STANDARD SPECIFICATIONS

SANITARY SEWER SYSTEM IMPROVEMENTS

FOR THE

TOWN OF JONESBOROUGH,

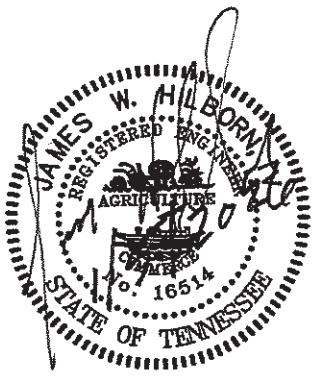
TENNESSEE

January 2026

Accepted by: _____

Kevin Brobeck, Utility Manager
Town of Jonesborough

Date: 1/6/2026



WPN 26.0005
Standard Specifications

APPROVED FOR CONSTRUCTION

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

TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION

DIVISION OF WATER RESOURCES

AND IS HEREBY APPROVED FOR CONSTRUCTION BY THE COMMISSIONER

February 23, 2026

THIS APPROVAL SHALL NOT BE CONSTRUED AS CREATING A PRESUMPTION OF CORRECT OPERATION OR AS WARRANTING BY THE COMMISSIONER THAT THE APPROVED FACILITIES WILL REACH THE DESIGNED GOALS.

APPROVAL EXPIRES FIVE YEARS FROM ABOVE DATE

GRW Engineers, Inc.
404 BNA Drive - Nashville, TN 37027

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SECTION 1

PROCEDURES

1. Purpose

The purpose of this section is to establish a step-by-step procedure to be followed by the Owner/Developer, Engineer and Contractor in initiating and completing the construction of any utility services that are to be connected to or become a part of the Town of Jonesborough sewer system. References to Engineer or Contractor imply the Owner's Engineer or Contractor.

2. Application for Connection

The applicant shall apply in writing to the Town of Jonesborough for approval of the sewer connection. The letter shall be accompanied by a map of the area showing streets, roads, property lines and topographical information, along with the proposed sewer facilities. The map shall be to a scale of not less than 1-inch equals 400 feet.

From the information submitted, the Town of Jonesborough will review the various elements of construction necessary to connect the proposed area to the sanitary sewer system. After review the Town of Jonesborough will send a letter of approval and/or comments to the applicant. With the letter of approval, the applicant may proceed into the design stage.

3. Design

The applicant, on receipt of the approval letter, may authorize his Engineer to prepare plans for the proposed facilities in accordance with the specifications contained herein. The design Engineer shall provide the following information:

a. Gravity sewer calculations shall show expected average flows and capacity and velocity at peak flows.

b. Sewage lift stations and force main calculations shall show pump capacity at design TDH (total dynamic head), head loss through the force main, static head between pump discharge and force main discharge, velocity through the force main, capacity of wet well and frequency of pump operations. Copies of the pump manufacturer's pump curve data and specifications shall be provided.

During the design stage, the Engineer shall work closely with the Town of Jonesborough to ensure the final plans meet all requirements of the Town of Jonesborough. There shall he no provisional approval of plans.

Plans for construction of sewer lines shall be drawn on plan sheets and/or plan profile sheets, 24" X 36", to a scale of not less than 1-inch equals 100 feet, and shall contain the following information:

Title Sheet

1. Name of Development.
2. Name of Owner/Developer.
3. Engineer's Seal, License Number, Signature, and Date.

Plan-Profile Sheets - 1"=50'

1. Topography and Layout of Streets, Property Lines, and Utility Easements.
2. Layout of Proposed Sewer Lines.
3. Location of Manholes by Station and Number.
4. Profile of Sewer Line.
5. Length of Sewer and Grade Between Manholes.
6. Size of Pipe and Material.
7. Invert of Sewer at Inlet and Outlet of Manholes.
8. Location of Watertight Manhole Frame & Covers.
9. Location, Size, and Material of House Connections.
10. Location of Existing Facilities such as Manholes, Utility Lines, and Storm Drains.
11. The Statement "ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE TOWN OF JONESBOROUGH'S STANDARD SPECIFICATIONS."
12. Engineer's Seal, License Number, Signature, and Date.

Plan Sheet (When Required)

1. Plan and Sections of Sewage Lift Station Showing Dimensions and Elevations. Scale 1/4" = 1'-0" min.
2. Name of Pump Manufacturer.
3. Pump Capacity at Design TDH.
4. Name of Liquid Level Controls Manufacturer.
5. Elevations of Cut-On & Cut-Off of Pumps.
6. Engineer's Seal, License Number, Signature, and Date.

4. Design Review

When the plans have been completed, two sets shall be submitted to Town of Jonesborough for review and approval. The Owner/Developer should allow Town of Jonesborough 30 days for the review time.

Town of Jonesborough shall review the plans as to the sanitary features of design and the standard specifications contained herein. Any plans submitted that do not completely comply with all requirements of Town of Jonesborough shall be returned to the Engineer unapproved with the necessary corrections noted. After all corrections are made, the corrected plans shall be returned to Town of Jonesborough so that each sheet may be stamped "Approved". Once the plans have been approved by the Town of Jonesborough, they shall be submitted to the Tennessee Department of Environment and Conservation for review. Construction ***cannot*** begin until

1. Approval is granted by the State, and;
2. A Pre-Construction Conference has been conducted with Town of Jonesborough to discuss construction aspects.

The plans shall be submitted to the following address:

Tennessee Department of Environment and Conservation
Division of Water Pollution Control
312 Rosa Parks Avenue
Nashville, Tennessee 37243

Any review fees charged by the State shall be paid by the Owner/Developer.
One set of stamped, State-approved plans shall be on the job site at all times. One set of stamped, State-approved plans shall be furnished to Town of Jonesborough prior to the beginning of construction.

5. Construction Start Notification

The Owner-Developer shall contact Town of Jonesborough by certified mail a minimum of seven (7) days prior to construction to allow Town of Jonesborough to review all required construction documents and assign an Inspector to the project. The Owner-Developer shall further notify by phone or in person to Town of Jonesborough 24 hours prior to construction. After construction begins, the Owner-Developer shall coordinate with the Town of Jonesborough Inspector on daily construction activities.

6. Construction Warranty

Contractor warrants and guarantees to Town of Jonesborough and Owner, if different, that all work will be in accordance with the Contract Documents and will not be defective. Contractor's obligation to perform and complete the work in accordance with the Contract Documents shall be absolute and includes, workmanship, equipment and materials.

The warranty period shall begin at Final Completion for the entire project. No consideration will be given to starting the warranty period at Substantial Completion or at the time of Owner use and/or occupancy.

7. Contract Closeout

a. Substantial Completion

When the project is considered to be substantially complete, Contractor shall submit the following to the Engineer:

1) Written notice that the project is substantially complete,
2) List of items to be completed or corrected.

Within a reasonable time, Engineer will inspect to determine status of completion, and compile a punch list of items to be completed and corrected. If it is determined that work is not substantially complete, Engineer will immediately notify Contractor in writing. Engineer will generally point out his reasons, but he will not be obligated to give an exhaustive list of discrepancies.

Contractor's Duties: Remedy deficiencies and send Engineer another written Notice of Substantial Completion.

Engineer's Actions:

1) Notify Town of Jonesborough of Substantial Completion,
2) Coordinate inspection(s) with Town of Jonesborough,
3) When Engineer considers work substantially complete, he will issue a Certification of Substantial Completion and copy Town of Jonesborough.

b. Final Completion

When the project is considered complete, Contractor shall submit a certification indicating the following:

1) Contract Documents have been reviewed and work has been inspected for compliance with those Documents.
2) Work has been completed in accordance with Contract Documents.
3) All punch list items have been corrected.
4) Equipment and systems have been tested in presence of Owner's Representative and are operational.
5) Work is complete and ready for final inspection.

Engineer's Actions During Final Inspection:

1) Notify Town of Jonesborough of Final Completion.
2) Inspect to verify the status of completion with reasonable promptness. Coordinate with the Town of Jonesborough.
3) If he considers work incomplete or defective, he will promptly notify Contractor in writing, listing deficiencies.

Contractor's Duties: Take immediate action to correct deficiencies, and send certification to Engineer that work is complete.

c. Contractor’s Closeout Submittals

Prior to Town of Jonesborough acceptance of project, Town of Jonesborough shall be in receipt of

1) Project Record Drawings (As-Built Plans),
2) Test results,
3) Operation and Maintenance Data,
4) Evidence of Payment and Release of Liens, and
5) Consent of Surety for Final Payment.

Upon acceptance of project the Town of Jonesborough will operate and maintain the collection system including the low-pressure lines and grinder pumps.

SECTION 2

SPECIAL PROVISIONS

1. Purpose

The purpose of this Standard Specification is to provide information and requirements to land developers, design engineers, and contractors in the construction of wastewater facilities that are to be connected to or become a part of the Town of Jonesborough. The ultimate goal of this specification is to ensure the protection of the health and welfare of the general public through the use of proper design features and construction methods.

2. Definitions

APPROVED - Material, equipment, workmanship, process or method that has been accepted by the Town of Jonesborough as suitable for the proposed use.

AS-BUILT - A certification by the Engineer whose stamp appears on the plans that the measurements, depths, materials, and facilities that are shown on the plans are true and correct and are constructed in accordance with the Standard Construction Specifications.

CONTRACTOR - The person, firm or corporation with whom the Owner-Developer has executed an agreement to perform the utility construction for the project.

ENGINEER - A Registered Professional Engineer, registered in the State of Tennessee.

OWNER-DEVELOPER - An individual, group of individuals, partnership, firm, association or corporation that is constructing, or having constructed, wastewater facilities that are to become a part of, or be connected to the Town of Jonesborough sewer system.

RESIDENT INSPECTOR - The Engineer, or his representative, who is required to be on the job site during any construction of facilities that are to become part of the Town of Jonesborough facilities to insure that the facilities are being constructed in accordance with the Standard Specifications.

TOWN OF JONESBOROUGH - The mayor, the Board of Mayor and Alderman, or its designated representative.

SHALL - Means a mandatory requirement.

3. Authority

The Town of Jonesborough shall decide questions which may arise as to the quality and acceptability of materials furnished. The Town of Jonesborough shall interpret the intent of these Standard Specifications and Standard Drawings.

Nothing contained in these Specifications or Standard Drawings is intended to conflict with any State or Federal law or regulations. If any requirement is found to be in conflict with a State or Federal regulation, then the more stringent requirement shall apply.

4. Shop Drawings

The Contractor shall submit to Engineer detailed drawings of all materials to be installed for sewer/water lines and appurtenances. The shop drawings shall be checked and signed by the Contractor indicating compliance with these Specifications before submitting to Engineer. Engineer shall indicate his review and approval of the equipment and/or materials to be furnished.

The Contractor shall be completely responsible for accuracy, completeness, and compliance with these Standard Specifications and Drawings.

Additional responsibilities of Engineer: After completing his review, Engineer shall submit a minimum of two copies of each shop drawing to Town of Jonesborough, subject to their review, one of which will be returned by Town of Jonesborough. Any Shop Drawing that has not been approved by Engineer will not be accepted by Town of Jonesborough.

5. Materials or Equipment to be Furnished

Where materials or equipment are specified by a single model number and manufacturer, the Town of Jonesborough has established this product as a standard and shall be used on work for the Town of Jonesborough. Where two or more manufacturers are specified it is intended by the Town of Jonesborough that either one or an approved equal may be used. Any deviations from these specifications shall be approved by the Town of Jonesborough. The Town of Jonesborough, where practical, may require submission of samples of materials or products.

6. Existing Utilities

Special precautions shall be taken by the Contractor to avoid damage to existing overhead and underground utilities owned and operated by the Town of Jonesborough or private utility companies.

Where existing utilities or other underground structures are encountered, they shall not be displaced or molested unless necessary, and in such case they shall be replaced in as good or better condition than found as quickly as possible.

7. Easements

The Developer/Owner shall provide permanent easements for all sewer lines. The easements shall be wide enough to provide ingress and egress for inspection and repair with a minimum width of 15 feet (10 feet on one side of centerline). Documentation of easement acquisition shall be furnished to the Town of Jonesborough.

8. Final Inspection and Certification

Final inspection will be held when the Town of Jonesborough is notified that work is complete and ready for inspection. All concerned parties shall be present for the inspection. Upon acceptance of construction, the Owner/Developer shall certify to the Town of

Jonesborough in writing that all payments have been made to all parties involved in the construction of the facilities.

A certified set of as-built drawings on reproducible material shall be furnished to the Town of Jonesborough for its use.

9. Water and Uplift

The Contractor shall by the use of well points, pumps, or other approved methods, prevent the accumulation of water in excavated areas. Should water accumulate, it shall be promptly removed. The Contractor shall also provide for dewatering areas adjacent to structures or lines to prevent uplift during construction operations. The Contractor will be held responsible for any damage due to uplift of such structures, lines and/or existing structures during construction operations.

10. Blasting

All blasting operations including storage of explosives shall be in accordance with all ordinances and state laws. No blasting shall be done within five (5) feet of any water mains, except with light charges of explosives. Any damage done by blasting is the responsibility of the Contractor and shall be promptly and satisfactorily repaired by him.

To implement this requirement and unless otherwise required by ordinance or law, each excavating crew shall be provided with two (2) metal boxes with suitable locks. One of these boxes shall be painted a bright color and stenciled with appropriate warning signs. At night all explosives and caps shall be removed from the boxes and stored in a central magazine. Compliance with laws, ordinances and regulations shall be the Contractor's responsibility, and he shall save the Town of Jonesborough harmless from any and all claims of any type or nature arising from blasting or storage of explosives.

11. Soil and Bank Erosion

The Contractor shall incorporate and maintain erosion and sediment control measures utilizing the Best Management Practices (BMPs) identified in the Tennessee Erosion and Sediment Control Handbook, under the direction of the Tennessee Department of Environment and Conservation, Division of Water Pollution Control, as conditions exist. BMPs generally include: Vegetative Practices, Structural Practices, and Stream Alteration Practices

Specific techniques for each Practice are identified in the Erosion and Sediment Control Handbook. For each technique offered in the Handbook the Contractor will find:

- Definition of technique
- Purpose for use
- Conditions for use
- Design Criteria for technique
- Construction Specifications for technique
- Maintenance measures or technique.

If a disturbed area is one acre or greater, Contractor and Owner Developer shall provide a Storm Water Pollution Prevention Plan in accordance with Tennessee General Permit No. TNR10-0000 Storm Water Discharges for Construction Activities. General components for an SWPPP include a Site Description, Storm Water Runoff Controls, Erosion and Sediment Controls, Stabilization Practices, Structural Practices, Storm Water Management, Maintenance Plan, and Inspections.

Owner Developer and Contractor shall execute a Construction Activity — Storm Water Discharges Notice of Intent (NOI) and a Notice of Termination (NOT) when an SWPPP is required. The NOI must be submitted to the:

Tennessee Department of Environment and Conservation
Knoxville Environmental Field Office
Division of Water Resources
3711 Middlebrook Pike
Knoxville, Tennessee 37921

12. Occupational Safety and Health Act

All work shall be done in strict compliance with the Occupational Safety and Health Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54).

It is not the intention of these Specifications to conflict with the Act in any way, and where conflicts may arise, the Act shall govern.

13. Noise and Odor Control

Some work may be performed adjacent to or near private residences. The Contractor shall be responsible for noise and odor abatement procedures and shall not commence work in these areas before 7:00 a.m. local prevailing time.

14. Chemical Requirements

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, reactant or of other classifications, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with the manufacturer's instructions.

15. Clean-Up

Clean-up shall commence at the first practical opportunity after each construction activity has been partially completed in stages, fully completed, or as directed by Town of Jonesborough Inspector. Any construction performed adjacent to roads, sidewalks, driveways, etc., shall be cleared of debris and opened to pedestrian and vehicle traffic. In the case of utility line construction, clean-up shall be opened to pedestrian and vehicle traffic. In the case of utility line construction, clean-up shall be maintained no more than 1000' behind pipe installation, and shall be brought up to the construction area at the end

of each work day. Clean-up is subject to final approval from Town of Jonesborough, the Washington County Highway Department and/or the Tennessee Department of Transportation.

SECTION 3

TESTING & CONTROL OF MATERIAL

1. Purpose

This Section together with such additions, deletions or modifications, if any, as may appear in any other particular Section of these Specifications shall govern the furnishing and testing of materials to be used in the work.

Materials of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.

2. Cost of Tests and Selection of Testing Agencies

All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency will be selected by the Contractor subject to the approval of the Town of Jonesborough. The Contractor shall pay for all required laboratory inspection service and shall submit to the Town of Jonesborough for approval the name and qualifications of the testing firm proposed. Such submission shall be made in adequate time for the Town of Jonesborough to make a decision in the normal course of business.

3. Sources of Supply

The Contractor shall submit a list indicating his sources of supply of all materials including manufactured items and receive the Town of Jonesborough's approval prior to the placing of orders. The Town of Jonesborough may require representative samples of any materials prior to approval of the source. The Town of Jonesborough's approval of the source of any sample shall not be construed to relieve the Contractor of furnishing materials which fully meet all provisions of the Specifications.

If it is found that sources which have been approved do not furnish uniformly acceptable products, the approval may be withdrawn. The Contractor and his supplier shall afford the Town of Jonesborough opportunities for inspecting products and materials at any time during their preparation. The Contractor and/or supplier shall furnish shipment thereof, without charge.

These requirements are not intended to stifle or hinder competition but are intended to assure quality and/or performance.

4. Approval of Testing Agencies and Reports

Whenever in these Documents inspection and testing of materials is required, bureaus, laboratories, and/or agencies selected by the Contractor for such inspection and testing service shall be approved by the Town of Jonesborough.

Documentary evidence, satisfactory to the Town of Jonesborough, that the material has passed the required inspection and testing must be furnished prior to the incorporation of such materials in the work, and rejected materials must be promptly removed from the premises.

Test reports shall contain as a minimum (1) the name and location of the supplier's plant, (2) the name of the person gathering the sample, (3) the date of the sampling, and (4) such other like data as may be required by the Town of Jonesborough.

5. Governing Specifications

It is the intention of the Town of Jonesborough in the preparation of these Standard Specifications to define properly the kind and quality of materials to be furnished. The standards and tentative standards of the American Society of Testing Materials (ASTM); standards of the American Waterworks Association (AWWA); standards of the American Standards Association (ASA); standards promulgated by the Federal Specification Board (Fed. Spec.); American Association of State Highway and Transportation Officials (AASHTO); The Federal Aviation Agency (FAA); or other such agencies may be referred to in the Specifications. Where such standards are referred to, said references shall be construed to mean the latest amended and/or revised versions of the said standard or tentative specifications unless specifically stated otherwise. In the selection of samples and the routine testing of materials, the testing laboratory shall follow the standard procedure as outlined by the ASTM, unless otherwise set out.

6. Extent of Inspection and Testing Service

It is intended that materials of construction, particularly those upon which the strength and durability of structures may depend, shall be inspected and tested to establish conformance with specifications and suitability for uses intended. The following paragraphs in this section of the detailed specifications describe the extent of testing requirements and methods of reporting test results for various materials that will be utilized on the project.

If it is found that this list does not cover all items that will require testing, then such materials shall be tested as directed by the Town of Jonesborough.

7. Cement

Cement shall have been shipped from the mill not more than three months prior to receipt on the work. Test and certificate showing specification conformance for each shipment from which material is used shall be furnished from the manufacturer.

8. Fine Aggregate (For Use in Cement Concrete)

Fine aggregate shall consist of natural river sand except that in special cases the Town of Jonesborough may approve manufactured sand. In certain instances sand manufactured from limestone aggregate may be required for acid protection.

Standard tests shall be made in advance of concreting by an approved independent laboratory per ASTM C-33, Pars. 2, 3, 4, and 5, and ASTM C-40 on each fine aggregate

proposed to be used, Alkali reactivity tests as per ASTM C-289. Other tests being satisfactory, the aggregate may be used pending results of 28-day mortar strength tests.

9. Coarse Aggregate (For Use in Cement Concrete)

Standard tests shall be made in advance of concreting by an approved laboratory on each grading of each coarse aggregate proposed to be used per ASTM C-33, Pars. 7, 8, and 9 and Alkali reactivity tests as per ASTM C-289.

10. Advance Tests of Concrete Design Mix(es)

Before commencement of concrete placing and after approval of cement and aggregates, an independent laboratory shall make from a single batch for each proposed mix a set of six (6) standard 6" cylinders per ASTM C-31 and cure in accordance therewith. Test two (2) cylinders at 7 days, two (2) cylinders at 14 days, and two (2) cylinders at 28 days per ASTM C-39. Two (2) beam flexure tests as per ASTM C-78 shall likewise be made and tested from the design batch.

The requirements for tests may be modified at the Town of Jonesborough's discretion without prejudice to its later requiring same (if it becomes in doubt about the quality of the concrete) if less than 50 cubic yards are required.

11. Reinforcing Steel

a. A certificate of origin and affidavit will be required for all reinforcing steel. All reinforcing steel shall be manufactured in the United States

b. Field inspection for section, rust, shape, and dimensions plus certified test report for heat number(s).

12. Structural Steel

Visual inspection at the site and certified copies of mill test on heat number used in fabrication.

13. Cast and Ductile Iron Pipe and Special Casting.

Each piece of pipe shall bear the manufacturer's name or trademark and the date cast. Each piece of pipe should also be certified by the manufacturer to have met the requirements of the governing standard specifications. Also, each piece shall be visually inspected in the field for specification conformance.

14. Ductile Iron Castings

a. Field Inspection:
For dimensions, coating, holes.

b. Laboratory Tests:
Certified test reports by foundry.

15. Polyvinyl Chloride Sewer Pipe

Inspection at the site, as practicable, per ASTM or other designated specification plus certified test reports from the supplier as performed by the manufacturer. Testing shall be in accordance with the requirements of ASTM D2412. Minimum "pipe stiffness" (F/Y) at 5 percent deflection shall be 46 psi or greater for all pipe sizes.

Deflection testing of PVC shall be run with a rigid ball or an engineer-approved 9-arm mandrel having a diameter equal to 95% of the inside diameter of the pipe. The test must be performed by manually pulling the test device through the line.

SECTION 4

GRAVITY SEWERS, MANHOLES, FORCE MAINS AND APPURTENANCES

1. Purpose

The purpose of this section is to outline the requirements for proper materials, equipment, construction, inspection, and final acceptance of gravity sewer lines, manholes, force mains, and appurtenances.

2. Pipeline Materials - Gravity Sewers

a. General

The sewer lines shall be either SDR 35 Polyvinyl Chloride (PVC) pipe or ductile iron pipe.

b. Polyvinyl Chloride Pipe for Gravity Sewers

Polyvinyl chloride pipe for gravity sewer lines shall be made from Class 12454-B or 12454-C Polyvinyl Chloride plastic as defined in the latest revision of ASTM Specification D 1784, "Specifications for Rigid Poly (Vinyl Chloride) Compounds."

The pipe shall conform to the latest revision of ASTM Specification D 3034 or ASTM Standard F-679 as it applies to Class 12454-B or 12454-C Polyvinyl Chloride plastic pipe. Pipe shall be SDR-35 with push-on elastomeric gasket joints designed so that the pipe and fittings may be connected on the job. Push-on joints shall form a watertight joint. Details of the push-on joint shall be in accordance with the approved manufacturer's standard practice. Joint lubricants shall be non-toxic and compatible with the gasket and pipe material. Gaskets shall be vulcanized natural or vulcanized synthetic rubber conforming to the latest revision of ASTM Specification F 477.

All PVC pipe shall be stored at the project site in strict accordance with the manufacturer's recommendations and at all times prior to actual installation of the pipe the Contractor shall be responsible for providing uniform support for each length of pipe stored at the site PVC pipe that has been bowed by the sun shall not he laid until it has been straightened and lies flat without restraint

The pipe shall be furnished at nominal lengths of 12.5 and/or 20 feet.

All fittings and accessories shall have push-on type joints as described above.
The pipe supplier shall furnish special fittings for use in connecting PVC pipe to existing pipe or ductile iron pipe where specified.

