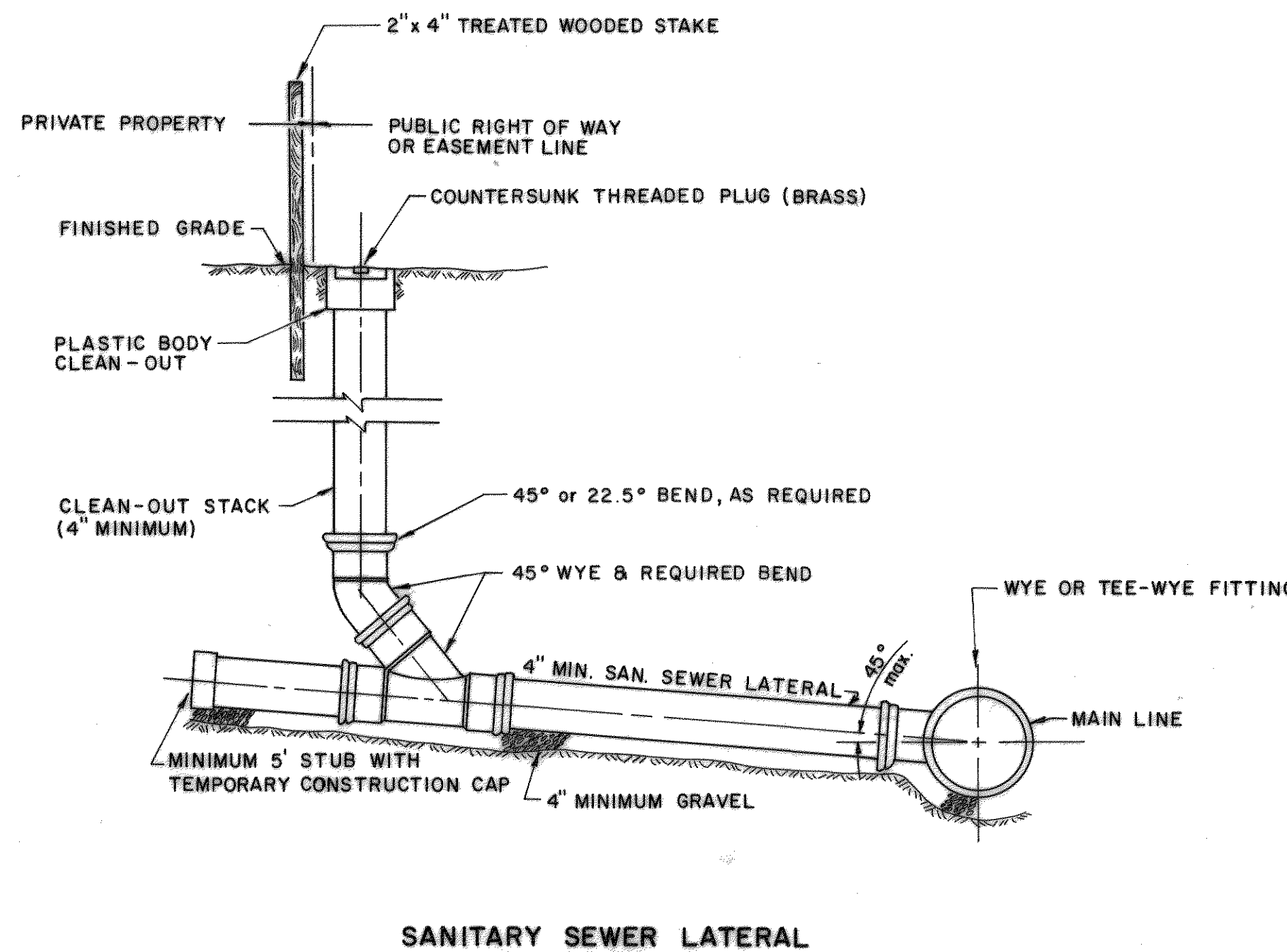
- 1.1 The work shall include the providing of all proper equipment, tools, accessories, labor and services required to install the sanitary sewer system, complete-in-place, using sound standard engineering techniques and construction practices.
- 1.2 Any equipment, tool or accessory found defective or not in a fit condition to accomplish the work continuously and expeditiously shall be promptly replaced with satisfactory equipment.
- 1.3 The Contractor shall include in the unit price per linear foot of pipe, complete-in-place, the expenses of procuring the field services of experienced and qualified manufacturer representatives for the approved materials. The representative shall instruct the Contractor's employees as to the proper installation procedures for the particular material.
2. LAYING PIPE AND PLACING MANHOLES
- 2.1 The installation of the sanitary sewer system shall begin at the downstream manhole and proceed upstream. The downstream sections shall be completed, tested and approved prior to allowing sanitary sewage from entering the trench. The Contractor shall not lay pipe or place manholes until all water has been removed from the trench, or when in the opinion of the County Engineer, the trench or the weather conditions are unsuitable for work.
- 2.2 The pipe that may require field cutting shall be done so in a neat and workmanlike manner, so as to leave a smooth end at right angles to the axis of the pipe. Care shall be taken to avoid damaging the pipe and any coatings and linings. Ductile iron pipe shall not be cut with an oxyacetylene torch.
- 2.3 The materials shall be visually inspected for defects before lowering the pipe or placing the manholes into the trench. During the laying operation, no tools, clothing or other material shall be placed in the pipe or manhole. The interior of the pipe shall be free of all soil, debris and superfluous materials prior to and during the installation.
- 2.4 The Contractor shall exercise every precaution to prevent foreign material from entering the pipe while it is being placed in the trench.
- 2.5 The pipe and the manholes shall be lowered carefully into the trench by suitable means and handled with care at all times to avoid damage. Under no circumstances shall the materials be dropped or dumped into the trenches.
- 2.6 Detection tape to be placed above all mains and laterals.
- 2.7 The pipe shall be installed in accordance with the pipe manufacturer's specifications and as directed by the County Engineer. The pipe shall be laid in true straight lines with bell ends upstream and with the invert of the pipe being the true elevation and grade of the system.
- 2.8 The Contractor shall be responsible for establishing and maintaining the horizontal alignment and vertical elevation and grade of the system in accordance with the engineering information as indicated on the plans.
- 2.9 The horizontal alignment of the pipe shall be maintained by a transit or other acceptable instrument plumbed over the center of the downstream manhole. The vertical elevation and grade shall be maintained by not less than three batter boards placed between manholes or by an adjustable laser level mounted at the invert of the downstream manhole with targets placed in the bell end of the pipe joint being laid.
- 2.10 When work is not in progress, the Contractor shall plug the pipe to prevent trench water or other substances from entering the pipe. The plug shall be watertight and shall remain in place until any required dewatering is completed.
- 2.11 All sewers shall be installed with a minimum of three (3) feet of cover, measured from the existing ground to the top of the installed pipe. Any pipe that is installed with less than three (3) feet of cover shall be concrete encased as per the detail.
- 2.12 All line construction shall be installed according to the latest edition of the Uniform Building Code of Virginia.
- 2.13 All connections shall be made to sewers by replacing a length of pipe with branch fittings, wye or tee-wye only.
- 2.14 Pipe bedding shall be only Class A, B or C (ASCE Manuals and Reports on Engineering Practice No. 37, WPCF Manual of Practice No. 9) The class of bedding shall be determined by the Engineer to provide strength necessary for the soil and load conditions that will be encountered.
- 2.15 Trenches shall be carefully backfilled with approved excavation materials consisting of earth, loam, sandy clay, sand and gravel, soft shale or other approved materials. All backfill shall be free from clods of earth or stones larger than two (2) inches in diameter, deposited in six (6) inch layers and thoroughly and carefully tamped until the pipe has been covered by twelve (12) inches of material, measured from the top of the pipe.