As a minimum the pipe shall have the following data applied to each piece:

1. Nominal Size
2. Type of Material
3. SDR or Class (color coded)
4. Manufacturer
5. NSF (National Sanitation Foundation seal of approval)
6. Quality Control Code

c. Ductile Iron Pipe

All ductile iron pipe shall be centrifugally cast, Grade 60-42-10 manufactured and tested in accordance with the requirements of the latest revision of ANSI Specification A21.51 for ductile iron pipe with a single rubber gasket seal, push-on joint, cement lined in accordance with the latest revision of ANSI Specification A21.4, and bituminous coated outside to a thickness of at least one mil. The minimum pressure class of the pipe shall be Class 350.

3. Pipeline Materials - Force Main

a. Ductile Iron Pipe

Ductile iron pipe shall be centrifugally cast, Grade 60-42-10 manufactured and tested in accordance with the requirements of ANSI Specification A21.51. The minimum pressure class of pipe for the force main shall be Class 350.

The pipe shall have a push-on type joint incorporating a single molded gasket and shall be cement-mortar lined with bituminous seal coat, inside and out, in accordance with the current requirements of AWWA C104/ANSI A21.4. Push-on type joints shall be furnished unless mechanical joints are specifically called for.

b. Polyvinyl Chloride Pipe

1. Material and Manufacturer

Polyvinyl chloride pipe for force mains shall be made from Class 12454-B or 12454-C Polyvinyl Chloride plastic as defined in the latest revision of ASTM D-1784, "Specifications for Rigid Polyvinyl Chloride Compounds."

The pipe and fittings shall conform to the latest revision of ASTM Specification D2241. Pipe shall be SDR-21, water pressure rating of 200 psi at 23°C (72.4°F). All pipe shall have push-on elastomeric bell-end joints design so that the pipe and fittings may be connected on the job without the use of solvent cement or any special equipment. Push-on joints and lubricants shall conform to the latest revision of ASTM D-3139. Gaskets shall be vulcanized natural or vulcanized synthetic rubber conforming to the latest revision of ASTM Specification F-477.

As a minimum, the pipe shall have the following applied to each piece:

(a) Nominal Size
(b) Type of Material
(c) SDR or Class (Color Coated)
(d) Manufacturer
(e) NSF (National Sanitation Foundation) Seal of Approval
(f) Quality Control Code

2. Fittings

All fittings for PVC pipe force mains shall be Class 350 mechanical joint cast iron or ductile iron conforming to the latest revision of ANSI Specifications A21.10 and A21.11 or ductile iron conforming to the latest revision of ANSI Specification A21.51 and shall meet the current requirements for the manufacturer's standards.

Fittings shown on the Plans and intended to convey the general configuration, but the Contractor shall furnish all fittings required.

All fittings shall be furnished bituminous coated outside to thickness of at least one mil and the manufacturer's standard cement inside to comply with the latest revision of ANSI Specification A21.4. In addition, a bituminous seal approximately one mil thick, shall be applied to the cement lining in accordance with the pipe manufacturer's standard practice.

4. Manholes

a. General

To prevent excessive leakage of water into manholes, special care is warranted in the design and construction of manholes, therefore, this design requires high quality watertight precast manholes. Dry cast manholes are not permitted.

Special emphasis is placed on the connection of the pipeline to the manhole in such a manner as to preclude shearing and/or leakage.

Standard manholes shall be four (4) feet or more in depth, measured from the pipe invert to the finished grade and have an eccentric type of top as shown on Standard Drawing S-3.

Shallow type manholes shall be four (4) feet or less in depth, measured from the pipe invert to the finished grade and have a flat type of top as shown on Standard Drawing S-4.

Standard drop manholes shall be constructed when the pipe enters the manhole two (2) feet or more above the invert. A drop pipe shall be provided and built as a part of the standard manhole. The drop pipe and invert connection shall be precast concrete as shown on Standard Drawing S-5.

1) Standard Manhole Frames and Covers

Manhole frames shall be furnished and set in a bed of mastic and bolted to the concrete as shown on Drawing S-3. The standard frame and cover shall be traffic type of grey cast iron ASTM A-48-83 with a 24" diameter opening weighing not less than 390 pounds as shown on Standard Drawing S-6. The covers shall be the solid type with no holes except watertight pick notches and furnished with a rubber gasket on the cover. The surface between the cover and frame shall fit smoothly without rocking and shall be thoroughly cleaned. The frame shall be attached to the manhole barrel by means of four 5/8" anchor bolts and shall be set in a bed of mastic to constitute a watertight seal between the barrel and the frame. Manhole frames and covers shall be Vulcan V-1312. See Standard Drawing S-6 for details.

2) Watertight Manhole Frames & Covers

The manhole frames shall be set in the same manner prescribed for standard frames except special attention shall be paid to securing a watertight connection to the manhole barrel.

The watertight manhole frame and cover shall be traffic type of grey cast iron ASTM-48-83 with a 24" diameter minimum clear opening weighing not less than 400 pounds and shall be of the bolted-cover design as shown Standard Drawing S-7. Watertight frames and covers shall be Vulcan V-2150-3.

The surface cover shall be the solid type with gasket seal and four (4) 1/2" stainless bolts to fasten cover and make watertight. The surface between this cover and frame shall fit without rocking. The frame shall be attached to the manhole barrel by means of four 5/8" anchor bolts and shall be set in a bed of mastic so as to constitute a watertight seal between the barrel and the frame.

Where watertight covers are used, manhole vent pipes shall be installed as shown on Standard Drawing S-8. These vents shall be installed every 1200 feet as a maximum.

3) Manhole Steps

Manhole steps shall be copolymer polypropylene plastic or corrosion-resistant rubber encased bent steel reinforcing bar type PS-1 by M.A. Industries, Inc., East Point, Georgia.

4) Manhole Inverts

Manhole inverts shall be formed from Class "C" concrete as shown on Standard Drawing S-3. Inverts for "straight-through" manholes may be formed by laying the pipe straight through the manhole, pouring the concrete invert and then cutting out the top half of the pipe. Curved inverts shall be constructed of concrete and shall form a smooth, even, half-pipe section as shown on the Plans.

5) Connection of Sewer Line to Manhole

The connection of the manhole to the pipeline(s) shall be accomplished by a Kor-N-Seal flexible boot connector that is molded from a neoprene compound meeting ASTM C-923 as shown on Standard Drawing S-3 and S-4.

Where new sewer lines are to be connected to an existing manhole, the Contractor shall core drill the wall of the manhole to the proper diameter and elevation for the new invert. A Kor-N-Seal boot shall be used to connect manhole and pipeline. See Standard Drawing S-14.

b. Precast Concrete Manholes

Precast manholes shall be constructed on a reinforced concrete foundation if the depth is fourteen (14) feet or greater and on six (6) inches of compacted crushed stone for manholes less than fourteen (14) feet in depth. The bottom section of the manhole shall be precast integrally with the precast ring and shall be 4'-0" in diameter. All concrete used in connection with the construction of manholes shall be Class "A" concrete and have a minimum 28-day compressive strength of 4000 psi.

Precast concrete rings shall be constructed using standard forms and shall conform to ASTM Standard Specification C478.

The precast sections shall be manufactured and installed in a manner so that there is no visible leakage in the manholes. The manhole sections shall be manufactured in lengths such that a finished manhole will have the least possible number of joints. No holes for lifting will be allowed. The precast rings shall be jointed using a confined 0-ring gasket joint as shown on Standard Drawing S-3, and the joint shall be grouted smooth on the inside and outside of the manhole so that no crack is visible.

The outside surface of all precast manholes shall be coated with two (2) layers of bitumastic coating applied at right angles to each other.

5. Alignment and Slopes of Sewer Lines

Gravity sewers shall be designed with straight alignments from manhole to manhole. The maximum permitted length between manholes is 400 feet. A change in direction of the

sewer line will only be allowed at manholes. When a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient.

The slope of the sewer lines shall be designed and constructed so that when flowing full the mean velocity will not be less than 2.0 feet per second. The minimum slopes for diameter size pipes will be as follows:

Sewer Size (inches)	Minimum slope * (feet/100 feet)
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.05 **
42	0.042 ***

* Great Lakes Upper Mississippi River Board, 1997.
** Recommended steeper – to give velocity of 2.1 ft/sec (WEF, 2007)
*** Recommended steeper – to give velocity of 2.3 ft/sec (WEF, 2007)

Sewer lines shall be laid with the same slope between manholes. Slopes greater than 20% will require anchoring of the sewer lines as per State of Tennessee recommendations (see Design Criteria for Sewage Works).

6. Excavation for Pipeline Trenches and Manholes

a. General

The excavation shall be carried to the depths required to serve the houses and to permit proper bedding of the pipe. The Contractor, at his own expense, shall provide adequate facilities for promptly removing water from all excavations. Trenches shall be excavated by open cut to the depths required. Trenches shall be of sufficient width to provide free working space on each side of the pipe and to permit proper backfilling around the pipe. Trenches shall not be excavated wider than 1' 6" plus the nominal diameter of the pipe, at the level of the crown of the pipe; See Paragraph 14, Shoring, Sheeting and Bracing of Excavations of this Section of these Detailed Specifications.

Unless specifically directed otherwise by the Town of Jonesborough or where required to uncover or determine the presence of underground obstructions, not more than three hundred (300) feet of trench shall be opened ahead of the pipe laying, and not more than two hundred (200) feet of open ditch shall be left behind

the pipe laying. Before laying the pipe, the Contractor shall open the trench far enough ahead to reveal obstructions that may necessitate changing the line or grade of the pipeline.
All barricades, lanterns, watchmen, and other such signs and signals as may be necessary to warn the public of the dangers in connection with open trenches, excavations and other obstructions shall be provided by and at the expense of the Contractor.

The trench shall be straight and uniform to permit laying pipe to the proper lines and grades.

When so required by the Town of Jonesborough, one-half of the street crossings and road crossings shall be excavated, then temporary bridges consisting of one-half inch steel plate shall be placed over the side excavated for the convenience of the traveling public; and then the remainder of the excavation shall be carried out. All backfilled ditches shall be maintained in such a manner that they offer minimal hazard to the passage of traffic. The convenience of the traveling public and the property owners abutting the improvements shall be taken into consideration. All public or private drives shall be promptly backfilled or bridged.

In excavation for concrete structures including manholes, the required width shall be such as to permit forms to be constructed in the proper manner and to permit proper backfilling upon completion of the structures.

All excavation shall be accomplished in accordance with applicable safety laws and regulations. The Town of Jonesborough does not assume responsibility of any degree or sort for acts of the Contractor.

In all areas along highways or roadways where the pipeline is being laid in the pavement or in the right-of-way of the road, excavation during each day shall be limited to the footage of pipe that can be laid and the trench be backfilled so that minimal ditch is left open overnight in such areas. The rules and regulations of the Tennessee Department of Transportation shall apply. The minimum depth of cover shall not be less than forty-two (42) inches for pipelines laid in the shoulder or traveled surface of any highway and/or roadway. If cover is less than 48 inches ductile iron pipe must be used. <u>All depths of cover and measured to the top of the pipe.</u>

b. <u>Force Main</u>

The excavation for the force main shall be carried to the depths indicated on the Plans and to permit proper bedding of the pipe. Trenches shall be opened to a depth so that the top of the pipe shall not be less than thirty-six (36) inches below the surface of the ground when laid through wooded areas, fields, and other such areas outside the pavement or traveled surface of the highways and roadways. The minimum depth of cover shall not be less than forty-two (42) inches for pipelines laid in the shoulder or traveled surface of any highway and/or roadway. If cover is less than 48 inches ductile iron pipe must be used. Any line laid within the pavement of a State Highway shall have a minimum depth of cover of four (4) feet. <u>All depths of cover and measured to the top of the pipe.</u>

c. Excavation Near Potable Water Line.

The Contractor shall protect water lines that cross the sewer lines by providing 18-inch minimum separation between the top of the sewer line and the bottom of the water line. When this vertical separation cannot be achieved, the water line shall be relocated to provide this separation or reconstructed with mechanical joint pipe with one (1) full length of water pipe being centered over the sewer line so that both joints will be as far from the sewer line as possible.

When sewer lines are being laid parallel to water lines, there should be a minimum of ten (10) feet horizontal separation or a minimum of eighteen (18) inches vertical separation as specified above and laid in separate trenches. See Standard Drawing S-13.

d. Excavation on Easements

Excavation of pipeline trenches on easements shall be performed in such a manner that the private property owner's facilities and ground shall be restored to as near their original condition as possible considering the work performed. The grass cover of the ditches or excavations shall be the same type as the original undisturbed cover.

Before any excavation is begun or before drilling and blasting, a minimum of nine (9) inches of the topsoil or original cover shall be removed and stockpiled in a manner so as not to contaminate the topsoil with other fill or excavated material. Should the depth of excavation require a trench wider than specified in paragraph a. above, a minimum of nine (9) inches of topsoil or original cover shall be removed from the additional area and stockpiled as described hereinbefore.

Excavated materials suitable for backfill shall be placed at a distance far enough from the ditch to allow excavated rock to be placed next to the open trench; however, stockpiling outside the easement shall be done only with the property owner's written permission.

e. Removal of Water

The Contractor shall always, during construction provide and maintain means and devices with which to promptly dispose of all water entering the excavations or other parts of the work and shall keep said excavations dry until the structures to be built therein are completed. No concrete shall be placed in water, nor shall water be allowed to rise over structures if there is danger of floatation or of setting up unequal pressures in the concrete, until the concrete has set at least twenty-four (24) hours and any danger of floatation has been removed.

The Contractor shall dispose of water from the work in a suitable manner without damage to adjacent property or sewers. No water shall be drained into work built or under construction.

During laying of sewers and until sewer pipe has been bedded in place with at least two (2) feet of backfill over the pipe, the Contractor shall keep the groundwater table below the bottom of the trench.

No sewer will be permitted to be laid except in a dry trench. Running water shall be completely blocked off by dewatering and/or sheathing. The trench must be dry and clean to ensure that the hub and spigot of the pipe are perfectly dry before a joint is made.

All removal and handling of water required to maintain dry trenches or other excavations for the construction of sewers or other structures in the dry trench shall be at the expense of the Contractor.

7. Pipe Bedding - Gravity Sewers

a. General

Bedding for gravity sewers shall be as shown on Standard Drawing S-1. Crushed stone used for bedding shall meet the requirements of the Tennessee Department of Transportation, Size 57, granular material. In general, the trench shall be opened below the bottom of the pipe and refilled with the bedding materials to a depth sufficient to provide a firm bed for the bottom quadrant of the pipe at the proper line and grade.

When rock is encountered, the trench shall be excavated to a depth at least six (6) inches below the invert of the pipe and refilled with crushed stone to a sufficient depth to provide a firm bed for the bottom quadrant of the pipe.

Material as specified hereinbefore for the type of pipe employed shall be brought up evenly along each side of the pipeline so as to secure the line and grade of the pipeline and to prevent damage thereto.

b. Bedding for Polyvinyl Chloride Gravity Sewer Line

A crushed stone envelope using Tennessee Department of Transportation, Size 57, granular material, up to a point twelve (12) inches above the top of the pipe is required for PVC pipe as shown on Standard Drawing S-1. In addition to the construction procedures outlined in other paragraphs of this Section of the

Specifications, PVC pipe shall be installed in full compliance with the latest revision of recommended practice for "Underground Installation of Flexible Thermoplastic Sewer Pipe," ASTM Designation D2321. The Town of Jonesborough may require periodic compaction tests to insure proper density of the compacted backfill according to Section 9 of the latest revision of ASTM Designation D2321.

Where sewer lines cross streets or run along shoulders, or at locations of improvements subject to damage by displacement the trench shall be backfilled entirely with Size 57 stone.

c. Bedding for Ductile Iron Gravity Sewer Lines

Bedding shall be as outlined in paragraph 7a. of this section of these specifications and as shown on Standard Drawing S-1.

8. Pipe Laying - Gravity Sewers

The trench shall be excavated to the required depth and width and bell holes dug in the bedding in advance of pipe laying.

The laying of gravity sewer pipes in finished trenches shall commence at the lowest point so that the spigot ends point in the direction of the flow. All pipes shall be laid with ends abutting and true to the line and grade. They shall be fitted and matched so that when laid in the work they will form a sewer with a smooth and uniform invert. Supporting pipes shall be as set out above under "Pipe Bedding - Gravity Sewers" and in no case will the supporting of pipes on blocks or earth mounds be permitted.

Branches, fittings and specials for sewer lines shall be provided and laid as required. All open ends of the pipe and of branches shall be sealed with stoppers or bulkheads firmly held in place to be watertight and easily removable.

Open ends of unfinished pipelines shall be securely plugged or closed at the end of each day's work or when the line is left temporarily at any other time.

9. Installation of Gravity Sewer Pipe to be Encased with Class "C" Concrete

The pipe shall be encased in Class "C" concrete and shall have a minimum 28-day compressive strength of 2500 psi. See Standard Drawing S-11 for details. Encasement will be required when minimum cover over the pipe cannot be accomplished as required by State Design Criteria.

Where concrete encasement is to be used, pipe shall be placed on six (6) inch concrete blocks positioned behind each pipe bell. After jointing the pipe, it shall be brought to the established grade by driving wooden wedges between the pipe and the concrete block. After the pipe has been brought to grade and is firmly affixed in place for true alignment the pipe trench shall be backfilled with Class "C" concrete to a point above the pipe as shown on Standard Drawing S-11. Expansion joints shall be provided at not less than twenty (20) feet intervals by making a vertical gap in the concrete of one (1) to three (3) inches; these joints shall coincide with a pipe joint. After twenty-four (24) hours the backfill will then be completed as specified herein.

10. Concrete Cradles, Caps, Collars, and Anchors

Concrete cradles, caps, collars, and anchors for the sewer lines shall be placed where required to comply with State Design Criteria. Concrete for cradles, caps, collars, or anchors shall be Class "C" and shall have a minimum 28-day compressive strength of 2500 psi. Concrete shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed when used for cradles or anchors. In tamping concrete, care shall be taken

not to disturb the grade or line of the pipe or injure the joints. See Standard Drawing S-2 for typical concrete cap and Drawing S-10 for typical concrete anchor.

11. Sewers in Relation to Streams

Sewers entering of crossing streams should be ductile iron pipe from manhole to manhole wrapped in plastic and encased by an impermeable barrier. The sewer should be free of alignment or grade changes. Employment of special design requirements shall be installed to prevent stream drainage from sinking at the crossing and following along the sewer pipe bedding such as an in-trench impounding structure of compacted clay or concrete check dam.

12. Pipe Laying and Bedding - Force Main

a. General

The trench shall be excavated to the required depth and width, bell holes and/or jointing holes shall be dug in advance of pipe laying.
The bed of each piece of pipe shall be carefully prepared so that each individual piece of pipe shall have a uniform bearing. Pipes shall be laid in a straight line and grade without kinks or sags and shall be laid in a workmanlike manner. Bell holes and/or jointing holes shall be large enough so that bell or hub will clear the ground and leave ample room for making joint and inspection of joints.
Before each pipe is lowered into the trench, it shall be thoroughly swabbed out to ensure its being clean. Each pipe shall be lowered separately unless special permission is given otherwise by the Engineer. In case a length of pipe is cut to fit a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe as per AWWA C600.

All angles or bends in the pipelines, either vertical or horizontal, shall be satisfactorily braced or anchored against the tendency of movement with joint harness, concrete or equal anchors as shown on the Plans.

Open ends of unfurnished pipelines shall be securely plugged or closed at the end of each day's work or when the lines are left temporarily at any other time. The maximum horizontal or vertical deflection for laying pipe shall be 1 per pipe section unless the manufacturer's printed instructions permit a greater deflection.

When rock is encountered laying D.I.P. or P.V.0 pipe, the trench shall be excavated to a depth at least six (6) inches below the invert of the pipe and refilled with the bedding material to a point 12" above top of pipe to provide a firm bed for the bottom quadrant of the pipe. Bedding, material for pipe laid in suitable earth or in rock is not a separate pay item. Bedding material shall be crushed stone and shall meet the requirements of the Tennessee Department of Transportation, Class I No. 57, granular material.

b. Polyvinyl Chloride Pipe

Plastic pipe shall be stored so as to prevent damage by crushing or piercing. If the pipe is to be stored for any length of time, it shall be shielded from direct sunlight. While

lowering the pipe into the trench, care shall be taken to avoid imposing strains on the pipe and the pipe shall be uniformly and continuously supported throughout the entire length on 6" crushed stone below the bottom of the pipe. Blocking of PVC pipe is not permitted. Backfill materials shall be crushed stone, Class I No. 57 up to a point twelve (12) inches over the pipe. The materials surrounding the pipe shall be brought up uniformly and compacted so as to exert uniform pressure on each side of the pipe. Great care is required to avoid causing the pipe to deform or "ellipse." The remainder of the backfill shall be placed and spread in approximately uniform layers in such a manner as to not bruise or cause excessive strain on the pipe walls.

c. Detectable Wire

Magnetically detectable wire shall be installed to locate all underground PVC pipe. Detectable wire shall be 12-gauge Thermo High Heat in a nylon jacket (12 ga. THEN). The wire shall have a minimum cover of 12" and be laid approximately 12" above the pipe.

d. Ductile Iron Pipe

Ductile iron pipe shall be laid on a soil foundation by placing select backfill material on the excavated trench bottom to a depth of not less than four (4) inches as per AWWA C150 laying condition 3. Bell holes shall be provided to insure that the pipe is uniformly supported over its entire length. Any unyielding material such as rock within the pipe foundation shall be removed and the foundation shall be brought up to grade as specified in Subparagraph a. of this Paragraph. No rock larger than two (2) inches shall be permitted within twelve (12) inches of the pipe.

13. Connection to Existing Manholes

Connection to an existing manhole shall be as shown on Standard Drawing S-14. A representative from The Town of Jonesborough must be present while the connection is being made. The Town of Jonesborough should be given at least 24 hours advance notice before connection is made.

14. Service Connection and Piping

Service connection piping shall be PVC pipe meeting the requirements of paragraph 2 of this section of these specifications or cast iron soil pipe meeting the following requirements.

Cast iron soil pipe and fittings shall conform to Federal Specifications WW-P-401, commercial extra heavy grade with bituminous coating. Joints shall be rubber gasketed slip-on type.

The ends shall be plugged with a watertight plug that can be easily removed by plumbers.

15. Backfilling Pipeline Trenches

a. General

In the backfilling of the trench, material reasonably free from rock shall be used. Walking or working on the complete pipeline, except as may be necessary in backfilling, shall not be permitted until the trench has been backfilled to a height of at least one (1) foot above the top of the pipe. The filling of the trench shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur.

In filling the remainder of the trench, the backfill material may be shoveled into the trench without compacting and heaped over whenever this method of backfilling may be used without inconvenience to the public.

In backfilling the pipeline trench in areas where the line is laid in the travelled surface of any roadway, driveway, and shoulder of road, backfill shall be crushed stone Mechanically tamped crushed stone backfill will be required on lines where street pavement is to he replaced immediately

Before final acceptance, the Contractor will be required to level off all trenches where backfill material has been piled up, or to bring the trench up to the level of the surrounding street, roadway, or terrain. The Contractor will be required to remove from the streets, roadways, and private property all excess earth or other materials.

b. Backfilling Operations Conducted on Easements

Backfilling of trenches or excavations on easements shall be performed in such a manner that the private property owner's facilities and grounds shall be restored to as near as possible their original condition immediately after pipe laying.

After the pipe bedding, pipe, and backfill along the sides of the pipe and over the pipe (if required) as specified hereinbefore has been placed, the excavated rock next to the ditch shall be placed in the ditch. Excavated rock shall not be placed any closer than eighteen (18) inches from the finished grade and any excess rock shall be removed by the Contractor and disposed of as directed.

The residue of the stockpiled bedding material shall be cleaned up and placed into the trench, leaving no bedding stone scattered over the area. The previously excavated materials suitable for backfill shall be placed into the ditch only upon clean-up and backfill of the bedding material. The top portion of the trench or excavation shall be filled using the stockpiled top soil. The ditch shall be left high to allow for settling unless this method of backfilling will cause inconvenience to the private property owner. Seeding or sodding shall proceed immediately following backfill.

If the backfilling operation is performed during extremely dry weather, the Contractor should leave some stockpiled top soil to use later as additional fill after settlement has occurred.

The Contractor will be held responsible for the condition of grass cover and the

condition of the ground surface at the time of final inspection unless the private owner has plowed or excavated the ground.

16. Unauthorized Excavation and Over-Breakage

Whenever the excavation is carried beyond or below the lines and grades proposed, the Contractor, at his own expense, shall refill such excavated space with such material and in such a manner as will ensure stability of the structure or line involved, including the use of crushed stone or Class "C" concrete.

Over-breakage is that portion of any material displaced or loosened beyond the finished work as planned or authorized, including slides. All over-breakage shall be removed by the Contractor and disposed of as directed.

17. Shoring, Sheeting and Bracing Excavations

Where unstable materials are encountered or as required by law or Government regulations, such as O.S.H.A., the sides of the trench or excavation shall be supported by substantial sheeting, bracing and shoring, or the sides sloped to the angle of repose. The design and installation of all sheeting, sheet piling, bracing and shoring shall be based on computations of pressure exerted by the materials to be retained under prevailing conditions. Adequate and proper shoring of all excavations shall be entirely the responsibility of the Contractor.

Foundations adjacent to where the excavation is to be made below the depth of the foundation shall be supported by shoring, bracing, or underpinning of a temporary or a permanent nature as may be required to assure the integrity of the structure. The Contractor will be held strictly responsible for any damage to said foundation or structure.

Even though computations shall be used to determine the size of the various components, no timber sheeting less than two (2) inches in thickness and timber bracing, cross bracing or struts less than six (6) inches in thickness will be acceptable.

Solid sheeting will be required for wet or unstable material. It shall consist of continuous vertical sheet piling of timber two (2) inches thick or of steel with suitable shores and braces. All sheeting to be left in place shall be two (2) inch thick timber.

Care shall be taken to avoid excessive backfill loads on the complete pipelines and the requirements that the width of the ditch at the level of the crown of the pipe not exceed that specified in Paragraph 5 of this Section of these Detailed Specifications.

Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

All sheeting, planking, timbering, bracing and bridging shall be placed, renewed and maintained as long as is necessary.

18. Inspection of Gravity Sewer Lines for Quality and Line and Grade

The Contractor shall notify the Town of Jonesborough when pipe will be received on the

job so that arrangements may be made for inspecting the unloading and stringing, as well as inspecting the pipe proper and examining for the manufacturer's identification. Pipe shall be unloaded and stored in accordance with the manufacturer's recommendations No. pipe (or other materials or equipment) shall be stored on private property without the permission of the property owner.

Inspection of construction shall be performed by the Resident Inspector or by the Town of Jonesborough. Before the Contractor backfills any of the lines, they shall first be inspected; and the Contractor shall be given permission to proceed with the backfilling. If any joints, pipes, or other workmanship or materials are found to be defective, they shall be removed and replaced by the Contractor.

After the sewer lines have been brought to completion, and prior to final inspection, the Contractor shall clean out the entire system by pushing through each individual line in the system, from manhole to manhole, appropriate tools for the removal from the lines of any and all debris and obstructions or may, if possible, flush clean with water.

If necessary during the process of rodding the system, water shall be turned into the system in such quantities to carry off the debris and trash.

During the final inspection, each individual line will be inspected, from manhole to manhole, to determine whether the completed lines are true to line and grade as proposed.

All lines or sections of lines that are found to be laid improperly with respect to line or grade, that are found to contain broken sections of pipe, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced at the Contractor's expense.

19. Inspection of Gravity Sewer Lines for Infiltration/Inflow

a. General

Prior to final acceptance of completed gravity sewer lines, the lines will be inspected or shall be tested to ensure compliance with the following provisions. (It should be recognized that much of the prescribed testing should be done prior to backfilling).

b. Allowable Pipeline Leakage

Generally, the Contractor will be required to lay sewer lines so that the groundwater infiltration shall not average more than twenty-five (25) gallons per twenty- four (24) hours per inch of nominal diameter per mile of sewer, including manholes and plugged services and as measured in a high groundwater condition approximately at the surface of the ground. These requirements may be applied to the entire system or may be applied to any single section of line between two (2) manholes. The more restrictive provisions set forth for specific items shall govern those items.

To test for infiltration/inflow, the Town of Jonesborough will require that the Contractor plug the open ends of all lines at a manhole so that measurements may

be made at each section of the sewer line. Temporary pumps may also be required. The Contractor will be expected to locate and repair leaks even if the location of same required T.V. inspection.

Manholes or flexible connectors shall have no visible leaks.

c. Testing of Manholes

All precast concrete manholes shall be vacuum tested to determine if they pass the infiltration/inflow requirements. The vacuum test shall be as follows:

1. The testing shall be done after assembly of the manhole including frame casting and prior to backfilling.

2. The manhole-to-pipe connection shall be a flexible connector, such as the Kor-N-Seal or approved equal.

3. All lift holes shall be plugged with an approved non-shrinking mortar.

4. The seal between the manhole sections shall be in accordance with ASTM C923.

5. The Contractor shall plug the pipe openings, taking care to securely brace the plugs and the pipe. Stub-outs, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn.

6. The test head shall be placed at the inside of the top of the casting and the seal inflated. The compression band shall be inflated to 40 psi to effect a seal between the vacuum base and the structure. The vacuum pump shall then be connected to the outlet port with the valve open, a vacuum drawn to 10" of Hg. and the valve closed.

7. With a measured vacuum of 10 inches of mercury established in the manhole, the time for the vacuum to drop to nine inches of mercury shall be recorded.

   Acceptance standards for leakage shall be established from the elapsed time for a negative pressure change from 10 inches to nine inches of mercury. The maximum allowable leakage rate for a four-foot diameter manhole shall be in accordance with the following:

Manhole Depth	Minimum Elapsed Time for a Pressure Drop of 1 Inch Hg
10 ft. or less	60 seconds
> 10 ft. < 15 ft.	75 seconds
> 15 ft. < 25 ft.	90 seconds

For manholes five feet in diameter, 15 seconds shall be added to the above

minimum times. For manholes six feet in diameter, 30 seconds shall be added to the time requirements for four-foot diameter manholes.

8. If the manhole fails the test, necessary repairs shall be made and the vacuum test and repairs shall be repeated until the manhole passes the test.

9. If a manhole joint mastic is completely pulled out during the vacuum test, the manhole shall be disassembled and the mastic replaced.

d. Testing Sewer Lines

The Contractor will be required to perform a Low-Pressure Air Test on all new sewer lines, including plugged service lines and manholes, as a condition of final acceptance. The line shall be tested from manhole to manhole. Basically, the test shall consist of installing a special pneumatic plug in the line at each manhole and pressurizing the line to about four (4) psi. After a two (2) minute temperature stabilization period the line pressure shall be brought to 3.5 psi and timing begins with a stop watch. The time required for a drop in pressure of 1.0 psi will be recorded. The minimum allowable time in seconds for this pressure drop to occur shall not exceed the times listed in the table below:

Pipe Size	Time in Seconds per 100 L.F.
6”	42
8”	72
10”	90
12”	108
15”	126
18”	144

If the time for the one (1) psi pressure drop is less than the calculated value, the line shall be repaired and retested until it passes the test.

If groundwater is present the test pressure shall be increased 1.0 psi for each 2.3 feet of water above the pipeline.

The tests shall be conducted in the presence of a the Town of Jonesborough representative and a complete tabulated report of the tests for each section of the sewer shall be prepared by the Contractor and submitted to the Town of Jonesborough.

In the event of a marginal test at the time of the final inspection, the Town of Jonesborough may recommend another inspection of the lines be held during the worst anticipated seasonal groundwater conditions.

In addition, the following test procedure may be used to determine the watertightness of the new sewers. The Town of Jonesborough will install and maintain a rainfall recorder which will show a graph of each 0.01-inch rainfall on

a twenty-four (24) hour chart. The Town of Jonesborough will also install a weir and a continuous flow recorder to determine if any leakage exists.

20. Leakage Testing of Force Main

Testing of lines shall comply with the provisions listed below, or similar approved procedures which will ensure equal or better results.

Pipe lines or whatever material shall be tested at the pressures as shown in the following table at which pressure the allowable leakage shall not exceed the requirements of AWWA Specification C-600 or as follows:

Force Main	Test Pressure	Allowable Leakage Per 1000 feet
1-1/4 inch	150 psig	0.20 gal. per hr.
1-1/2 inch	150 psig	0.25 gal. per hr.
2-inch	150 psig	0.30 gal. per hr.
2-1/2 inch	150 psig	0.35 gal. per hr.
3 inch	150 psig	0.40 gal. per hr.
4 inch	150 psig	0.60 gal. per hr.
6 inch	150 psig	0.80 gal. per hr.
8 inch	150 psig	1.00 gal per hr.

Pressure shall be measured at low point on section of pipe line. The Contractor shall furnish all gauges, meters, pumps, and other equipment required and shall maintain said equipment in condition for accurate testing as determined by the Engineer.

Where leaks are visible at exposed joints and/or evident on the surface when joints are covered the pipe shall be rejoined and leakage minimized regardless or total leakage as shown by test.

Duration of test shall be not less than two (2) hours where joints are exposed and not less than eight (8) hours where joints are covered.

Lines which fail to meet the leakage requirements shall be repaired and re-tested until test requirements are met.

All pipe, fittings, and other materials found to be defective under test shall be removed and replaced at the Contractor's expense.

21. Replacing Streets, Roadways, and Driveways

a. General

The Contractor shall replace all streets, alleys, drives, and roadways which may be removed, disturbed, or damaged in connection with his operation. The Contractor shall reconstruct same to the original lines and grades and in such a manner as to

leave all such surfaces in fully as good or better condition as that which existed prior to his operations. Backfill material under gravel drives, paved streets and roadways shall be Tennessee Department of Transportation, Size 67, granular material.

The Contractor shall repair damaged base on either side of the trench wherever necessary. The edges of pavement shall be trimmed to neat lines a minimum of 12 inches outside of the trench wall, and the entire area shall be repaved. See Standard Drawing S-1.

Gravel, crushed limestone, bituminous materials, or other materials used in the resurfacing of streets shall meet the current requirements of the Standard Specifications of the Tennessee Department of Transportation.

22. Seeding, Sodding and Landscaping

All disturbed areas shall be left smooth and thickly sown with grass seed to match existing pre-construction grass conditions. The Contractor shall replace all sod, disturbed during construction, to match existing sod.

The Town of Jonesborough shall inspect the seeding within 60 days after planting and determine if it is acceptable. An area is considered acceptable if it is represented by a minimum of 100 seedlings per square foot of the permanent species of grass representative of the seed mixture. If an acceptable growth is not obtained on the first planting, reseeding and remulching will be required.

23. Termination of Force Main

The force main shall enter the existing receiving manhole with its centerline horizontal and turn down with necessary fittings as shown on Plans. The design should minimize turbulence at the point of discharge.

Consideration shall be given to the use of inert materials or protective coatings for the receiving manhole to prevent deterioration as a result of hydrogen sulfide or other chemicals where such chemicals are present or suspected to be present or suspected to be present because of industrial discharges or long force mains.

24. Boring and Casing for Water and Sewer Tines

a. Bore and Jack for Gravity and Force Main Sewers

The work to be performed hereunder shall consist of the installation of a casing pipe for the purpose of installing a sanitary sewer or water line as shown on the drawings or as called for in these specifications. Is shall include the excavation of a boring pit, auger boring between the points specified on the drawings, furnishing and installing of the carrier pipe, and disposing of the excavated materials in the manner herein provided.

The casing pips shall be steel meeting the latest approved American Railway

Engineering Association "Specifications for Pipelines for Carrying Flammable and Non-flammable Substances". The steel casing pipe shall have a minimum yield strength of 35,000 psi and shall have the minimum wall thickness shown on the following table:

TABLE OF MINIMUMW ALL THICKNESS FOR STEEL CASING PIPE FOR E80 LOADING		
(not coated or cathodically protected)		
Carrier Pipe	Casing Pipe	Nominal Thickness
4	8	0.188”
6	12	.0188”
8	16	0.271”
10	20	0.344”
12	22	0.344”
14	24	0.375”
16	26	0.406”
18	28	0.438”

Carrier Pipe: The carrier pipe shall be ductile iron pipe with restrained joint gaskets. Restrained joint gaskets shall be Fast Grip as manufactured by American Cast Iron Pipe or equal.

The boring shall be accomplished by means of auguring to the size, line and grade shown on the drawings.

Jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide watertight joints.

Do not remove unacceptable casing without prior approval from the Engineer. If the removal of casing pipe is permitted, make proper provisions to prevent caving in of the earth surrounding the casing.

The carrier pipe shall be furnished by the Contractor. Contractor shall install prefabricated spacers to center and restrain carrier to be located on each side of the pipe joint, and at least 2 feet from each end of casing, and otherwise 6'-7' on center. Provide flexible watertight wraps with stainless steel straps at each end of casing pipe. Install the carrier pipe in the casing by jacking it through the casing.

Guarantee a usable completed casing between the points specified and to the line and grade specified. The allowable tolerance at eth downstream end point of the bore shall be such that the invert of the carrier pipe may be positioned within a vertical area limited on the top by an elevation no higher than the elevation shown on the drawings and on the bottom by an elevation no lower than the existing inlet pipe invert. For sewers, the sides shall be a minimum of 8" inside the interior face of the manhole at the end of the bore.
The allowable tolerance at the upstream end point of the bore shall be such that the invert of the carrier pipe may be positioned at the elevation shown on the drawings.

b. Directional Bore for Force Main Sewers

Directional boring is an approved alternative for **force main sewers only** and shall be granted by Town of Jonesborough only on a "case-by-case" basis. The force main shall be SDR-9 polyethylene unless otherwise authorized by Town of Jonesborough and must be equipped with butt-fused mechanical joint adaptors. This alternative method shall apply to pipe diameters 8" or less.

25. Sewage Air and Vacuum Release Valves

Air and vacuum release valves for sewer force mains shall be installed as shown on the Plans or at the high point on the force main line.

Air and vacuum release valves for sewer force mains shall be APCO Series 400 Sewage Air and Vacuum Valve as manufactured by Valve and Primer Corporation, or equal, with a two (2) inch NPT inlet and one (1) inch NPT outlet. Valve shall operate at pressures below 20 psi. Air valves shall be supplied with all attachments.

26. Plug Valves and Ball Valves

a. Plug Valves

Plug Valves shall be of the non-lubricated eccentric type, with resilient plug faces, semi-steel bodies and shall be suitable for 125 psi working pressure. Port Areas of valves shall be at least eighty (80) percent of full pipe area. All plug valves shall open left. Valve boxes shall be supplied with each valve and all necessary adapters to connect valve to PVC force main pipe. Five (5), 48-inch long, tee wrenches shall be supplied for each different size operating nut.

Plug valves shall be Dezurik Series 100, Homestead Ballcentric, Dresser X-centric Series 800, Keystone Ballcentric, or approved equal.

b. Ball Valves

Ball valves shall be used where authorized by Town of Jonesborough for 1-1/4", 11/2", 2", 2-1/2" & 3" PVC pipe. Valves shall be of the true union design with independent floating seat retainers at each end. Valves shall be made of rigid, un-plasticized polyvinyl chloride, Type 1, Grade 1. Valves shall have TFE seats and Vitron 0-ring seals. Port opening through ball shall be same size as pipe. All valves shall be supplied with valve box and all necessary adapters to connect valve to PVC force main pipe. Valves shall be as manufactured by Hayward Manufacturing Company or approved equal.

27. Rip-Rap

Rip-rap shall be of the rubblestone type (Plain) and placed to a depth of not less than twelve (12) inches. Materials and construction methods for rubble stone rip-rap (Plain) shall

conform to the requirements of the Tennessee Department of Transportation Standard Specifications. See Standard Drawing S-12.

SECTION 5

RESIDENTIAL GRINDER PUMPS AND APPURTENANCES

1. Scope

The work under this Section of the Detailed Specifications consists of the furnishing of all labor, materials, equipment, and services necessary for the installation of grinder pumps for Town of Jonesborough. The Contractor/Developer (Contractor) shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged on delivery. The Contractor shall be responsible for the safe storage of material furnished by him until it has been incorporated in the completed project. All motors and electrical and mechanical components shall be stored in a dry environment.

Refer to Standard Drawings S-24 through S-35.

2. Grinder Pump Stations

a. General Description

The grinder pump stations shall be completely factory built and tested, each consisting of a grinder pump suitably mounted in a fiberglass or high density polyethylene basin, pump removal system, electrical quick disconnect, shut-off valve, anti-siphon valve, and check valve assembled within the basin, remote electrical alarm/disconnect panel, and all necessary wiring and controls. The pumps shall be semi-positive displacement type grinder pumps. For ease of serviceability, all pump motor/grinder units shall be of like type and horsepower throughout the system.

b. Manufacturer

The equipment specified shall be a product of a company experienced in the design and manufacture of grinder pumps for specific use in low pressure sewage systems. The company shall submit detailed installation and user instructions for its product; submit evidence of an established service program including complete parts and service manuals, and be responsible for maintaining a containing inventory of grinder pump replacement parts. Manufacturer shall be Environment One or approved equal.

c. Operating Conditions

The grinder pumps shall be capable of delivering 14 gpm against a total dynamic head of 15 feet (7 psig) and 9 gpm at 138 feet (60 psig). The pumps must also be able to operate at negative heads without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create an apparent head.

d. Grinder Pumps

1) Pump

The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with a mechanical seal. The pump shall be made of materials suited for use in domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, good aging properties, and outstanding wear resistance.

2) Grinder

The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece stainless steel motor shaft. The grinder impeller assembly shall be securely fastened to the pump motor shaft. The grinder will be of the rotating type with a stationary hardened and ground chrome steel shredding ring spaced in accurate close annular alignment with the driven impeller assembly, which shall carry two hardened type 400 series stainless steel cutter bars. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures The grinder shall be constructed so as to eliminate clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour tank free of deposits or sludge banks which would impair the operation of the pump. The requirements shall be accomplished by the following, in conjunction with the pump:

a) The grinder shall be positioned in such a way that solids are fed in an upward flow direction.

b) The inlet shroud shall have a diameter no less than 5 inches.

c) At maximum flow the average inlet velocity must not exceed 0.2 feet per second.

d) The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.

The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects", such as paper, wood, plastic, glass, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter s/s discharge piping.

3) Electric Motor

As a minimum, the motor shall be a 1 HP, 1725 RPM, 230 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, squirrel cage induction type with a low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories Inc., for the application.

4) Mechanical Seal

The core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

e. Tank and Integral Access Way

1) General

Tanks shall be made of fiberglass reinforced polyester resin (FRP) or high density polyethylene (HDPE). Tank capacities and dimensions shall be as shown on the standard drawings.

2) Fiberglass Reinforced Polyester

Fiberglass tanks shall be custom molded of reinforced polyester resin and shall be furnished with one inlet grommet to accept a 4.50-inch OD DWV pipe. The access way shall be an integral extension of the FRP tank and shall be made of high density polyethylene of a grade selected for environmental stress cracking resistance. It shall have an access opening at the top to accept a lockable fiberglass cover.

3) High Density Polyethylene Construction

The tank shall be made of high density polyethylene of a grade selected for environmental stress cracking resistance. Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. Corrugations of outside wall are to be of a minimum amplitude of 1-1/2" to provide necessary transverse stiffness. Any incidental section of a single wall construction are to be a minimum .250 inch thick. All seams created during tank construction are to be thermally welded and factory tested for leak tightness. Tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to maximum external soil and hydrostatic pressure.

The tank shall be furnished with one EPDM grommet fitting to accept a 4.50" OD DWV pipe.
The access way shall be an integral extension of the wet well assembly and include a lockable cover assembly providing low profile mounting and water-tight capability. Access way design and construction shall facilitate field adjustment of stations weight in increments of 4" or less without use of any adhesives or sealants requiring cure time before installation can be completed.
The station shall have all necessary penetrations molded in and factory sealed. No field penetrations shall be acceptable.
All discharge piping shall be constructed of 304 Series Stainless Steel and terminate outside the access way bulkhead with a stainless steel, 1-1/4" female NPT fitting. The discharge piping shall include a stainless steel ball valve rated for 200 psi WOG. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.
The access way shall include single NEMA 4X electrical quick disconnect for all power and control functions, factory installed with access way penetrations warranted by the manufacturer to be watertight. The access way shall also include a 2" PVC vent to prevent sewage gases from accumulating in the tank.

f. Check and Anti-Siphon Valves

The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve build into the stainless steel discharge piping. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Working parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back pressure. The valve body shall be an injection molded part made of glass filled PVC.

Each grinder pump station shall also include one separate check valve for installation in the 1-1/4" service lateral between the grinder pump station and the sewer main preferably near the curb stop or property line.

The pump discharge piping shall also be equipped with a factory installed, integral anti-siphoning air relief valve immediately below the check valve. This valve will automatically open when the pump is off.

g. Controls

Necessary controls shall be located in the top housing of the core unit. The top housing will be attached with stainless steel fasteners.
Non-fouling wastewater level detection for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air-bell level sensor connected to a pressure switch. The level detection device shall have no moving parts in direct contact with the wastewater. High-level sensing will be accomplished in the manner detailed above by a separate air-bell sensor and pressure switch of the same type.

To assure reliable operation of the pressure sensitive switches, each core shall be equipped with a breather assembly, complete with a suitable means to prevent accidental entry of water into the motor compartment.

The grinder pump will be furnished with a length of 6 conductor, 12 gauge, type SJOW cable; pre-wired and watertight to meet UL requirements.

h. Alarm/Disconnect Panel

Each grinder pump station shall include a NEMA 3R, UL listed Alarm/Disconnect Panel suitable for wall or pole mounting. The NEMA 3R enclosure shall be manufactured of thermoplastic to assure corrosion resistance. The enclosure shall include a hinged, padlocked cover, secured dead front and component knockouts. The enclosure shall not exceed 7.5"W 8.75"H x 3.75"D.

The panel shall contain on (1) - 30 amp, double pole circuit breaker for the power circuit and one (1) 15 amp single pole circuit breaker for the alarm circuit. The panel shall contain terminal blocks, integral power bus, push to run feature and a complete alarm circuit.

The Alarm/Disconnect Panel shall include the following features: audio & visual alarm, push-to-run switch, and high level (redundant) pump starting control. The alarm sequence is to be as follows:

1) When liquid level in the sewage wet-well rises above the alarm level, visual and audio alarms will be activated. The contacts on the alarm pressure switch will close. The redundant pump starting system will be energized.

2) The audio alarm may be silenced by means of the externally mounted, push-to-silence button.

3) Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off' setting of the alarm pressure switch.

The visual alarm lamps shall be inside a red fluted lens at least 2-5/8" in diameter and 1-11/26" in height. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 3R rating. During a high level alarm condition the light will illuminate to indicate that the pump core requires servicing.

The audio alarm shall be a printed circuit board in conjunction with an 86 dB buzzer with quick mounting terminal strip mounted in the interior of the enclosure. The audio alarm shall be capable of being de-activated by depressing a push-type switch which is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure.

The Alarm/Disconnect Panel as manufactured, shall be listed by Underwriters Laboratories, Inc.

i. Core Unit

The grinder pump station shall have cartridge type easily removable core assemblies containing pump, motor, grinder, controls, check valve, anti-siphon valve, and electrical quick disconnect and wiring. The watertight integrity of the core unit, shall be established by 100% factory test at a minimum of 5 psig.

3. Factory Test

Each grinder pumps shall be submerged and operated for 5 minutes (minimum). Included in this procedure will be the testing of all ancillary components such as the anti-siphon valve, check valve, discharge line, level sensors and each unit's dedicated controls. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field, shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps will not be acceptable. Certified test results shall be available upon request showing the operation of each grinder pump at two (2) different points on its curve, with the maximum pressure no less than 60 psi. Town of Jonesborough reserves the right to inspect such testing procedures at the grinder pumps manufacturer's facility.

All completed stations shall be factory leak tested to assure the integrity of all joints, seams and penetrations. All necessary penetrations such as inlets, discharge fittings and cable connectors shall be included in this test along with their respective sealing means (grommets, gaskets, etc.).