- 2.16 The remainder of the backfill shall be placed in the trench in layers not exceeding two (2) feet and thoroughly tamped. No stone or rock larger than ten (10) inches in its greatest dimension shall be used for backfilling.
- 2.17 Trenches in public roadways shall be excavated, backfilled and compacted in accordance with the requirements of the Virginia Department of Transportation's Road and Bridge Specifications and under the direction of the resident inspector.
- 2.18 The flow channels through the manholes shall be of such shape and slope as to provide a smooth transition between the inlet and outlet sewers and to reduce any turbulence that may occur. Benches shall be sloped to the channel to prevent the accumulation of solids.
- 2.19 Line connections directly into the manhole or to short stubs integral with the manhole, shall be made with flexible joints. Flexible joints shall be such as to permit the manhole to settle without destroying the integrity of the line connections.
- 2.20 Frames, covers and steps shall be of suitable material and designed to accommodate prevailing site conditions and to provide safe operation and maintenance.
- 2.21 A drop pipe shall be provided for any sewer entering a manhole at an elevation of two (2) feet or more above the manhole invert. See the detail for the correct installation of a drop manhole.
3. JOINTING
- 3.1 The sanitary sewer system shall be laid and joined complete-in-place to such a degree that each length and section of pipe between manholes shall have a smooth and uniform invert.
- 3.2 The previous joint shall be completed and the entire length well bedded prior to joining another length of pipe. Bell holes shall be dug of sufficient size so as to insure proper jointing.
- 3.3 The Contractor shall not use excavation equipment to push the pipe into the home position, unless approved by the County Engineer, and then only for one joint length at a time.
- 3.4 The Contractor shall join the pipe as recommended by the Manufacturer to obtain the degree of watertightness required. The use of lubricants, primers, adhesives or similar materials shall be as recommended by the Manufacturer and approved by the County Engineer.
- 3.5 The pipes shall be connected to the manholes through precast openings and joined with either a flexible boot adapter or pipe seal gasket.

4. CONNECTIONS TO EXISTING SYSTEMS

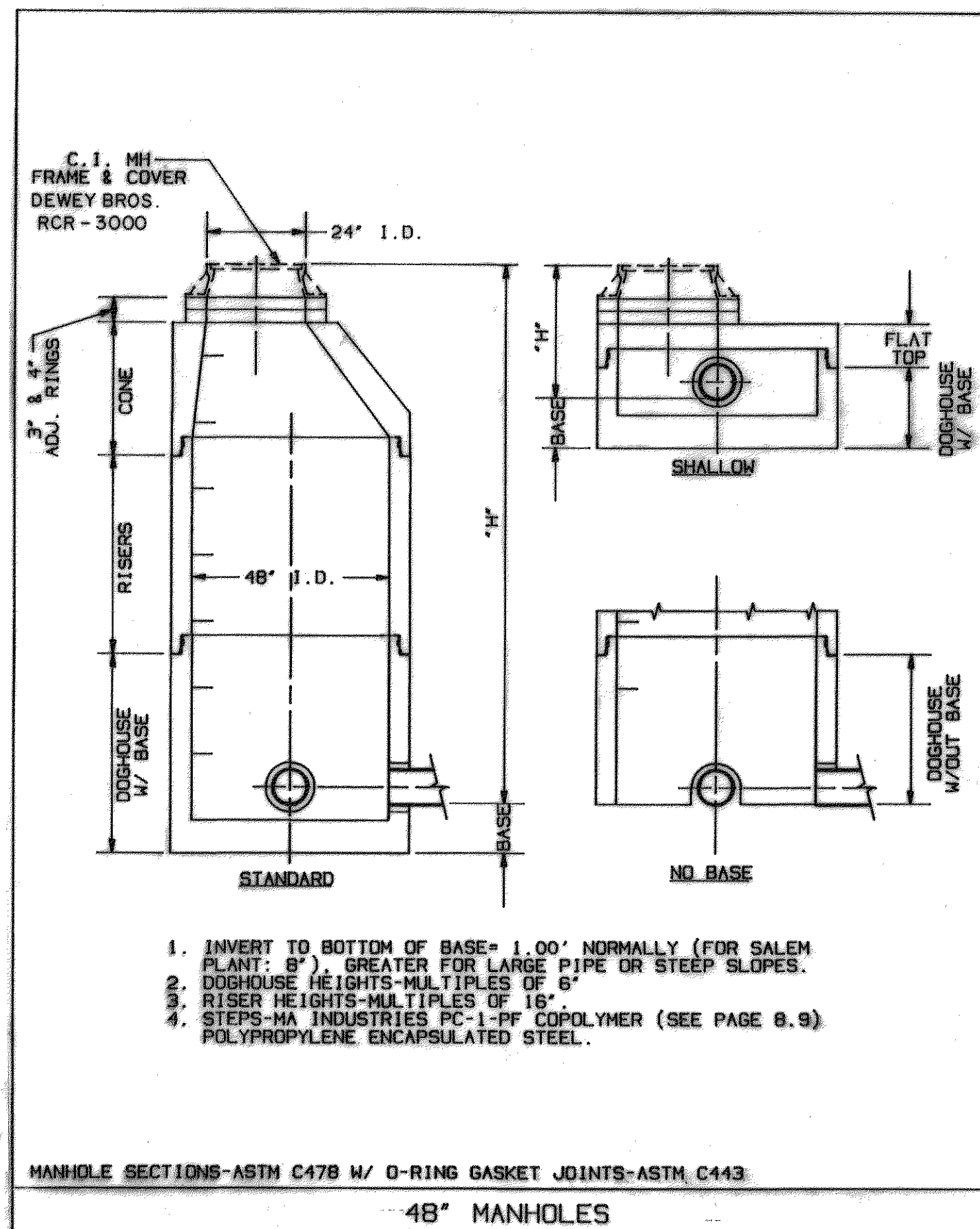