4. Serviceability

The grinder pump core unit shall have two lifting hooks complete with nylon lift-out harness connected to its top housing to facilitate easy core removal when necessary. All mechanical and electrical connections must provide easy disconnect accessibility for core unit removal and installation. A push-to-run feature will be provided for field trouble shooting. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

5. Delivery

All grinder pumps units will be delivered to the job site, 100% completely assembled, including testing, ready for installation. Grinder pump units will be individually mounted on wooden pallets.

6. Installation

Earth excavation and backfill are specified under site work, but are also to be done as a part of the work under this section, including any necessary sheeting and bracing. The Contractor shall be responsible for handling groundwater to provide a firm, dry subgrade for the structure, and shall guard against flotation or other damage resulting from general water or flooding. The grinder pump stations shall not be set into the excavation until the installation procedures and excavation have been approved by the Engineer.

Remove packing material. User’s instruction must be given to Town of Jonesborough. Hardware supplied with the unit, if required, will be used at installation. The basin will be supplied with a standard 4" inlet grommet (4.50" OD) for connecting the incoming sewer line. Appropriate inlet piping must be used. The basin may not be dropped, rolled or laid on its side for any reason.

Installation shall be accomplished so that 1" to 4" of access way, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the hole must be large enough to allow of the concrete anchor.

A 6" (minimum) layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8" or more than 3/4" shall be used as bedding material under each unit. A concrete anti-flotation collar, as detailed on the drawings, and sized according to the manufacturer's instructions, shall be required and shall be pre-cast to the grinder pump or poured in place. Each grinder pump station with its precast anti-flotation collar shall have a minimum of four (4) lifting eyes for loading and unloading purposes. The unit shall be leveled, and filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an 8" sleeve is required over the inlet prior to the concrete being poured.

The Contractor will provide and install a four (4) foot piece of four inch SCH 40 PVC pipe with cap, to stub-out the inlet for the property owners' installation contractor, as depicted on the contract drawings.

Backfill of clean native earth, free of rocks, roots, and foreign objects shall be thoroughly compacted in lifts not exceeding 12" to a final Proctor Density of not less than 85%. Improper backfilling may result in damaged access ways.

The grinder pump station shall be installed at a minimum depth from grade to the top of the 11/4" discharge line, to assure maximum frost protection. The finish grade line shall be 1" to 4" below the bottom of the lid, and final grade shall slope away from the grinder pump station.

All restoration will be the responsibility of the Contractor. The properties shall be restored to their original condition in all respects, including, but not limited to, curb and sidewalk replacement, landscaping, loaming and seeding, and restoration of the traveled ways, as directed by Town of Jonesborough.

The electrical enclosure shall be furnished, installed and wired to the grinder pumps station by the Contractor. An alarm device is required on every installation, there shall be no exceptions. It will be the responsibility of the Contractor and Town of Jonesborough to coordinate with the individual property owner(s) to determine the optimum location for the "Alarm/Disconnect Panel."

The Contractor shall mount the alarm device in a conspicuous location, as per national and local codes. The Alarm/Disconnect Panel will be connected to the grinder pump station by a length of six (6) conductor 12 gauge TC type cable as shown on the contract drawings. The power and alarm circuits must be on separate power circuits.

7. Start-up and Field Testing

The manufacturer shall provide the services of qualified factory trained technician(s) who shall inspect the placement and wiring of each station, perform field tests as specified herein, and instruct Town of Jonesborough personnel in the operation and maintenance of the equipment before the stations are accepted by Town of Jonesborough. All equipment and material necessary to perform testing shall be the responsibility of the contractor. This will include, as a minimum, a portable generator (if temporary power is required) and water in each basin.

The services of a trained factory-authorized technician shall be provided at a rate of one (1) four (4) day week for each 100 grinder pump stations supplied. Each day shall be ten (10) person hours in duration.

Upon completion of the installation, the authorized factory technicians will perform the following test on each station:

a. Make certain the discharge shut-off valve is fully open. This valve must not be closed when the pump is operating. In some installations, there may be a valve(s) at the street main that must also be open.

b. Turn ON the alarm power circuit.

c. Fill the wet well with water to a depth sufficient to verify the high level alarm is operating. Shut off water.

d. Turn ON pump power circuit. Initiate pump operation to verify automatic "on/off' controls are operative. Pump shall immediately turn ON. Within one (1) minute alarm light will turn OFF. Within three (3) minutes the pump will turn OFF.

Upon completion of the start-up and testing, the Manufacturer shall submit to the Engineer the start-up authorization form describing the results of the tests performed of reach grinder pumps station. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed.

8. Shop Drawings

After receipt of notice to proceed, the Contractor shall furnish a minimum of six (6) sets of shop drawings detailing the equipment to be furnished including dimensional data and materials of construction. Town of Jonesborough shall promptly review this data, and return four (4) copies as accepted, or with requested modifications. Upon receipt of accepted shop drawings, the Manufacturer shall proceed immediately with fabrication of the equipment.

9. Operation and Maintenance Manuals

The Contractor shall supply five (5) copies of Operation and Maintenance Manuals to Town of Jonesborough.

10. Warranty

The grinder pump Manufacturer shall provide a part(s) and labor warranty on the complete station and accessories, including, but not limited to panel and redundant check valve, for a period of twenty-four (24) months after notice of Town of Jonesborough acceptance, but no greater than twenty-seven (27) months after receipt of shipment. Any defects found during the warranty period will be reported to the Manufacturer by Town of Jonesborough.

SECTION 6

SEPTIC TANK EFFLUENT SYSTEMS

1. Scope

This specification outlines requirements for concrete septic tanks and septic tank effluent pump (STEP) and septic tank effluent gravity (STEG) systems. When used for septic systems the septic tank shall meet the Tennessee Department of Environment and Conservation, Division of Water Resources Rule 0400-48-01.08 for septic tanks.

2. Septic Tank

a. Material

Concrete will be ready mixed with cement conforming to TYPE II standards. Cement content shall be not less than six sacks per cubic yard with an aggregate size of 3/4". The concrete shall have a minimum 28 day compressive strength of 5,000 psi.

Reinforcing will be 6"x6"x10 gauge wire mesh centered in top, bottom, sides, ends and lids, with one inch of concrete cover. Additional top reinforcing shall be #3 rebar with 12" center length and 18" center width.

Sealant shall be 1" x 1" Butyl Rubber Mastic Sealant between lid and tank at the joint-line and shall run continuous.

b. Septic Tank Construction

The septic tank shall be 1000 gallons in capacity with 12" freeboard. It will have three inlets with maximum pipe size of 4". The inlet manhole shall be 16" round clearance with a #3 rebar handle. The lid shall have a 16" round opening with grooves to accept the pump riser on the outlet end.

The septic tank shall have 3" thick walls with a 4" thick bottom and top. The walls and bottom shall be poured monolithically.

The septic tank shall undergo a hydrostatic test at the factory using an above ground procedure.

The inlet tee will be for the contractor to furnish and install.

The septic tank shall have the manufacturers’ initials and size on the outlet end.

c. Installation. Testing. Bedding and Backfill

The septic tank hole shall not be more than 2 feet longer and wider than the tank with a maximum backfill cover of 30" and a minimum backfill of 6". There shall be a minimum of 6" of 3/4" stone bedding in soil terrain and 12" of rock under the septic tank. The stone bedding will be level.

After setting the septic tank in the hole, it shall be filled with water to check for leakage then backfilled after passage of the leak test. The leakage test procedure shall be as follows:

The tank shall be filled with water to a point 2 inches into the riser. After 24 hours, make-up water shall be added as necessary to bring the level back to the original fill point. Water level shall be measured over the next two hours. Any loss shall be cause for rejection.

The backfill must contain no rocks or stones larger than 2" in diameter, and the tank should be backfilled immediately after testing. Initially, a 12" layer of selected soil should be placed and compacted along the tank.

Septic tanks shall not be installed beneath the paths of vehicles or heavy equipment.

d. Risers & Lids

Inlet risers (required only on two compartment tanks and tanks with greater than 1500 gallon capacity) shall be ribbed PVC as manufactured by ORENCO SYSTEMS, Inc. (0 SI) or approved equal. Risers shall extend to the ground surface and shall have a minimum nominal diameter of 21 inches.

e. Outlet Risers

Outlet risers shall be ribbed PVC as manufactured by OSI or approved equal. Risers shall be at least 12" high and shall have a minimum nominal diameter of 24" when used with 12" or 15" diameter pump vaults, or 30" when used in a duplex application. Risers shall be factory-equipped with the following:

1. Two 1" diameter rubber grommets, one for the splice box and one for the pump discharge, installed as shown on the drawing.

2. Adhesive shall be two-part epoxy, one pint per riser, for bonding riser to tank. One quart for 30-inch diameter.

f. Lids

One shall be furnished with each riser. Lids shall be OSI Model FL-21g, FL-24g, or FL30g or approved equal, as appropriate, fiberglass with green non-skid finish, and provided with urethane gasket, stainless steel bolts, and wrench. The riser and lid combination shall be able to support a 2500 lb. wheel load. (NOTE: This is not to imply that PVC risers are intended for traffic areas. Please refer to section on traffic protection.)

g. Insulation

Rigid closed-cell foam insulation of 2" or 4" thickness shall be bonded to the underside of the lid. The R value shall be no less than 10 per 2" increment. (If required)

h. Riser Installation

Shall be accomplished according to the manufacturer's instructions.

3. STEP Pumping Assemblies for Single-Family Dwellings

a. General

All pumping systems shall be ORENCO SYSTEMS (OSI) High-Head Pumping Assembly or approved equal, and shall be composed of:

1. Risers & Lids. Same as sub-paragraphs d. through h. in paragraph 2 above.

2. Screened pump vault shall be OSI Model SVT1548-18FI or SV1560-24FI Bio-tube Screened Pump vault. The filter shall have a minimum effective screen area of no less than 22.5 square feet. The screened pump vault shall consist of a 15" diameter, 48" or 60" deep PVC vault with eight (8) 1-1/8" diameter holes evenly spaced around the perimeter, located approximately to allow for maximum sludge and scum accumulation before requiring pumping (approximately 70% of minimum liquid level). Housed inside the PVC vault shall be the Bio-tube assembly consisting of 1/8" mesh polypropylene tubes and a 4" diameter flow inducer to accept the high-head effluent pump.

3. Discharge hose and valve assembly shall be OSI Model HV125PRBCX, 1" diameter, 150 psi PVC ball valve, PVC flex hose with working pressure rating of 200 psi, Schedule 40 PVC pipe, and a 12" length of PVC flex hose with fittings to be installed outside the riser. When pumping downhill, include anti-siphon assembly OSI Model AS, and 6 GPM flow controller, OSI Model FC.

4. Mercury switch float assembly shall be OSI Model MF2AR, with three mercury switch floats mounted on a PVC stem attached to the effluent screen. The floats must be adjustable without removing screened pump vault. The high/low alarms and on/off function shall be preset as shown on the drawing. Each mercury switch float shall be secured with a nylon strain relief bushing. The "A" & "R" floats shall be UL- or CSA-listed and shall be rated for 4.5 A @ 120V.

5. High-Head effluent pump shall be OSI Model 100S105BHF or 100S1071-111F, 2 HP, 115 V, single phase, 60 Hz, 2-wire motor, with an 8 foot long extra heavy duty (SO) electrical cord with ground to motor plug. Pump shall be UL and/or CSA listed as an effluent pump. Pump shall be provided with a non-prorated five (5) year warranty.

6. Electrical splice box shall be OSI Model SB4, UL approved for wet locations, equipped with four (4) electrical cord grips and a 3/4-inch outlet fitting. Also included shall be UL-listed butt splice connectors.

7. Controls and alarms shall be OSI Model S-1ROETM and be listed per UL 508. Panels shall be field repairable without use of soldering irons or substantial disassembly. Control panels shall meet the following:

a) Redundant-Off Relay: 115V, automatic, single pole.

b) Audible Alarm: Panel mount with a minimum of 80 db sound pressure at 24 inches as a warble tone.

c) Visual Alarm: NEMA, 4, 7/8-inch diameter, oil-tight, with push-to-silence feature.

d) Audio-Alarm Reset Relay: 115 V, automatic, with DIN rail mount socket base.

e) Toggle Switch: 15 amp motor rated, single-pole, double-throw with three positions: Manual (MAN), (OFF) and Automatic (AUTO).

f) Fuse Disconnect: DIN rail mount socket base with 5 amp, 10,000 AIC fuse.

g) Current-Limiting Circuit Breaker: Rated for 20 amps, OFF/ON switch, DIN rail mounting with thermal magnetic tripping characteristics.

h) Enclosure: NEMA 4X, fiberglass with stainless steel or non-metallic hinges, stainless steel screws and pad lockable latch. 10" high X 8" wide X 5 1/8" deep.

i) Alarm Circuit: Wired separately from the pump circuit so that, if the pump internal overload switch or current-limiting circuit breaker is tripped, the alarm system remains functional.

j) Motor Start Contactor: rated for 24 FLA, single-phase, 60 Hz.

k) Elapsed Time Meter: 115 VAC, 7-digit, non-resettable.

b. Installation

All pumping systems shall be installed in accordance with the manufacturer's recommendations and the standard plans.

c. Location

The pump control panel shall be mounted on the side of the house nearest the tank and pump. NEC requires that the control panel be located within 50 feet of and within sight of the pump.

4. STEG Gravity Assemblies for Single-Family Dwellings

a. General

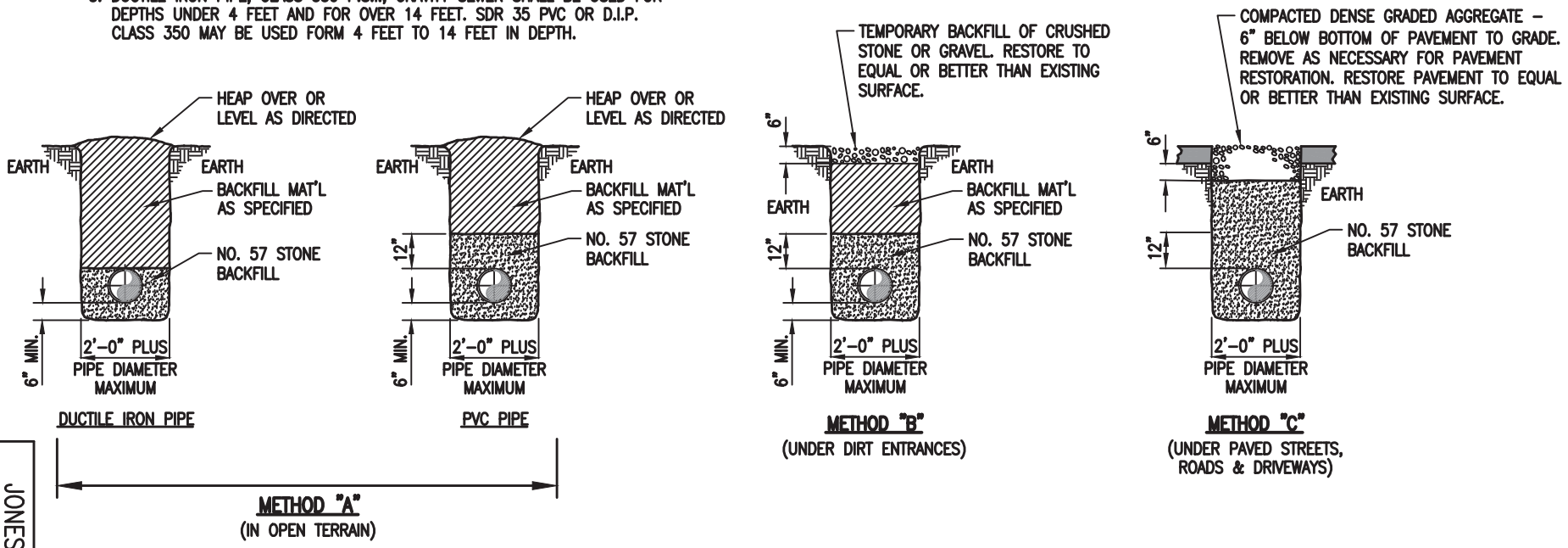
1. Risers & Lids. Same as sub-paragraphs d. through h. in paragraph 2 above.

2. All filter systems shall be supplied by a reputable manufacturer with at least five years' experience in supplying equipment for effluent sewers. Gravity systems shall be equipped with OSI Model FT0444-36 Bio-tube Effluent Filter or approved equal. The filter shall have an effective screen area of no less than 5.3 square feet and a flow are of no less than 1.5 square feet. The effluent filter shall consist of a 4" diameter, 44" deep PVC vault with eight (8) 1-1/8" diameter holes evenly spaced around the perimeter, located approximately to allow for maximum sludge and scum accumulation before requiring pumping (approximately 70% of minimum liquid level). Housed inside the PVC vault shall be 1/8" mesh polypropylene tubes with a solid base to prevent solids from entering through the bottom during ebullition. The 4" direct coupled outlet shall contain two 2" diameter flow modulating orifices and one 2" diameter vent hole. The lateral from the tank to the collection line shall be laid to a uniform grade with no high points.

b. Installation

All gravity systems shall be installed in accordance with the manufacturer's recommendations and the standard plans.

NOTE:
1. SEE SPECIFICATIONS FOR DEPTH REQUIREMENT OF SEWER PIPE.
2. UNTIL REPAVING IS COMPLETE USE A DENSE GRADE STONE FOR A TEMPORARY SURFACE – EQUAL TO EXISTING SURFACE OR 6" MIN.
3. DUCTILE IRON PIPE, CLASS 350 P.S.I., GRAVITY SEWER SHALL BE USED FOR DEPTHS UNDER 4 FEET AND FOR OVER 14 FEET. SDR 35 PVC OR D.I.P. CLASS 350 MAY BE USED FORM 4 FEET TO 14 FEET IN DEPTH.



JONESBOROUGH, TENNESSEE

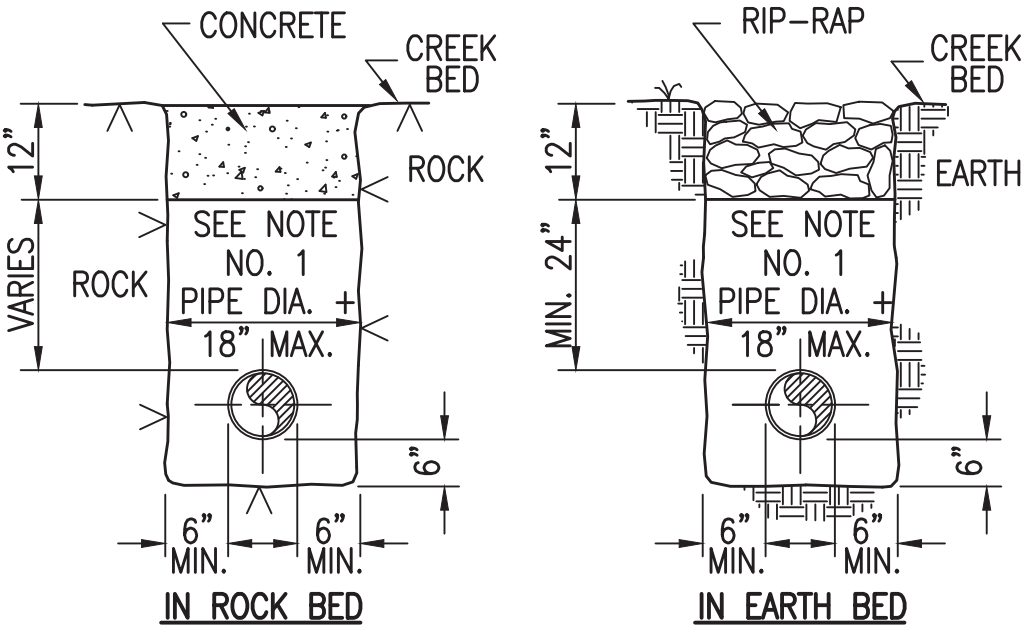
STANDARD GRAVITY SEWER BEDDING AND BACKFILLING

NOT TO SCALE

JONESBOROUGH, TENNESSEE
STANDARD SEWER DRAWING
NO. S–01

NOTES:

1. CRUSHED STONE OR CONCRETE AS REQUIRED.

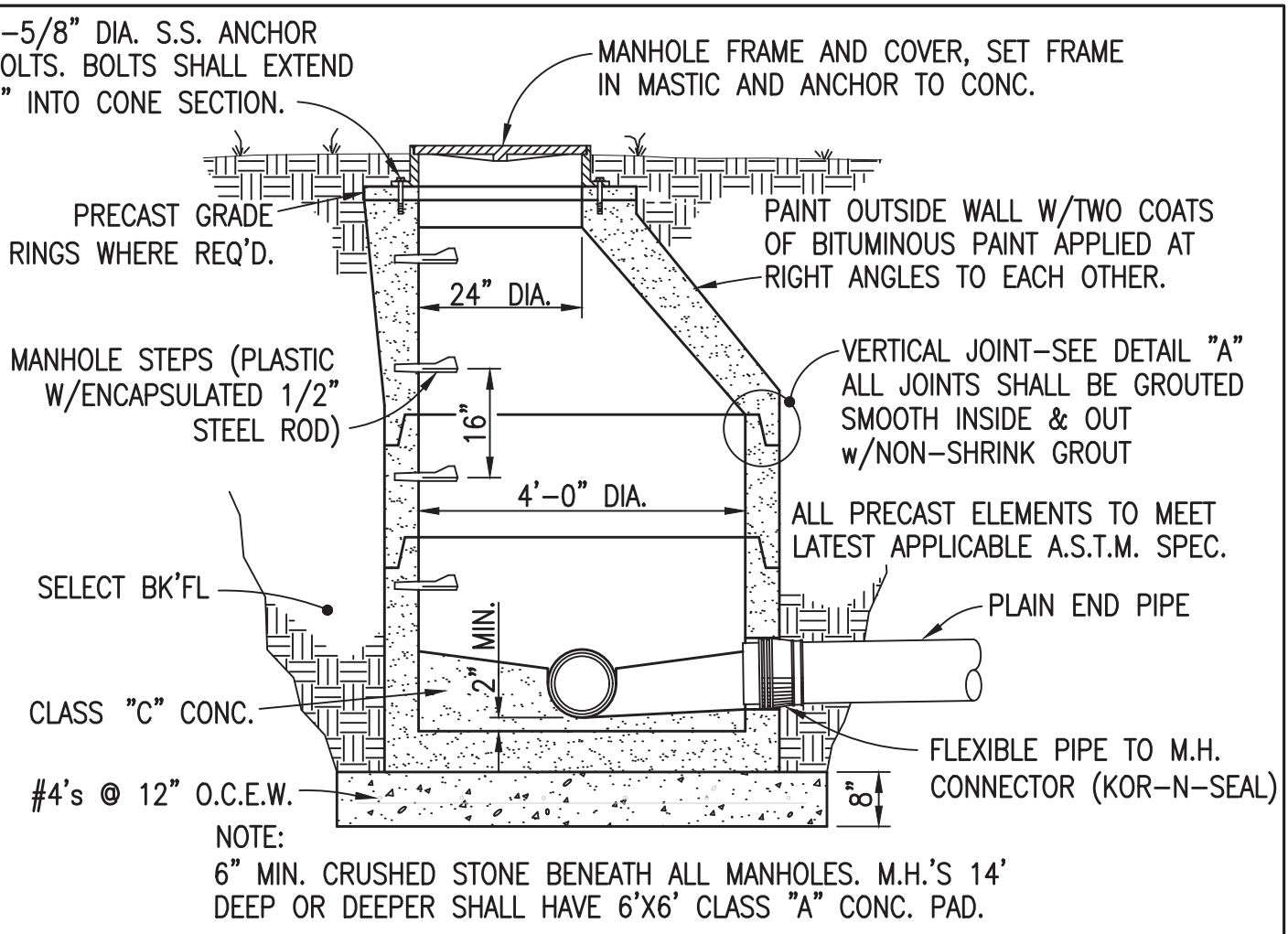


JONESBOROUGH, TENNESSEE

STANDARD CREEK CROSSING DETAIL

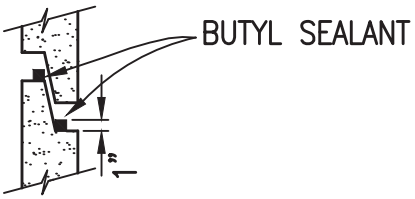
NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S– 02

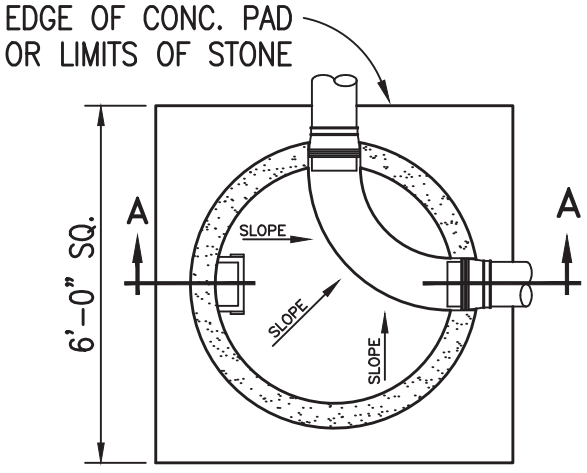


NOTE:
6" MIN. CRUSHED STONE BENEATH ALL MANHOLES. M.H.'S 14' DEEP OR DEEPER SHALL HAVE 6'X6' CLASS "A" CONC. PAD.

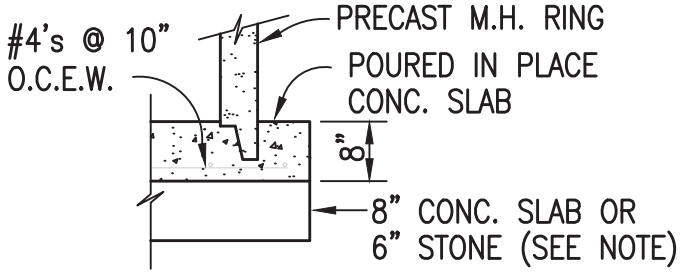
SECTION A – A



DETAIL "A"



PLAN OF M.H. BOTTOM



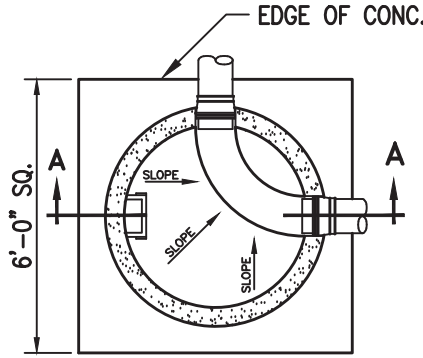
ALT. M.H. BOTTOM

JONESBOROUGH, TENNESSEE

STANDARD MANHOLE

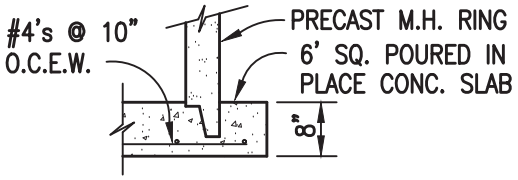
NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S– 03



PLAN OF M.H. BOTTOM

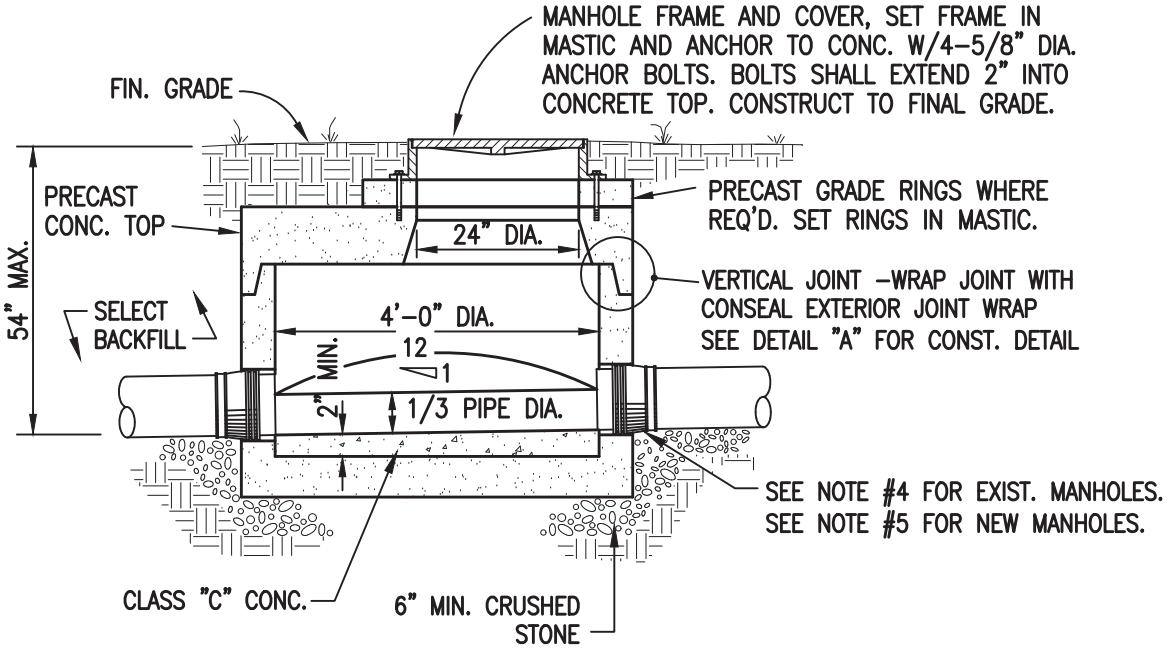
DETAIL "A"



ALT. M.H. BOTTOM

NOTES:

1. ALL PRECAST ELEMENTS TO MEET LATEST APPLICABLE A.S.T.M. SPECIFICATIONS, XYPEX ADMIX C-1000 (DYE) WATERPROOFING ADMIX SHALL BE ADDED TO THE CONCRETE MIX.
2. 6" MINIMUM CRUSHED STONE BENEATH ALL MANHOLES.
3. USE STANDARD MANHOLE FRAME & COVER UNLESS OTHERWISE SPECIFIED.
4. FLEXIBLE JOINT AT ALL MANHOLE/PIPE CONNECTIONS - NEOPRENE BOOT OR APPROVED EQUAL ON ALL EXISTING MANHOLES. SEAL OPENING WITH NON-SHRINK GROUT.
5. A-LOK CAST-IN BOOTS ON ALL NEW MANHOLE STRUCTURES.



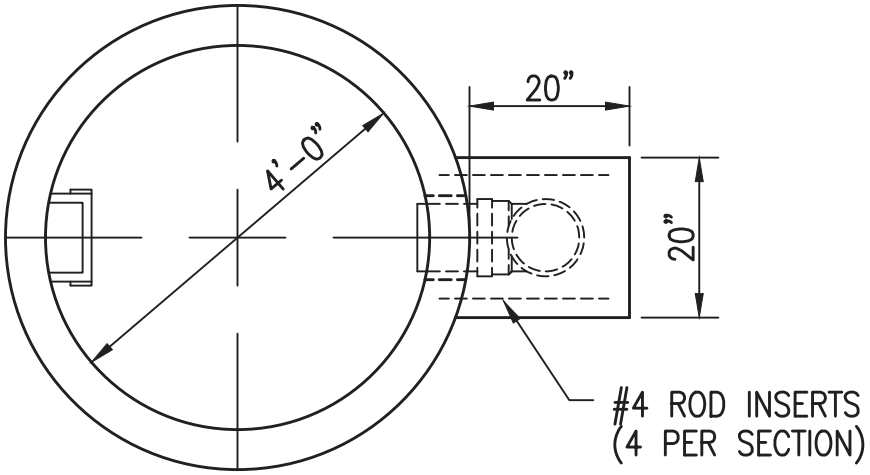
JONESBOROUGH, TENNESSEE

SHALLOW TYPE MANHOLE DETAIL

NOT TO SCALE

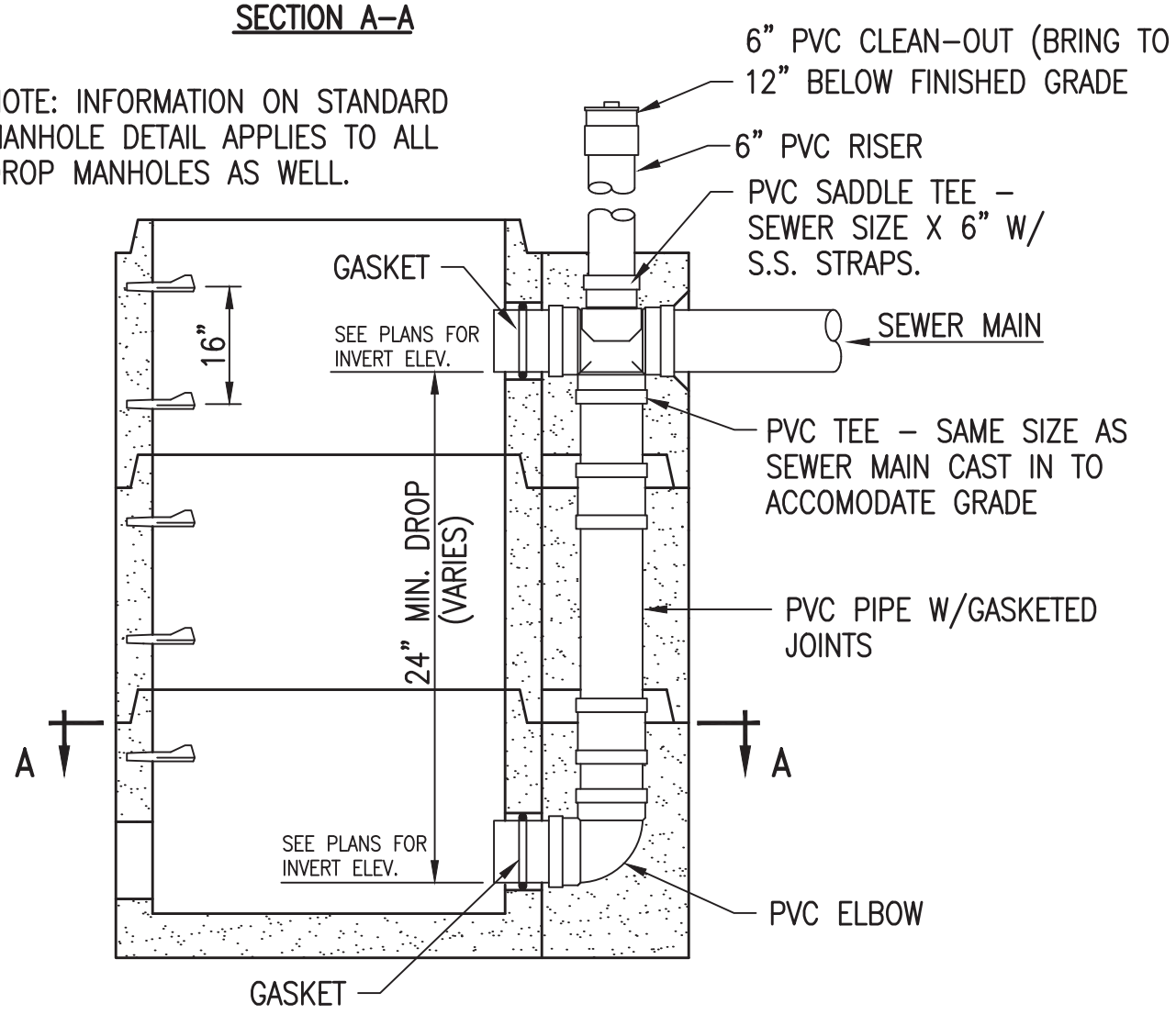
JONESBOROUGH, TENNESSEE
STANDARD SEWER DRAWING

NO. S-4



SECTION A–A

NOTE: INFORMATION ON STANDARD MANHOLE DETAIL APPLIES TO ALL DROP MANHOLES AS WELL.

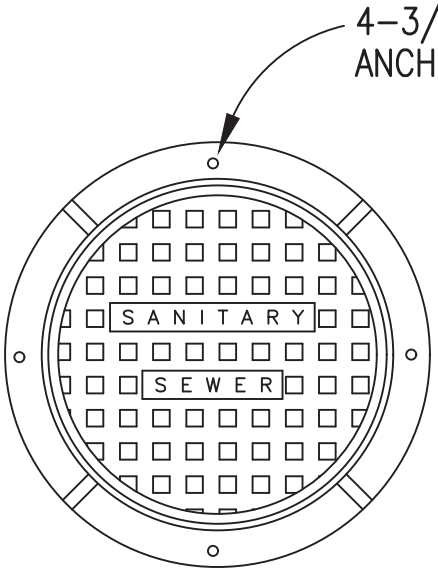


JONESBOROUGH, TENNESSEE

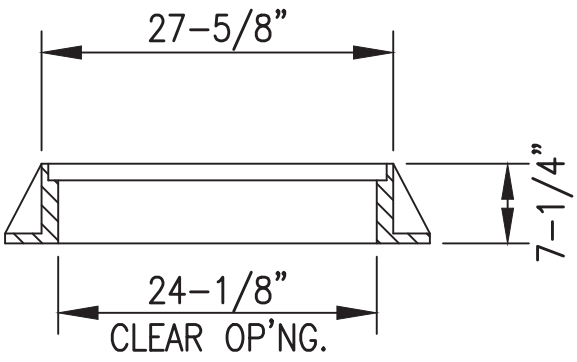
4' PRECAST DROP MANHOLE

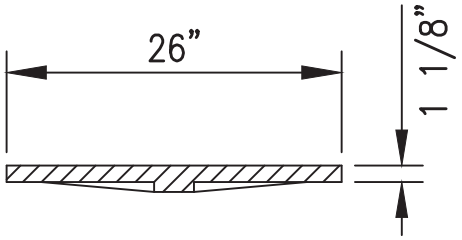
NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S–5



NOTE:
1. JOHN BOUCHARD & SONS MOD. 1150 TRAFFIC DUTY RATED OR APPROVED EQUAL
2. APPROX. WT. OF FRAME AND COVER SHALL NOT BE LESS THAN 400 LB. AS SPECIFIED.





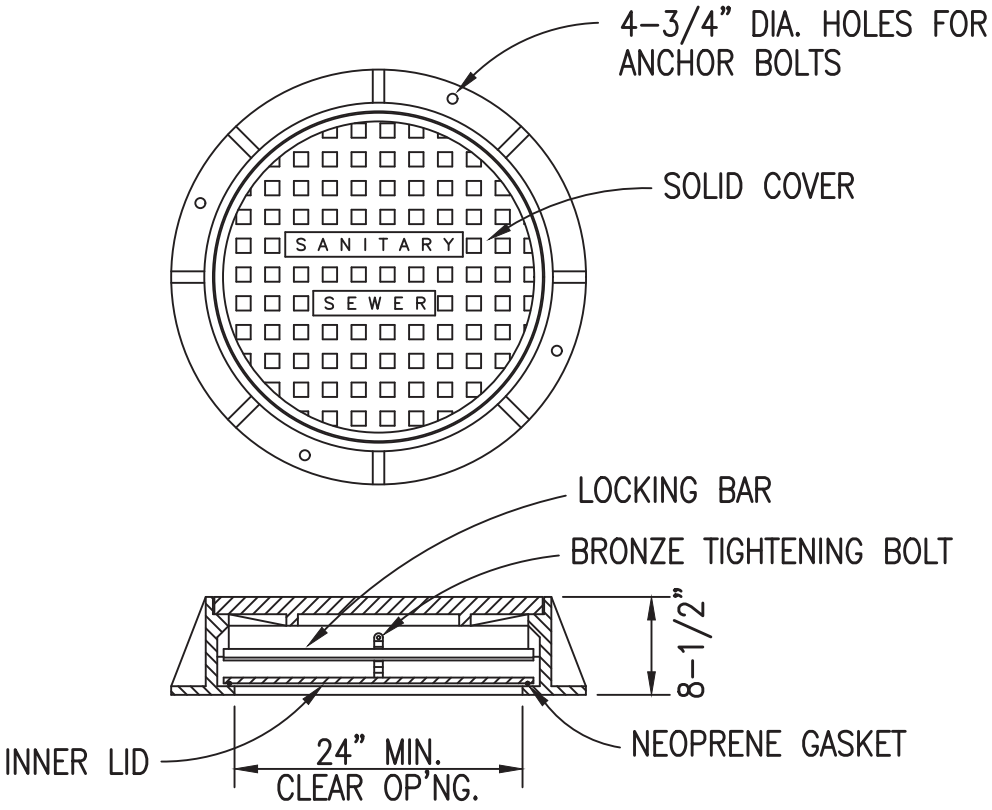
JONESBOROUGH, TENNESSEE

STANDARD MANHOLE FRAME & COVER

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S–6

NOTE:
1. USE JOHN BOUCHARD & SONS, NEENAH OR APPROVED EQUAL
2. APPROX. WT. OF FRAME AND COVER SHALL NOT BE LESS THAN 450 LB. AS SPECIFIED.



JONESBOROUGH, TENNESSEE

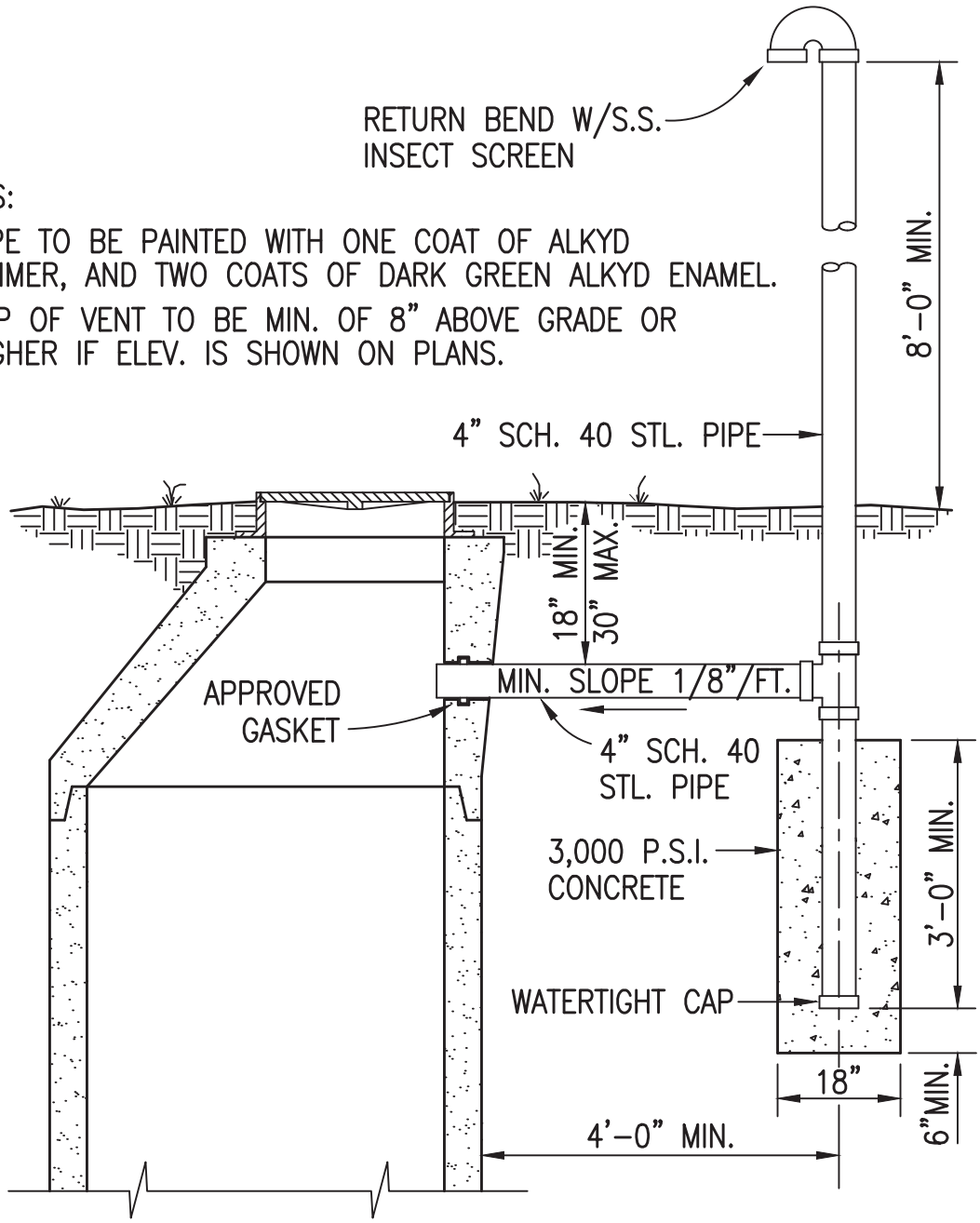
WATERTIGHT FRAME & COVER

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S–7

NOTES:

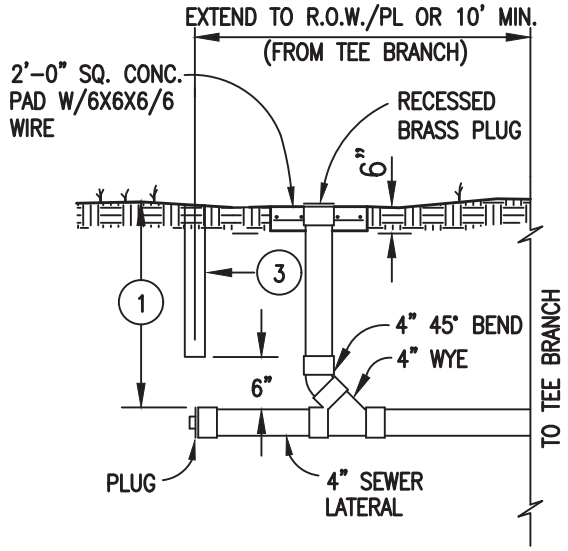
1. PIPE TO BE PAINTED WITH ONE COAT OF ALKYD PRIMER, AND TWO COATS OF DARK GREEN ALKYD ENAMEL.
2. TOP OF VENT TO BE MIN. OF 8" ABOVE GRADE OR HIGHER IF ELEV. IS SHOWN ON PLANS.