- 4.1 The Contractor shall maintain the existing sewage flows at all times by pumping, diverting, or other means acceptable to the County Engineer. Care shall be taken to avoid the entering of foreign debris into the existing system.
- 4.2 The Contractor shall at no time allow sewage flow to be diverted into a natural watercourse or back-up into any service connections. The Contractor shall be responsible for all damages which may occur as a result of failing to maintain the sewage flow.
- 4.3 The new pipe connection to be made to an existing manhole, where no stub or opening exists, shall be made through an opening of minimum diameter, cut into the manhole at the required elevation and location.
- 4.4 The existing invert channels and benches shall be reworked as required so as to form a new flow channel from the connection to the existing flow channel.
- 4.5 The new pipe connected into an existing manhole shall be secured in position and the remaining opening filled and sealed with brick and mortar. The outer surface of the connection shall be given a coat of heavy bitumastic waterproofing compound.
5. SERVICE CONNECTIONS
- 5.1 The Contractor shall make all service connections to the sewer pipe and from manholes where shown on the plans or where located in the field by the County Engineer. The service connections to the sewer pipe shall be made with either a WYE or TEE-WYE fitting at the Contractor's option.
- 5.2 The WYE or TEE-WYE branch fittings for service connections shall be commercially manufactured and installed in strict accordance with the recommendations of the pipe manufacturer.
- 5.3 All service connections shall be a minimum of four (4) inches in diameter and shall be installed at a minimum grade of 0.25" per foot or 2.08%.
- 5.4 Future service connections shall be extended to the property line or edge of the sanitary sewer easement and be properly capped with a watertight fitting to prevent infiltration into the sewage system. The fitting shall be installed in strict accordance with the recommendations of the pipe manufacturer.
- 5.5 Future service connections shall be field marked with a treated wooden (2"x4") marker, three (3) feet long and set vertically plumb with the end of the capped extension pipe. The top of the markers shall be painted green and set to a height of 18" above finished grade.
- 5.6 Existing services that are to be connected to the new sewer pipe and are in satisfactory condition shall not be replaced to the property line but shall be replaced and connected to the first compatible joint which will insure a water tight connection.