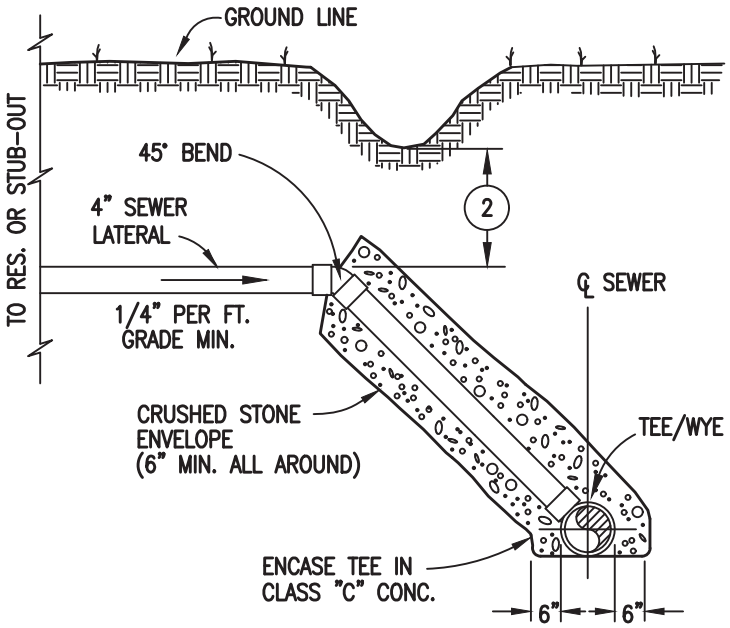
STANDARD MANHOLE VENT

NOT TO SCALE

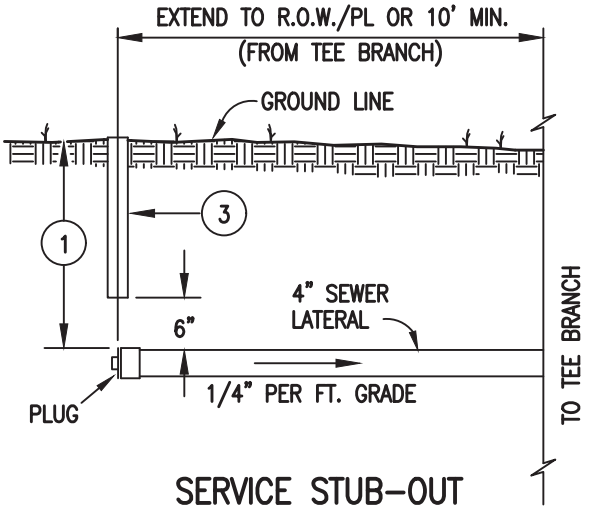
JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S-8



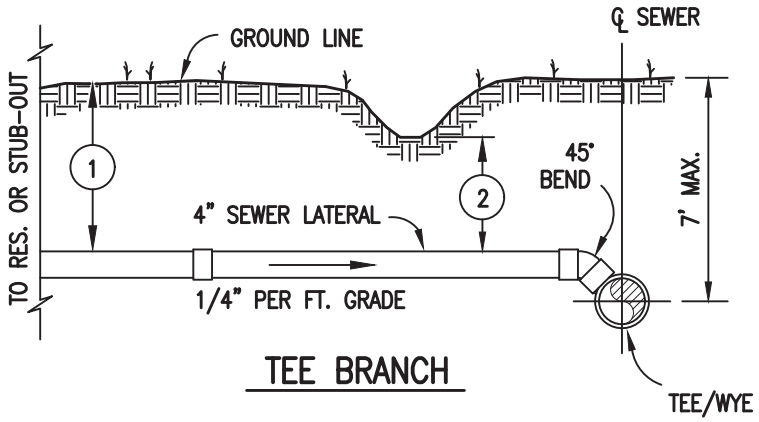
SERVICE STUB-OUT W/CLEANOUT



TEE BRANCH FOR SEWER DEPTHS OF 7' OR MORE



SERVICE STUB-OUT W/O CLEANOUT



TEE BRANCH

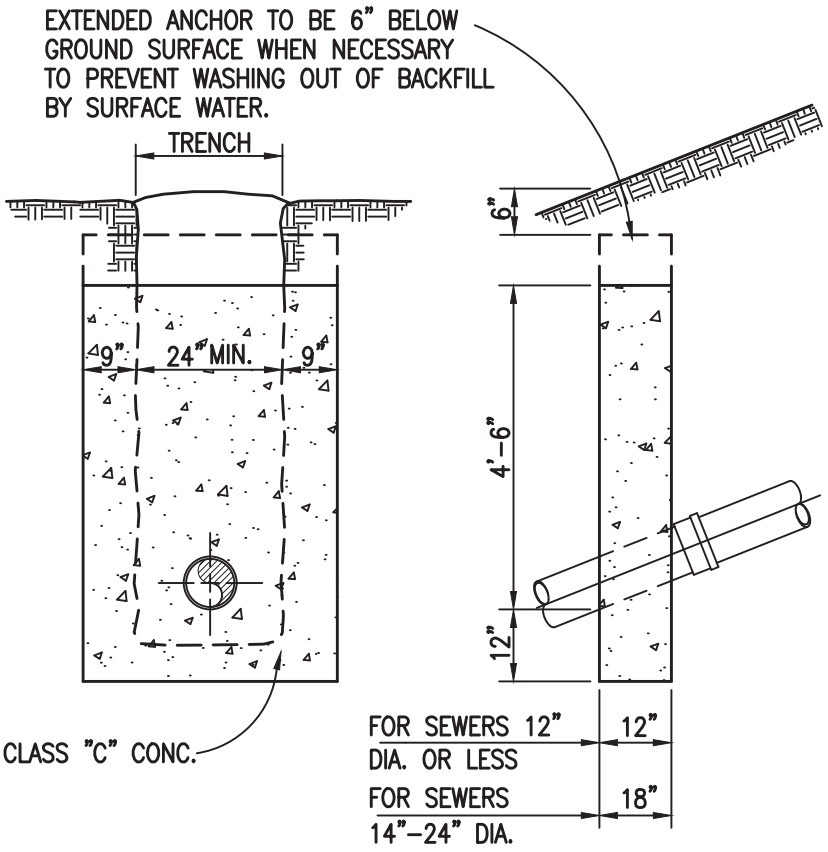
1. DEPTH AS NECESSARY TO PROVIDE 18" COVER AT BUILDING LINE.
2. 18" MIN. COVER AT DITCH CROSSINGS OR USE CONC. ENCASEMENT.
3. SEWER MARKER SET FLUSH WITH GROUND – PRESSURE TREATED WOOD 2"x2" WITH LARGE HEAD TACK IN TOP OR METAL POST/PIPE.

JONESBOROUGH, TENNESSEE

SANITARY SEWER CONNECTIONS

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S-9



SEWERS ON 20 PERCENT SLOPE OR GREATER SHALL BE ANCHORED SECURELY WITH CONCRETE ANCHORS. SUGGESTED MINIMUM ANCHORAGE SPACING IS AS FOLLOWS:

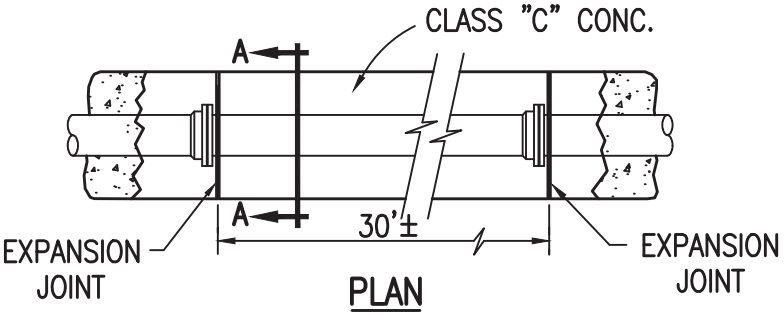
1. NOT OVER 36 FEET CENTER TO CENTER ON GRADES 20 PERCENT AND UP TO 35 PERCENT.
2. NOT OVER 24 FEET CENTER TO CENTER ON GRADES 35 PERCENT AND UP TO 50 PERCENT.
3. NOT OVER 16 FEET CENTER TO CENTER ON GRADES 50 PERCENT AND OVER.

JONESBOROUGH, TENNESSEE

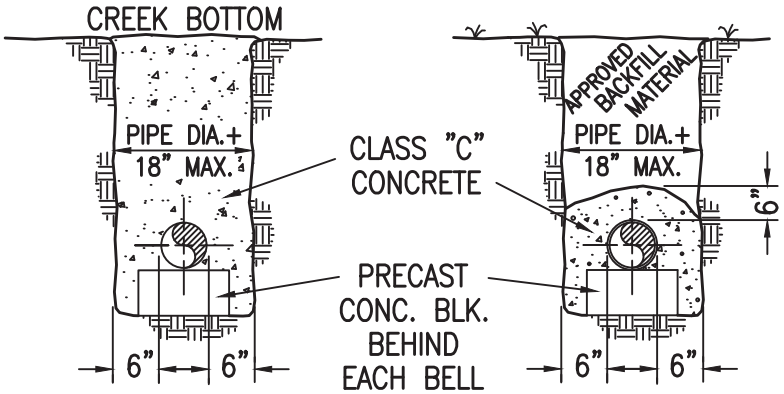
CONCRETE ANCHOR DETAL

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S-10



PLAN



SECTION A–A
(ENCASEMENT WITH CONCRETE BACKFILL)

SECTION A–A
(ENCASEMENT WITH APPROVED BACKFILL)

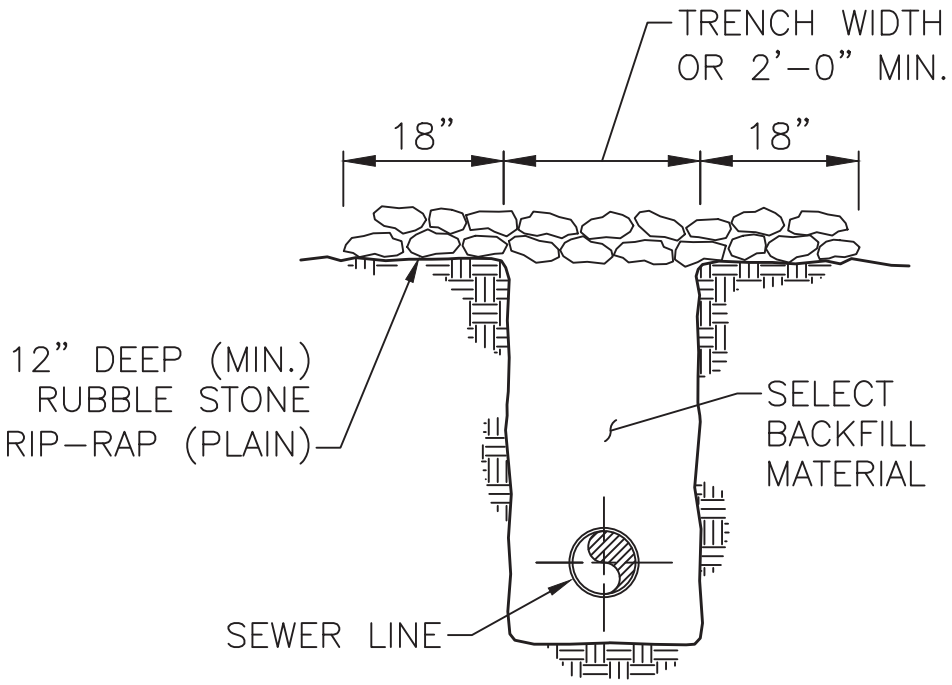
NOTES:
1. FOR ENCASEMENT OVER 30' LONG PLACE 3/4" FIBERBOARD EXPANSION JOINT AT PIPE JOINTS BETWEEN POURS APPROX. EVERY 30'
2. CONCRETE – f'c = 2,500 psi

JONESBOROUGH, TENNESSEE

STANDARD CONCRETE ENCASEMENT

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S–11

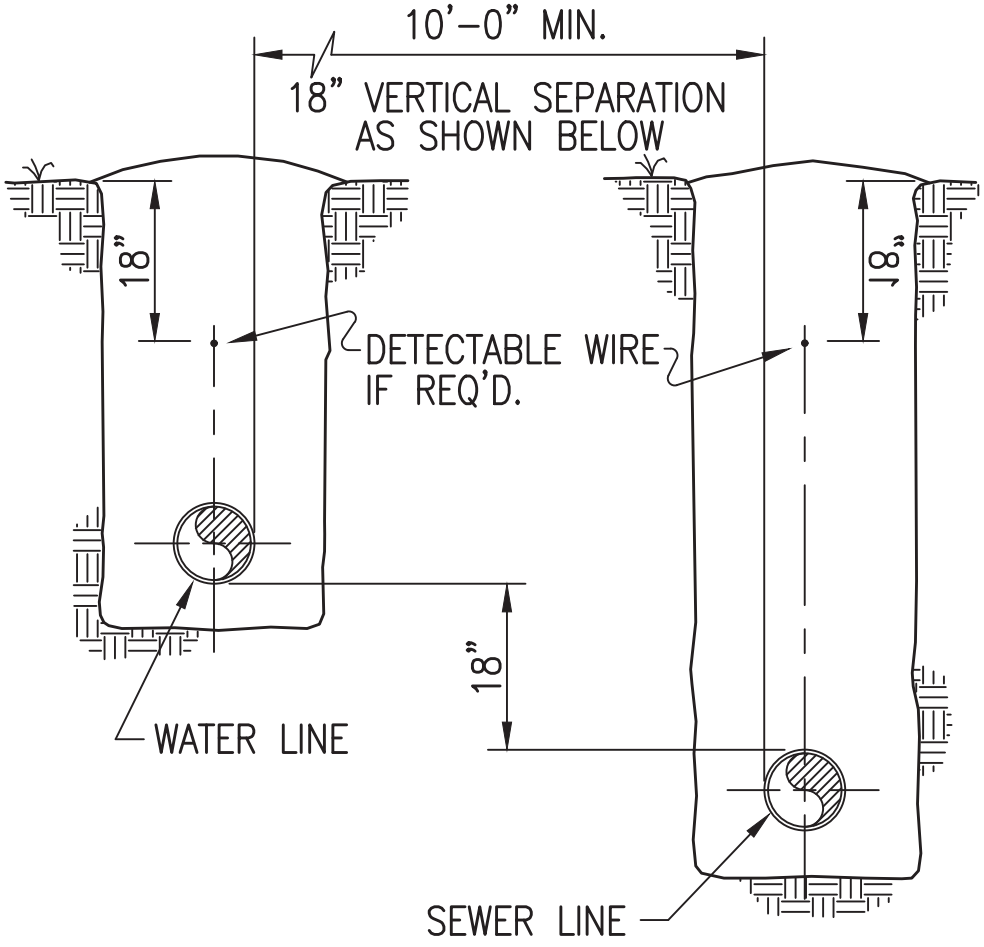


JONESBOROUGH, TENNESSEE

RIP-RAP DETAIL

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S–12

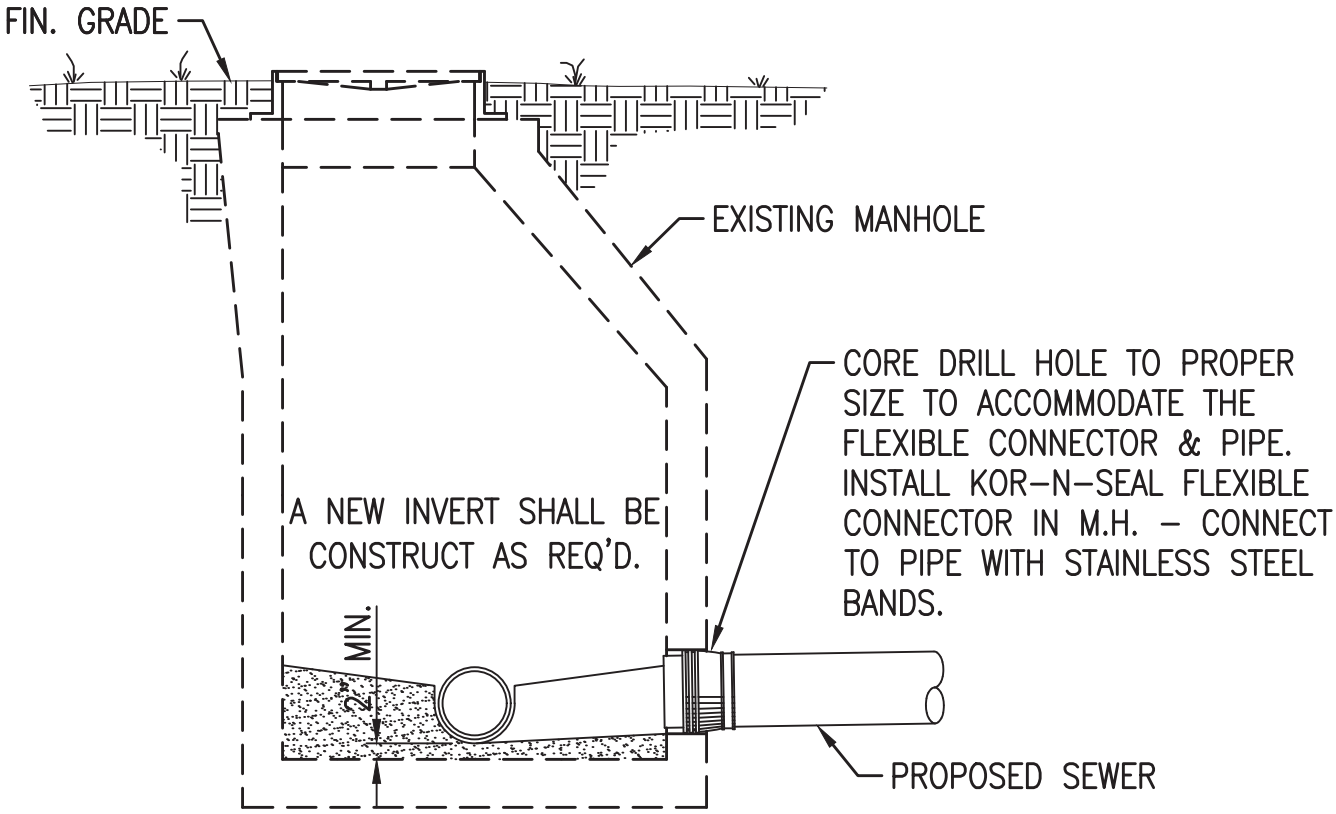


JONESBOROUGH, TENNESSEE

PIPELINE SEPARATION DETAIL

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S–13

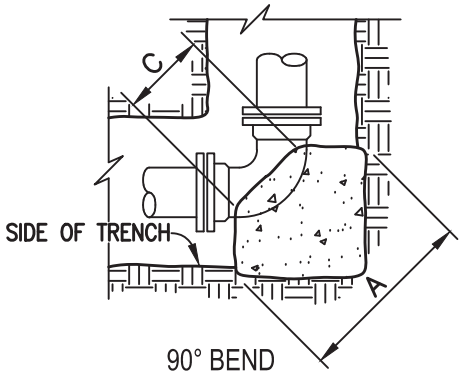


JONESBOROUGH, TENNESSEE

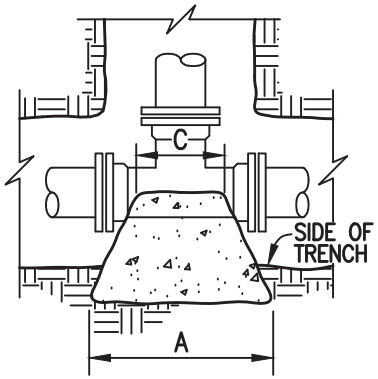
GRAVITY SEWER CONNECTION AT EXISTING MANHOLE

NOT TO SCALE

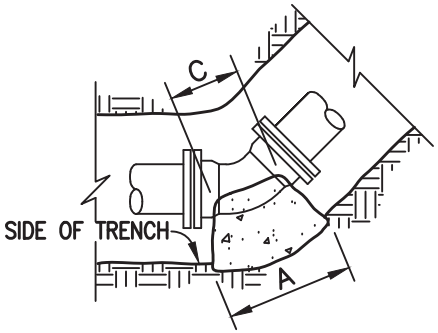
JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S-14



90° BEND



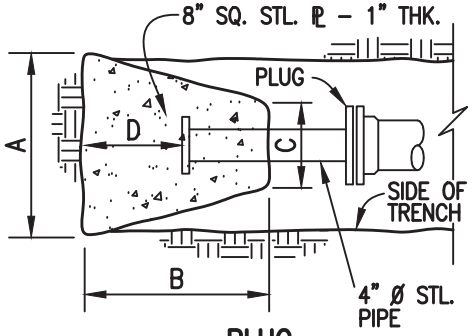
TEE



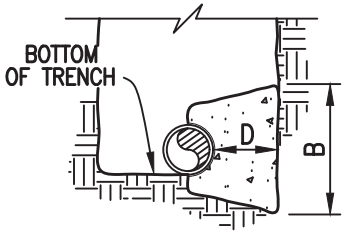
45° — 22 1/2° — 11 1/4° BEND

NOTES:

1. THRUST BLOCKS DESIGNED FOR 200 PSI PRESSURE AND 2000 PSF SOIL BEARING. FOR GREATER PRESSURE OR LESS SOIL BEARING, QUANTITIES WILL HAVE TO BE RECALCULATED.
2. THRUST BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH.
3. IF EXACT SIZE PIPE BLOCKING IS NOT SHOWN, USE NEXT LARGER SIZE.
4. THRUST BLOCKING TO BE POURED IN PLACE CLASS C CONC.



PLUG



TYPICAL SECTION

90° BEND							
SIZE	16"	12"	10"	8"	6"	4"	2"
A	84	60	51	42	32	24	18
B	72	60	51	42	32	24	18
C	30	18	16	12	12	9	9
D	34	30	24	17	13	9	9

45° BEND							
SIZE	16"	12"	10"	8"	6"	4"	2"
A	58	43	38	32	24	18	12
B	58	43	38	32	24	18	12
C	24	16	14	12	12	8	8
D	24	18	15	12	9	6	6

22 1/2° BEND							
SIZE	16"	12"	10"	8"	6"	4"	2"
A	42	32	27	24	18	12	9
B	42	32	27	24	18	12	9
C	18	16	14	12	10	8	8
D	18	13	11	9	6	4	4

11 1/4° BEND							
SIZE	16"	12"	10"	8"	6"	4"	2"
A	30	24	21	17	12	9	9
B	30	24	21	17	12	9	9
C	18	16	14	12	10	8	8
D	12	9	8	6	5	4	4

PLUG							
SIZE	16"	12"	10"	8"	6"	4"	2"
A	66	52	43	34	27	20	18
B	66	52	43	34	27	20	18
C	12	12	12	12	12	12	12
D	44	32	22	15	11	11	11

TEE							
SIZE	MAIN	16"	12"	12"	12"	8"–10"	8"–12"	2"–6"
	BRANCH	16"	12"	8"–10"	2"–8"	8"–10"	2"–6"	2"–6"
A		66	52	43	34	43	26	26
B		66	52	43	34	43	26	26
C		30	12	12	12	12	12	12
D		30	26	21	14	21	13	13

DIMENSIONS ARE IN INCHES

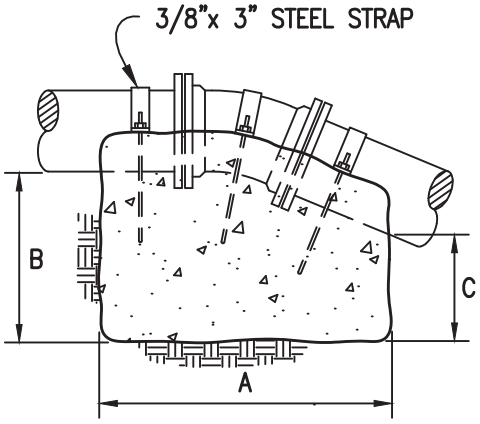
JONESBOROUGH, TENNESSEE
STANDARD SEWER DRAWING

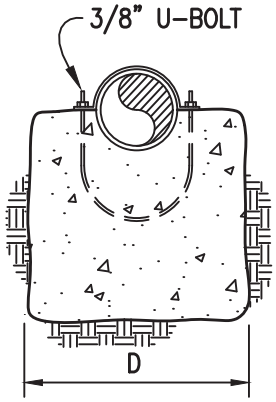
NO. S–15

JONESBOROUGH, TENNESSEE

THRUST BLOCKING DETAIL

NOT TO SCALE





90° BEND							
SIZE	16"	12"	10"	8"	6"	4"	2"
A	85	67	60	54	42	34	30
B	85	67	60	54	42	34	18
C	80	63	56	50	38	30	16
D	76	66	60	48	48	36	24

45° BEND							
SIZE	16"	12"	10"	8"	6"	4"	2"
A	72	60	50	46	35	30	24
B	72	60	50	46	35	28	24
C	68	56	46	42	30	24	18
D	72	60	60	48	48	36	24

22 1/2° BEND							
SIZE	16"	12"	10"	8"	6"	4"	2"
A	58	50	42	38	30	24	18
B	58	48	42	38	30	24	18
C	54	44	38	34	26	20	14
D	60	48	48	36	36	30	24

11 1/4° BEND							
SIZE	16"	12"	10"	8"	6"	4"	2"
A	42	36	30	29	24	20	18
B	42	36	30	29	24	20	18
C	38	32	26	24	20	16	14
D	60	48	48	36	30	24	24

DIMENSIONS ARE IN INCHES

NOTES:

1. THRUST BLOCKS DESIGNED FOR 150 PSI PRESSURE. FOR GREATER PRESSURE QUANITIES WILL HAVE TO BE RECALCULATED.
2. THRUST BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH.
3. IF EXACT SIZE PIPE BLOCKING IS NOT SHOWN, USE NEXT LARGER SIZE.
4. THRUST BLOCKING TO BE POURED IN PLACE – CLASS "C" CONCRETE.

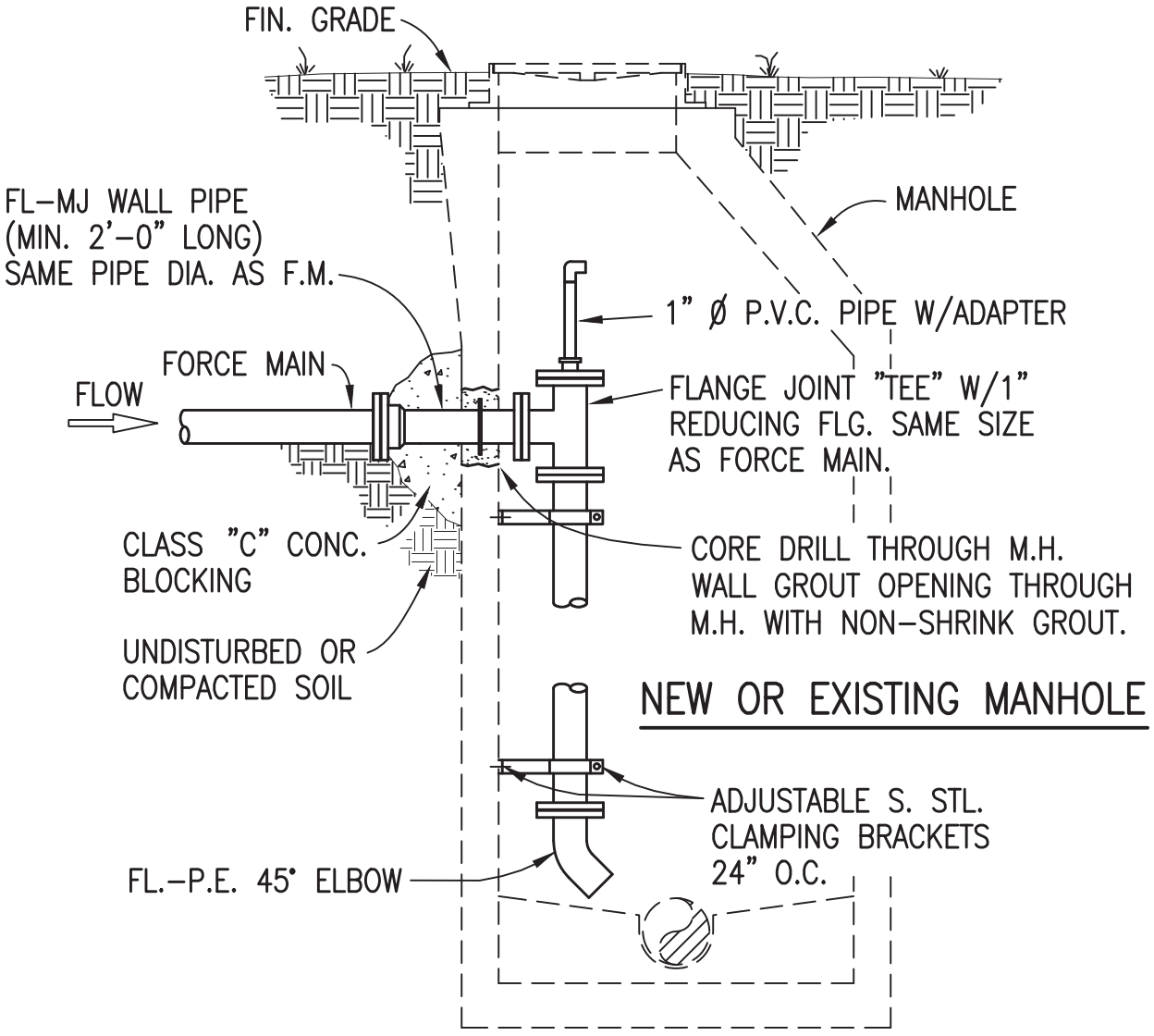
JONESBOROUGH, TENNESSEE

VERTICAL CONCRETE ANCHOR

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S–16

NOTE:
1. THE FORCE MAIN PIPING SHALL HAVE A MIN. OF 30" COVER.

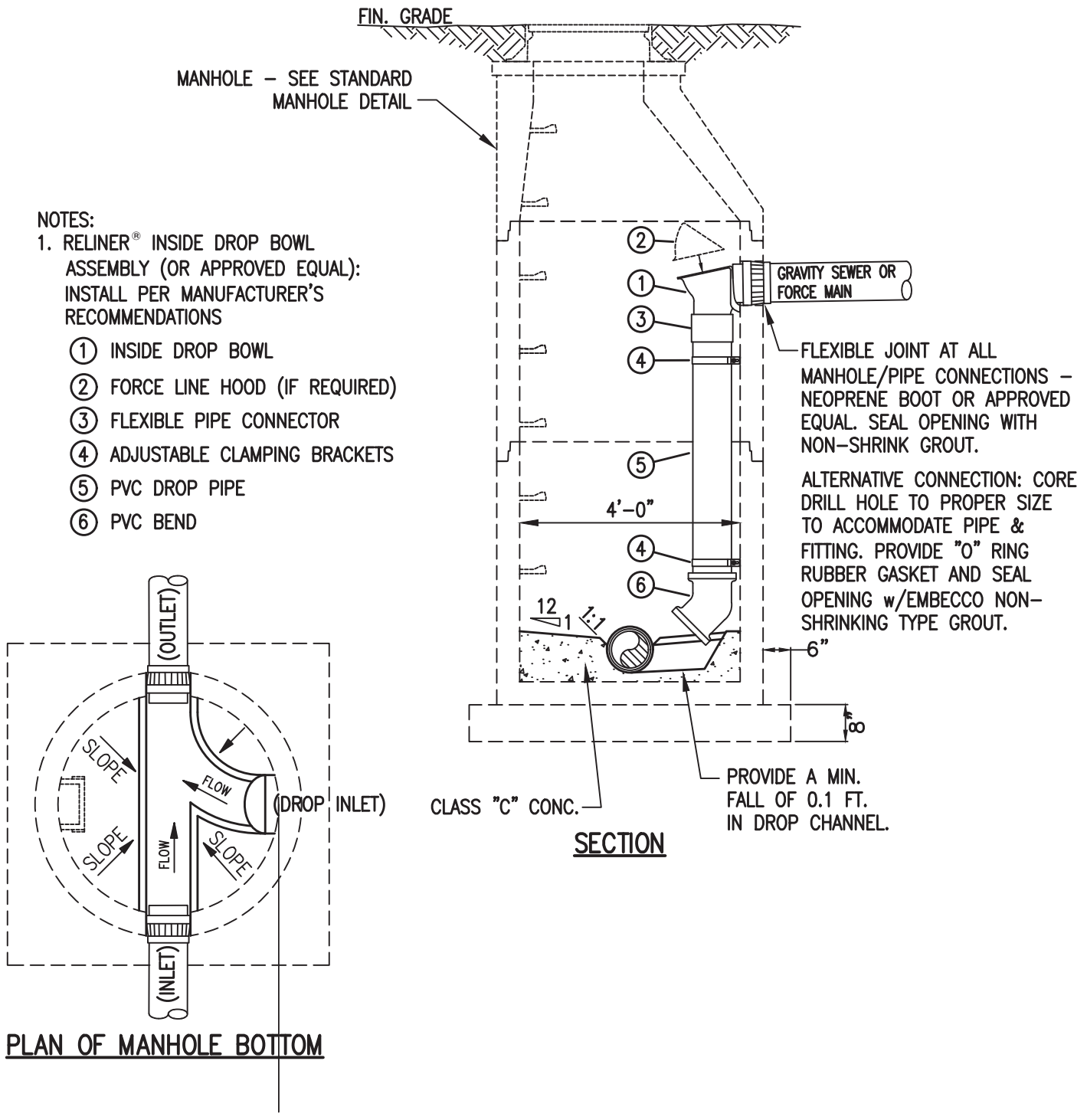


JONESBOROUGH, TENNESSEE

FORCE MAIN CONNECTION AT MANHOLE

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S–17



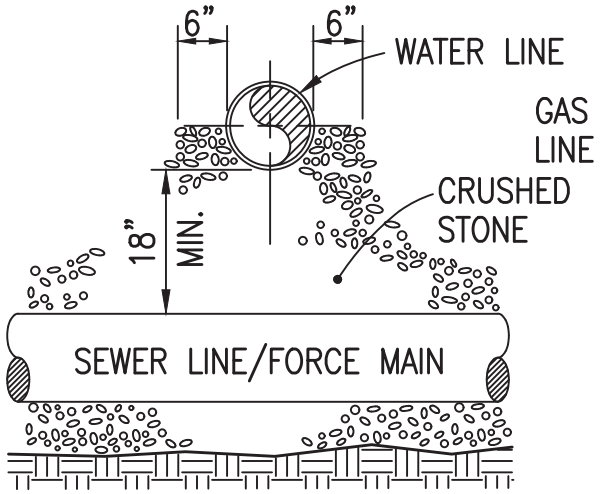
JONESBOROUGH, TENNESSEE

STANDARD INSIDE DROP MANHOLE

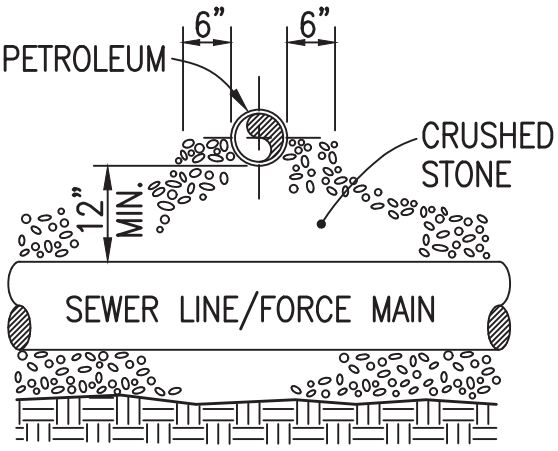
NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S–18

NOTE:
SEWER LINES AT WATER MAIN CROSSING SHALL BE ARRANGED SO THAT THE SEWER JOINTS WILL BE AS FAR AS POSSIBLE FROM WATER MAIN JOINTS



SEWER LINE/FORCE MAIN
UNDER WATER LINE



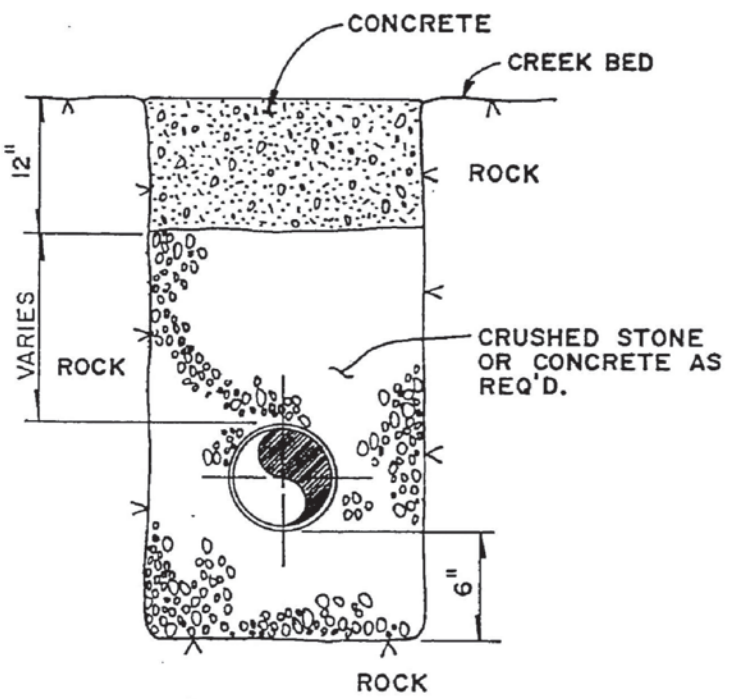
SEWER LINE/FORCE MAIN
UNDER GAS TRANSMISSION LINE

JONESBOROUGH, TENNESSEE

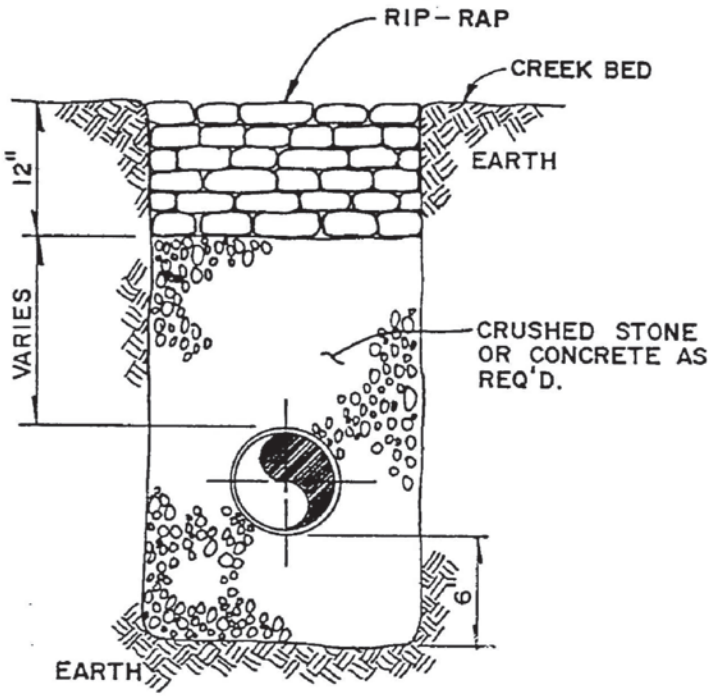
PIPE CROSSING FOR SEWER LINE/FORCE MAIN

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S–19



IN ROCK BED

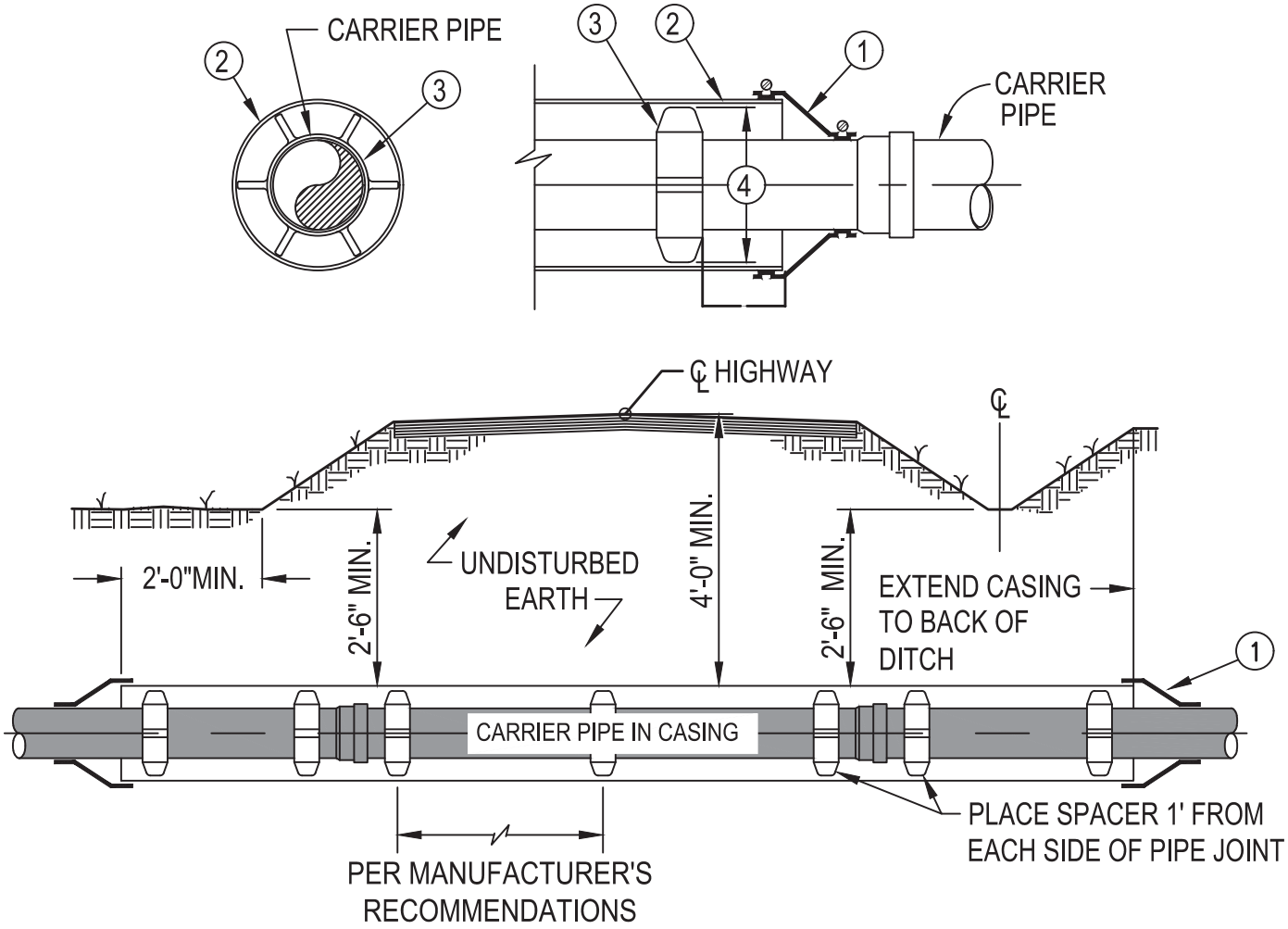


IN EARTH BED

STANDARD CREEK CROSSING DETAIL

NOT TO SCALE

JONESBOROUGH, TENNESSEE STANDARD SEWER DRAWING	NO. S-20



(1) CASING END SEALS PER SPECIFICATIONS.

(2) SMOOTH WALL STEEL CASING PIPE WITH BITUMINOUS COATING OUTSIDE.

(3) CASING SPACER MODELS PER SPECIFICATIONS. CASING SPACERS SHALL BE INSTALLED IN A CENTERED/RESTRAINED CONFIGURATION. DISTANCE BETWEEN SPACERS PER MANUFACTURER'S RECOMMENDATIONS.

(4) SPACER RISERS/RUNNERS SHALL BE SIZED AND TRIMMED TO MAINTAIN 1/2" *MAXIMUM* CLEARANCE BETWEEN RUNNER AND CASING PIPE.

NOTE: CARRIER PIPE IN ALL CASING OVER 60 FEET IN LENGTH SHALL BE DUCTILE IRON WITH LOCKING GASKETS.

JONESBOROUGH, TENNESSEE

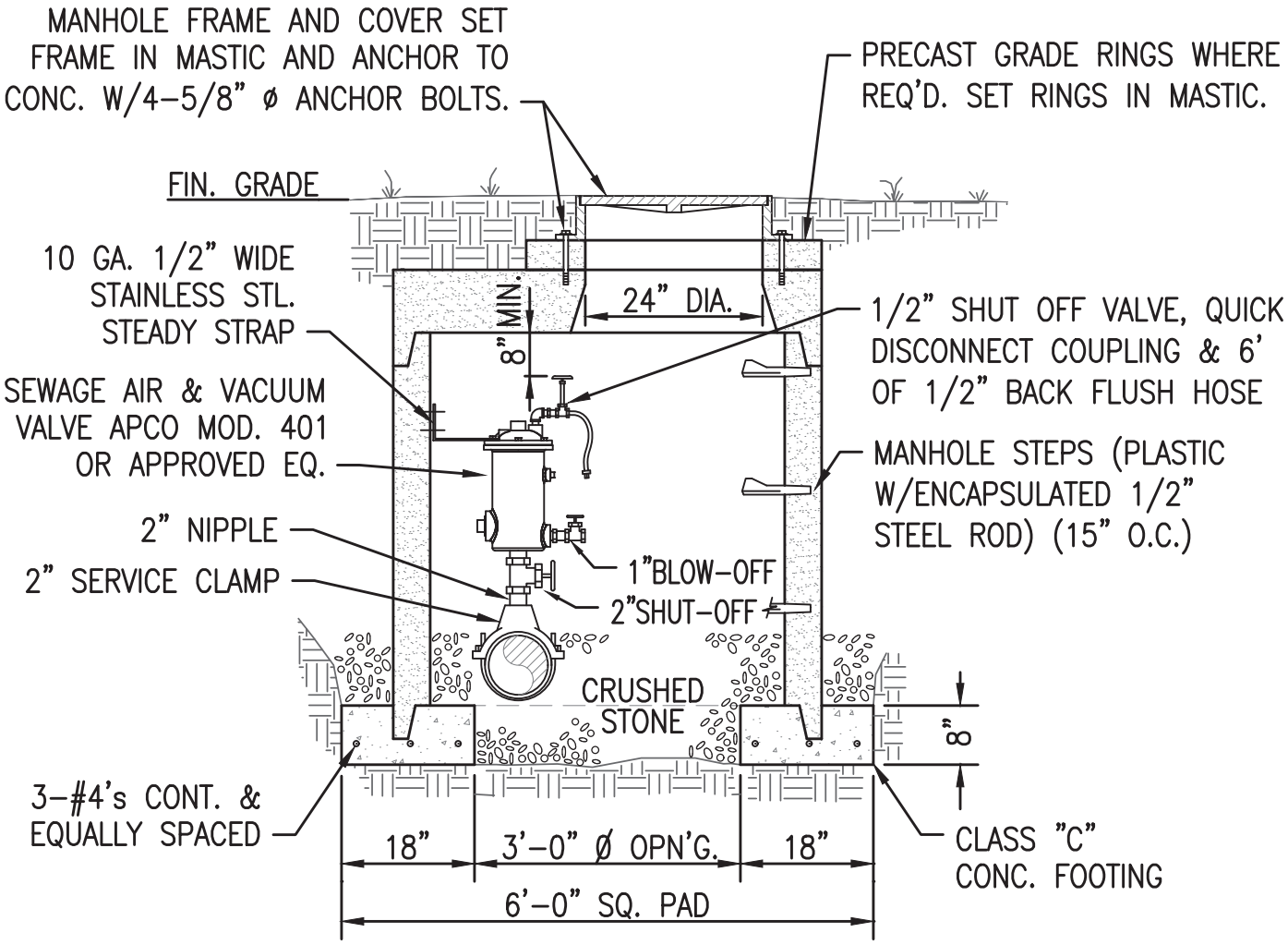
ROADWAY CROSSING INSTALLATION

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S–21

NOTES:

1. USE VENTED MANHOLE FRAME & COVER (MIN. WT. 400 LBS.) MARKED "SEWER". WHEN IN ROADWAY USE TRAFFIC RATED FRAME & COVER (JOHN BOUCHARD & SONS, NEENAH OR APPROVED EQUAL).
2. PIPE GRADE SHALL BE LOWERED, IF REQUIRED, WHEN APPROACHING AIR RELEASE VAL. TO GIVE VERTICAL SPACE FOR AIR RELEASE APPURTENANCES. (SEE SHOP DRAWINGS).
3. SEAL PIPE THROUGH MANHOLE OPENINGS W/NON-SHRINK GROUT.
4. ALL ACCESSARY VALVES & PIPING SHALL BE SCHD. 80 PVC OR STAINLESS STEEL.
5. USE 4' DIA. PRECAST MANHOLE A.S.T.M. C-478 w/PRECAST FLAT TOP.