6. MATERIALS
- 6.1 All materials and appurtenances required for the work shall be new, of first class quality and shall be furnished, delivered, erected, connected, and finished in ever detail as specified and indicated. All materials found defective, regardless of the circumstances, shall be replaced at the expense of the Contractor.
- 6.2 The materials specified for the construction shall comply with the latest revisions of the applicable American Society of Testing Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), Virginia Department of Health (VDH) and the Virginia Department of Transportation (VDOT).
- 6.3 The Contractor shall install only one type of pipe between structures except where ductile iron pipe is specified or indicated.
- 6.4 Polyvinyl chloride (PVC) pipe and fittings shall be SDR 35 and conform with ASTM D 3034.
- 6.5 Roadway and railway casing pipe shall be a minimum of sixteen (16) inches in diameter, meeting all requirements of ASTM A139 and having a minimum yield strength of 35,000 psi.
- 6.6 Manholes shall be precast, conforming to ASTM C 478 with rubber gasket type joints.
- 6.7 PVC pipe and fittings shall be bell and spigot type joints. The bell and spigot joints shall be sealed with elastomeric gaskets conforming to ASTM D 3132. The joints shall be made in strict accordance with the recommendations of the manufacturer.
- 6.8 Sewer lines shall be tested for exfiltration or infiltration not to exceed 200 gallons per inch of pipe diameter per mile per day. Test must be performed with a minimum of four (4) feet of head.
- 6.9 Sewer lines may also be tested by air pressurization. If air testing is employed, the manholes must be tested by exfiltration, with inflatable stoppers used to plug all lines into and out of the manhole. The manhole shall then be filled to the top with water and allowed to soak for 12 hours. Leakage shall not exceed one half (1/2) gallon per hour.

MANHOLES TESTS

1. Exfiltration Test of Manholes: Each manhole shall be tested for exfiltration. The test shall be performed by plumbing all connecting pipes with inflatable stoppers and filling the manhole with water to the top. A 12 hour soaking period will be allowed. Leakage from the manholes on sanitary sewers shall not exceed one-half gallon per hour. Leakage from manholes designated as water-tight tested shall be zero when tested for a period of 2 hours with readings every thirty minutes. The Contractor shall maintain written records of all manhole exfiltration tests showing test location, date and time and hourly leakage rate.
2. Vacuum Test of Manholes: At the Contractor's option, an air-vacuum test may be applied to precast manholes only, with the following requirements:
 - a. Manholes shall be tested after assembly and prior to backfilling.
 - b. Stubs, manhole boots, and pipe plugs shall be secured to prevent movement while the vacuum is drawn.
 - c. The installation and operation of vacuum equipment and indicators shall be in accordance with equipment specifications by the manufacturer.
 - d. A measured vacuum of 10 inches of mercury shall be established in the manhole. The time for the vacuum to drop to 9 inches shall be recorded and compared to the table below. The maximum allowable leakage rate shall be in accordance with the following:

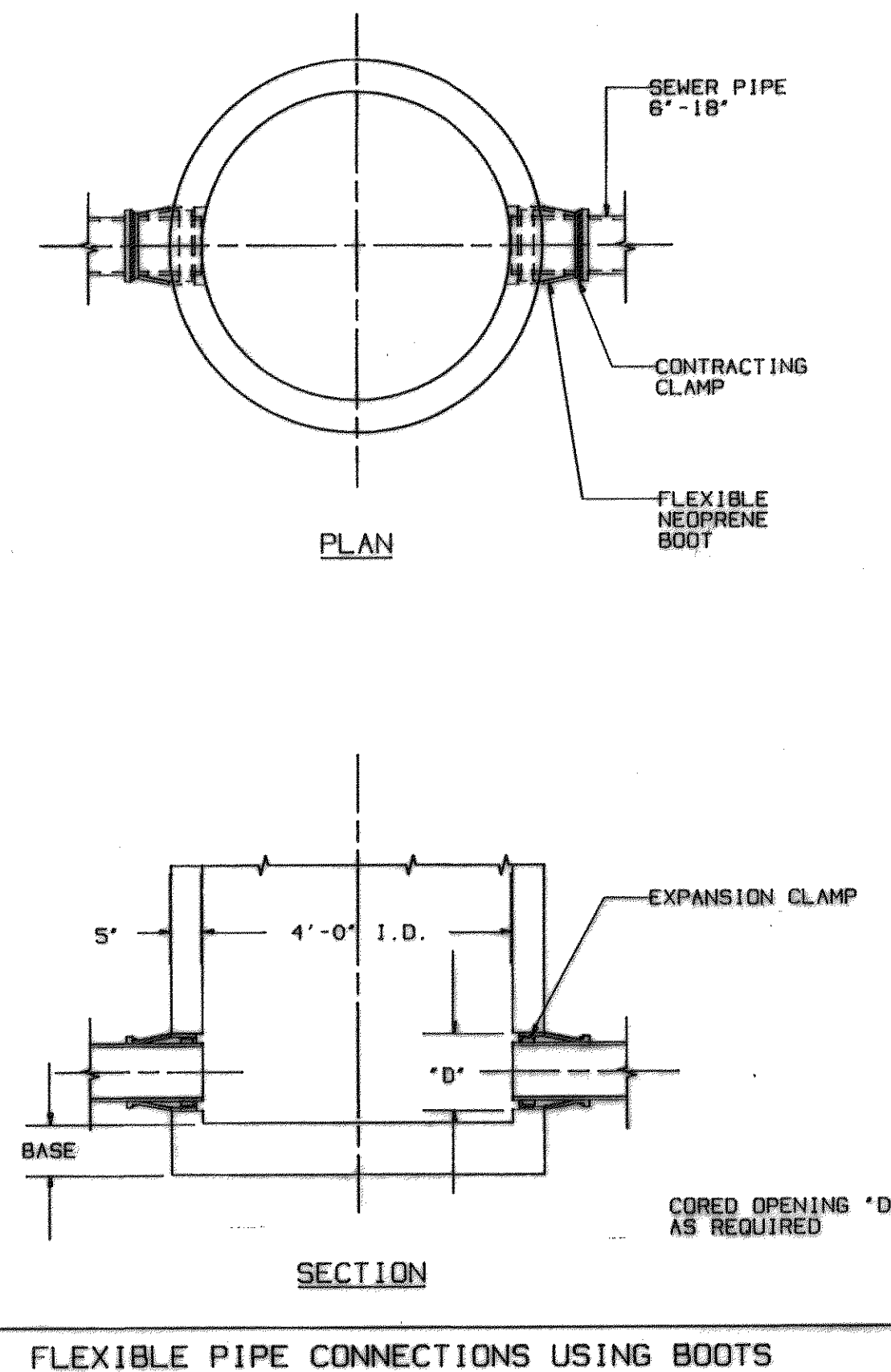


SANITARY SEWER LATERAL

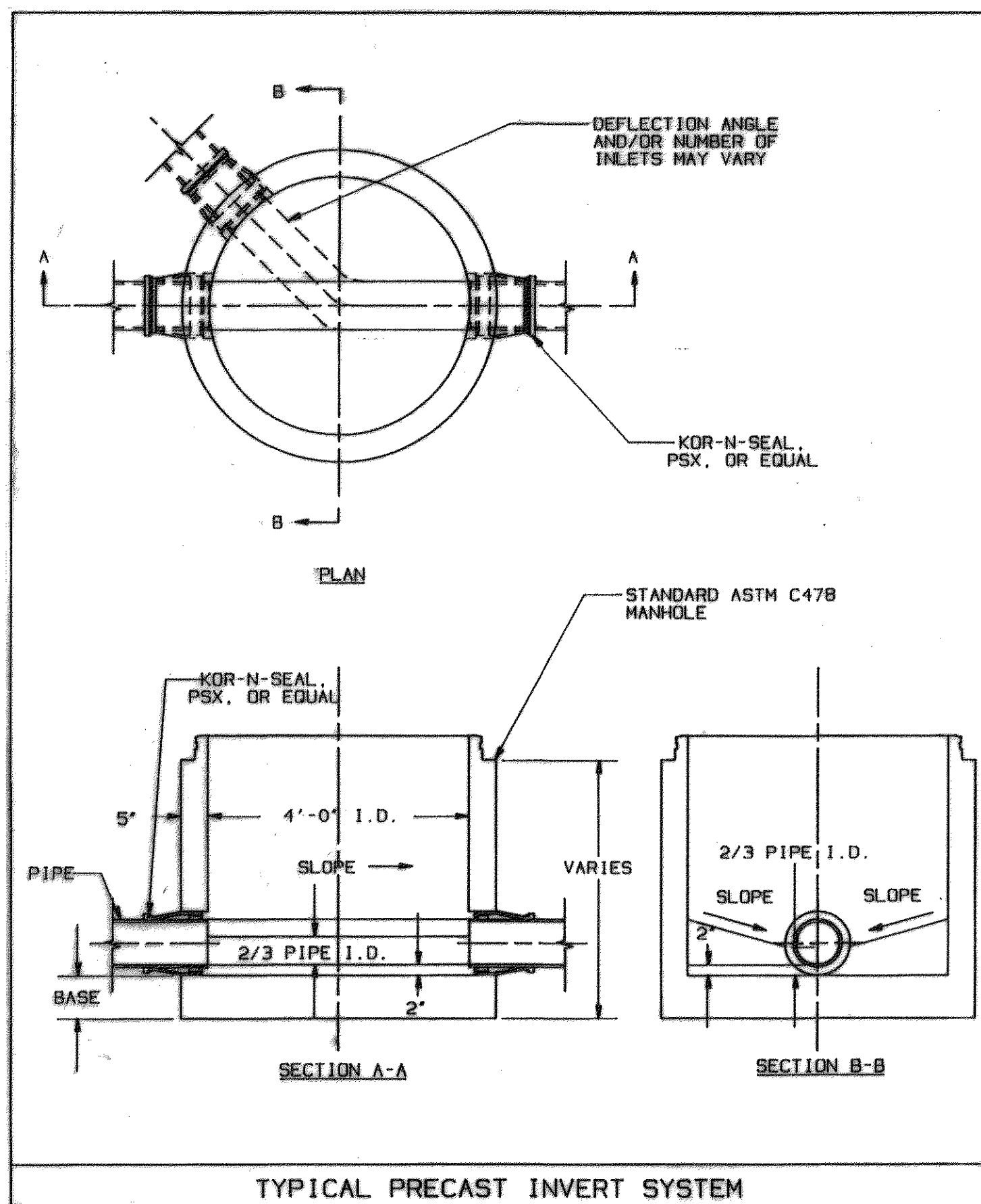


1. INVERT TO BOTTOM OF BASE= 1.00' NORMALLY (FOR SALEM PLANT: 8"). GREATER FOR LARGE PIPE OR STEEP SLOPES.
2. DOORHOUSE HEIGHTS-MULTIPLES OF 6"
3. RISER HEIGHTS-MULTIPLES OF 18"
4. STEPS SHALL BE OF 1-PF COPOLYMER (SEE PAGE 8.9) POLYPROPYLENE ENCAPSULATED STEEL.

48" MANHOLES



FLEXIBLE PIPE CONNECTIONS USING BOOTS



TYPICAL PRECAST INVERT SYSTEM

DATE	7/29/1991	SCALE	N/A
REVISIONS	1	CHKD.	R.G.L.
JOB NO.	910726	PER COUNTY REVIEW	8-12-91
LANG ENGINEERING Co. Consulting Engineers • Land Planners P.O. Box 565 Daleville, Va. 24083 (703) 992-5520			
BOTETOURT INDUSTRIAL PARK SANITARY SEWER EXTENSION BOTETOURT COUNTY VIRGINIA			
SHEET NO. 2			