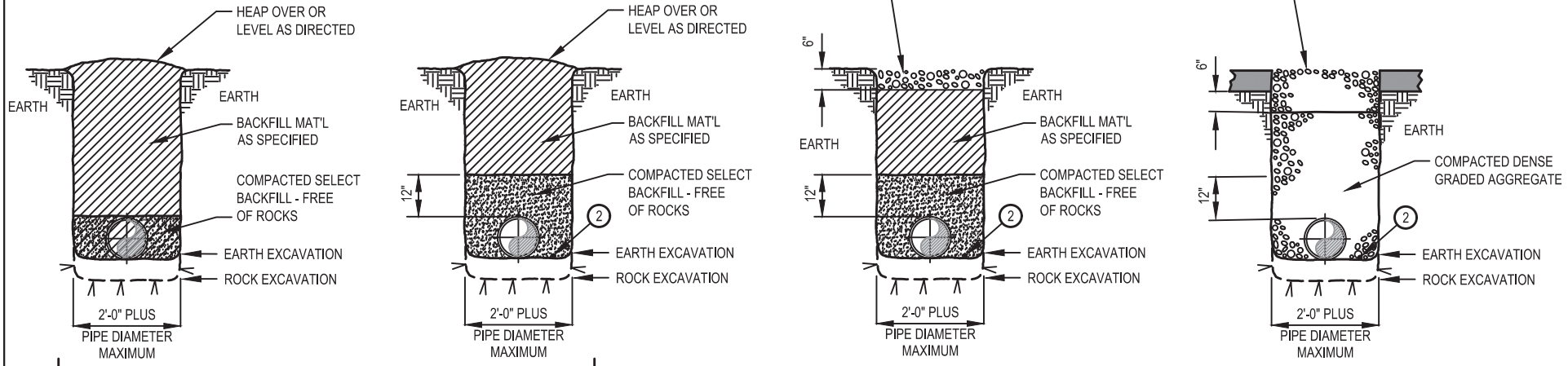
JONESBOROUGH, TENNESSEE

SEWAGE AIR & VACUUM VALVE

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD SEWER DRAWING	S-22

NOTE:
1. SEE SPECIFICATIONS FOR DEPTH REQUIREMENT OF PIPE.
2. DETECTOR WIRE OR TAPE, IF REQUIRED.

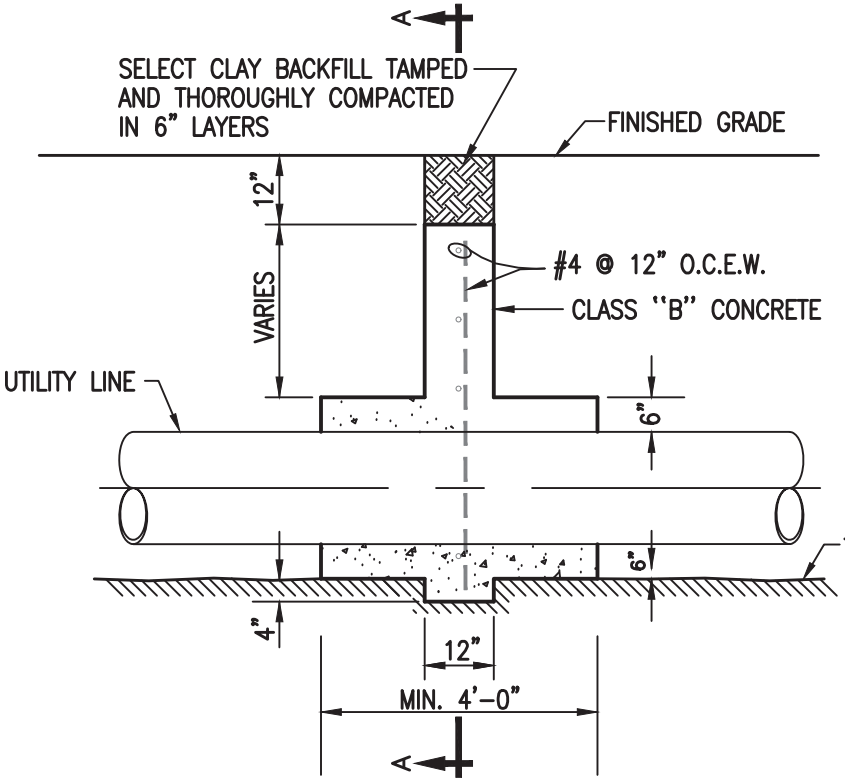


JONESBOROUGH, TENNESSEE

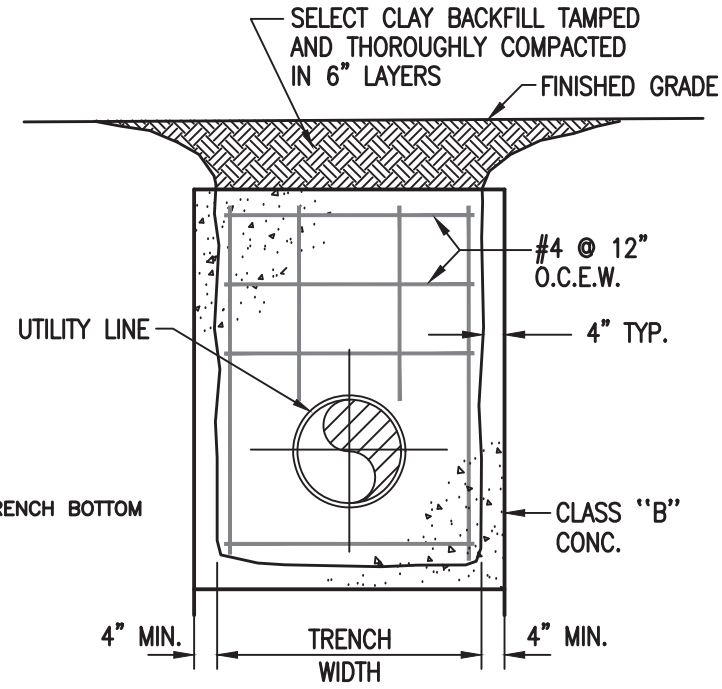
STANDARD FORCE MAIN BEDDING & BACKFILLING

NOT TO SCALE

JONESBOROUGH, TENNESSEE
STANDARD SEWER DRAWING
NO. S-23



SIDE VIEW



SECTION A–A

NOTE:

1. A 4" MIN. KEYWAY SHALL BE CUT IN UNDISTURBED EARTH/ROCK. FRACTURED AND SHOT ROCK SHALL BE REMOVED TO CLEAN SOLID ROCK IN ROCK TRENCHES. THIS IS REQUIRED ON SIDES AND BOTTOM. TRENCH MUST BE CLEANED TO SOLID UNFRACTURED ROCK.
2. BACKFILL MATERIAL SHALL BE OF A SELECT CLAY MATERIAL. SEE STANDARD GRAVITY SEWER BEDDING AND BACKFILLING DETAIL (S–1).

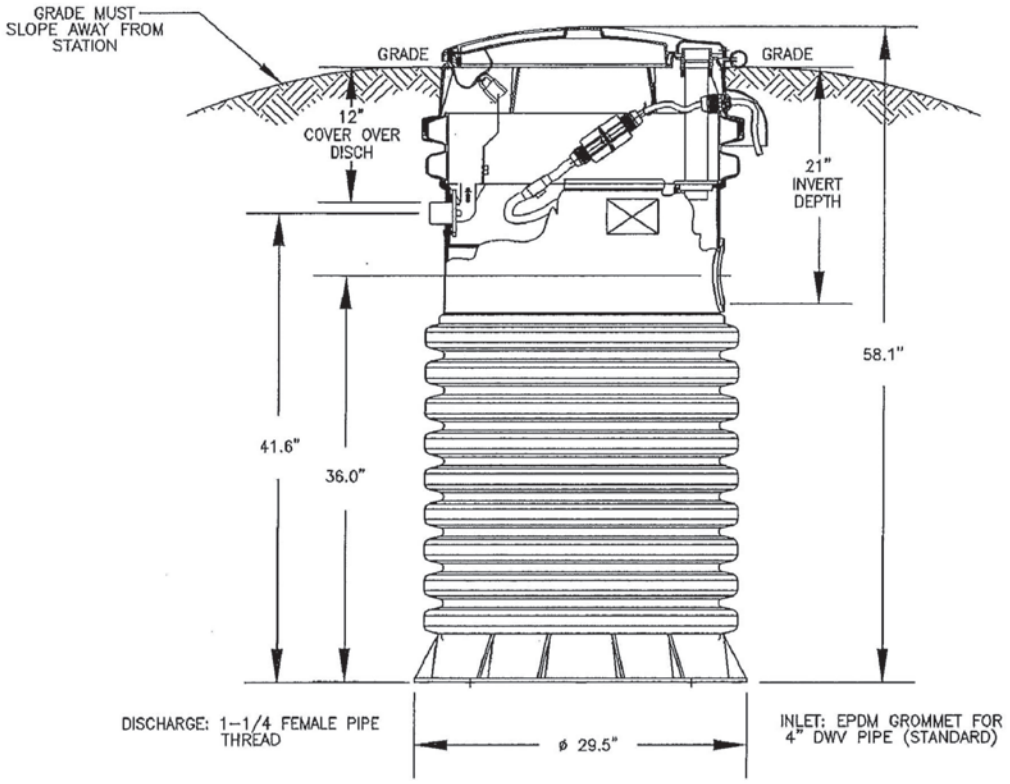
CONCRETE CHECK DAM

NOT TO SCALE

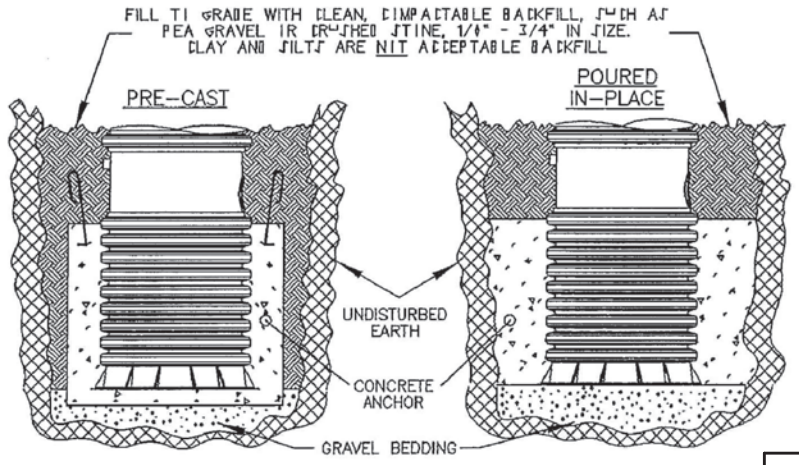
JONESBOROUGH, TENNESSEE
STANDARD SEWER DRAWING

NO.
S–24

ENVIRONMENT ONE – MODEL 2010–58 GRINDER PUMP

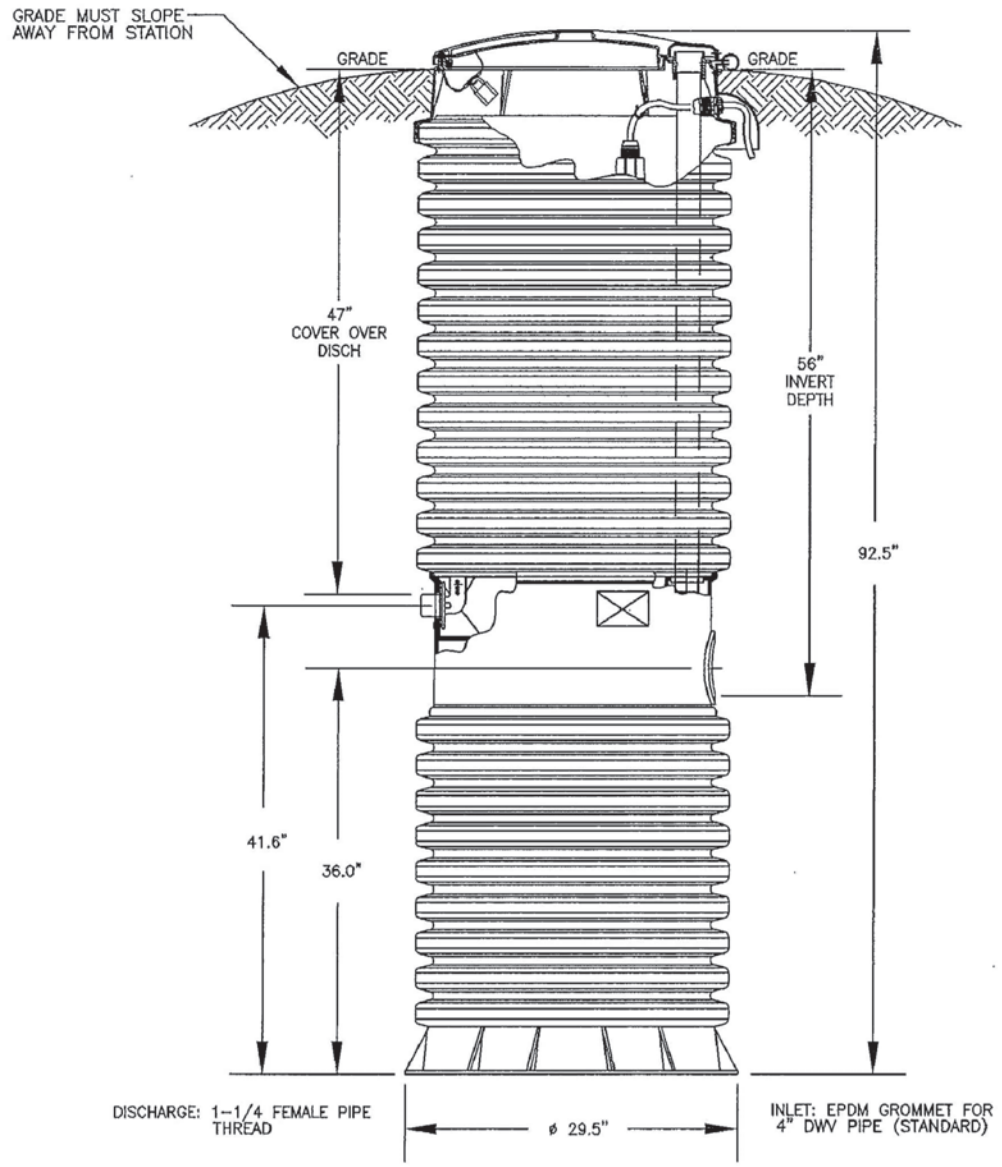


NOTE: A CONCRETE ANCHOR OF 1500 lbs (9.8 cu ft) IS REQUIRED ON ALL MODEL 2010 58" STATIONS.

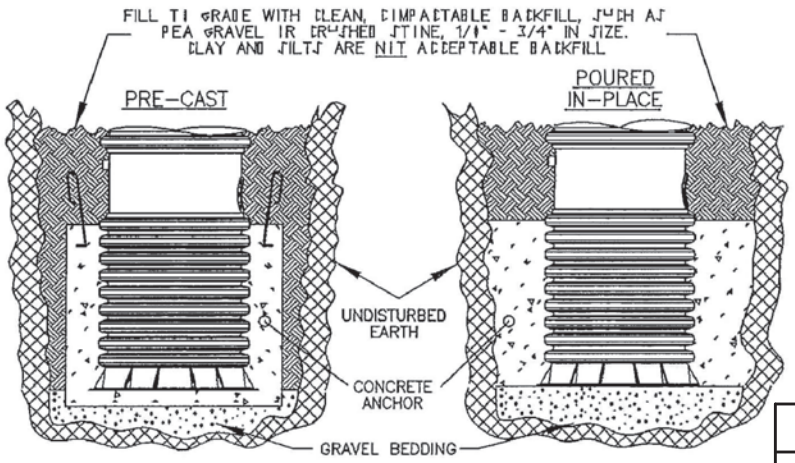


JONESBOROUGH, TENNESSEE	NO.
STANDARD LOW PRESSURE SEWER DRAWING	LP–01

ENVIRONMENT ONE – MODEL 2010-93 GRINDER PUMP



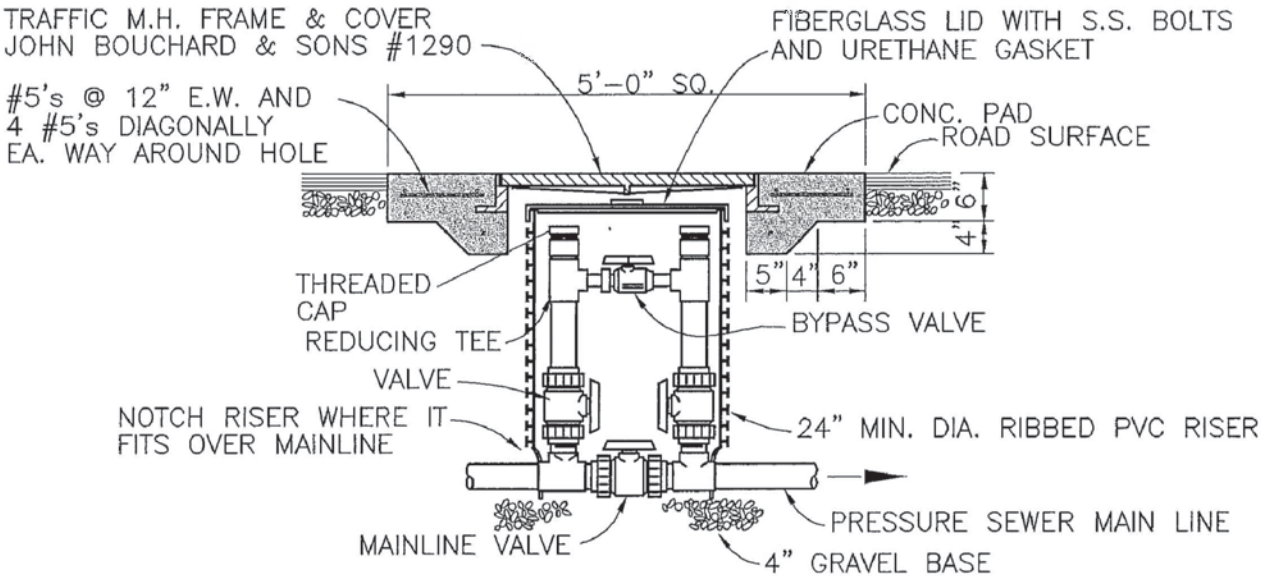
NOTE: A CONCRETE ANCHOR OF 1500 lbs (9.8 cu ft) IS REQUIRED ON ALL MODEL 2010 58" STATIONS.



JONESBOROUGH, TENNESSEE	NO.
STANDARD LOW PRESSURE SEWER DRAWING	LP – 02

NOTE:

1. USE BALL VALVE FOR 3" AND SMALLER PIPING. USE PLUG VALVE FOR GREATER THAN 3" PIPING.
2. 4" AND LARGER VALVES INSIDE CLEANOUT/ PIGGING BOX REQUIRES A 4' MANHOLE
3. USE CONCRETE PAD WITH MANHOLE FRAME AND COVER IN TRAFFIC LOCATIONS.



MAINLINE SIZE	BYPASS LINE SIZE
2"	1-1/2"
3"	2"
4"	3"
6"	4"

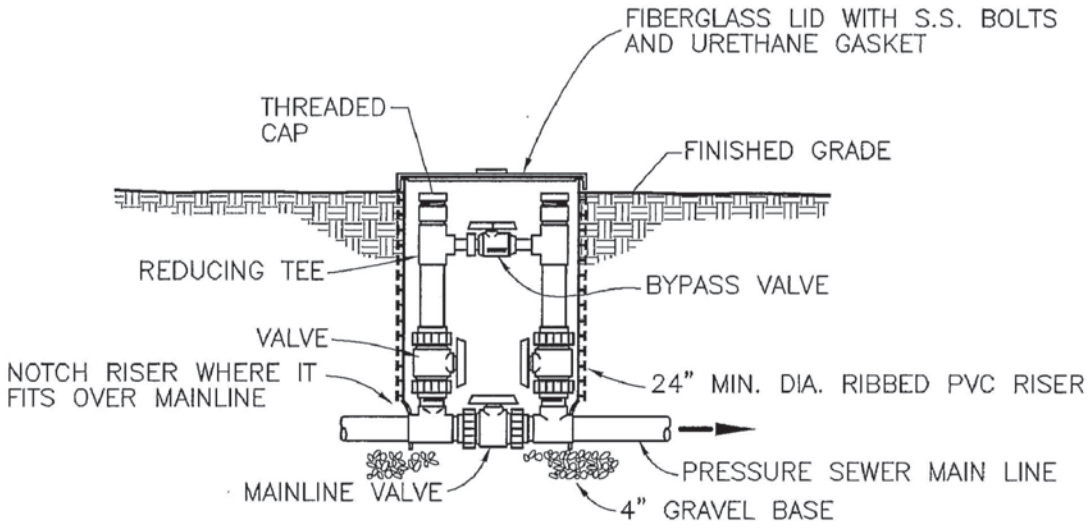
IN ROADWAY CLEANOUT/PIGGING BOX

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD LOW PRESSURE SEWER DRAWING	LP-03

NOTE:

1. USE BALL VALVE FOR 3" AND SMALLER PIPING. USE PLUG VALVE FOR GREATER THAN 3" PIPING.
2. 4" AND LARGER VALVES INSIDE CLEANOUT/ PIGGING BOX REQUIRES A 4' MANHOLE

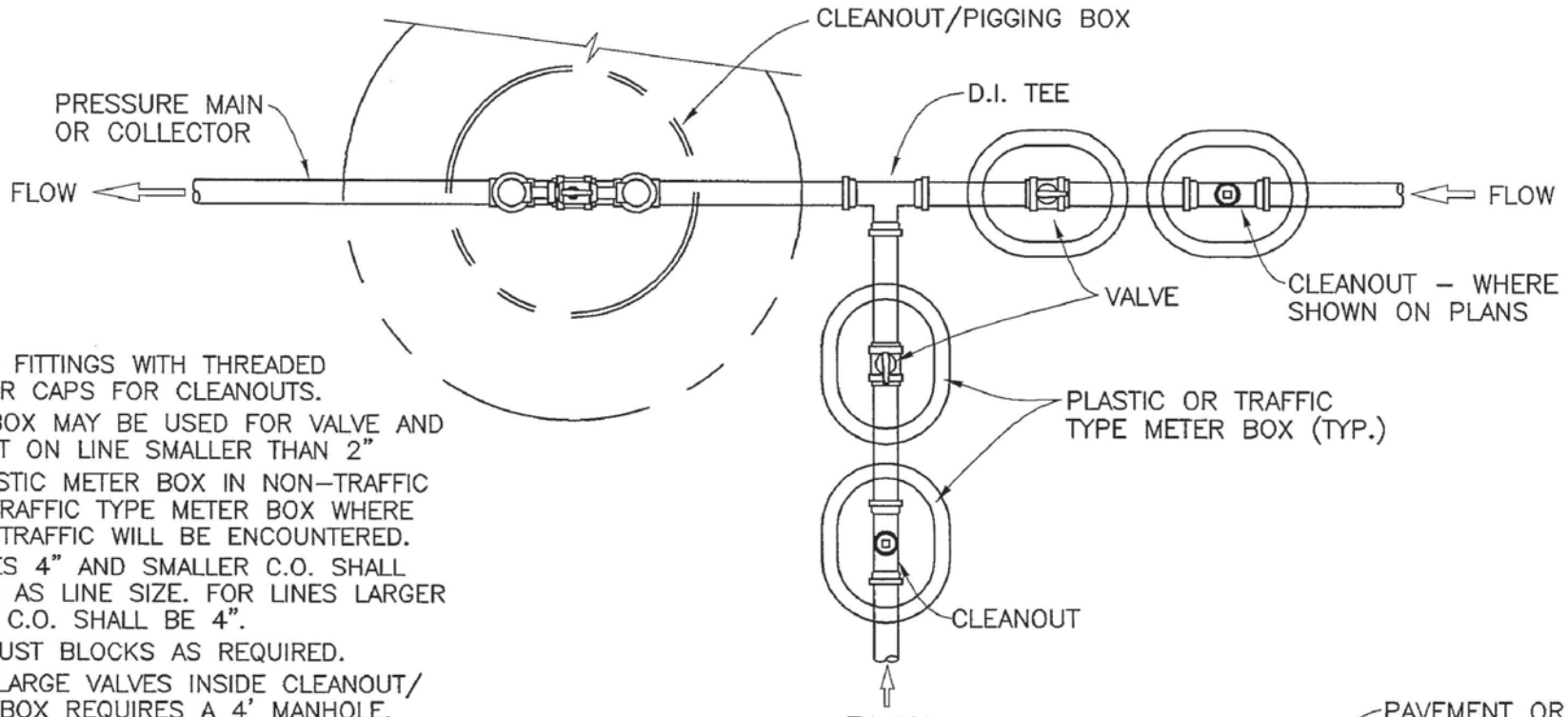


MAINLINE SIZE	BYPASS LINE SIZE
2"	1-1/2"
3"	2"
4"	3"
6"	4"

OUTSIDE ROADWAY CLEANOUT/PIGGING BOX

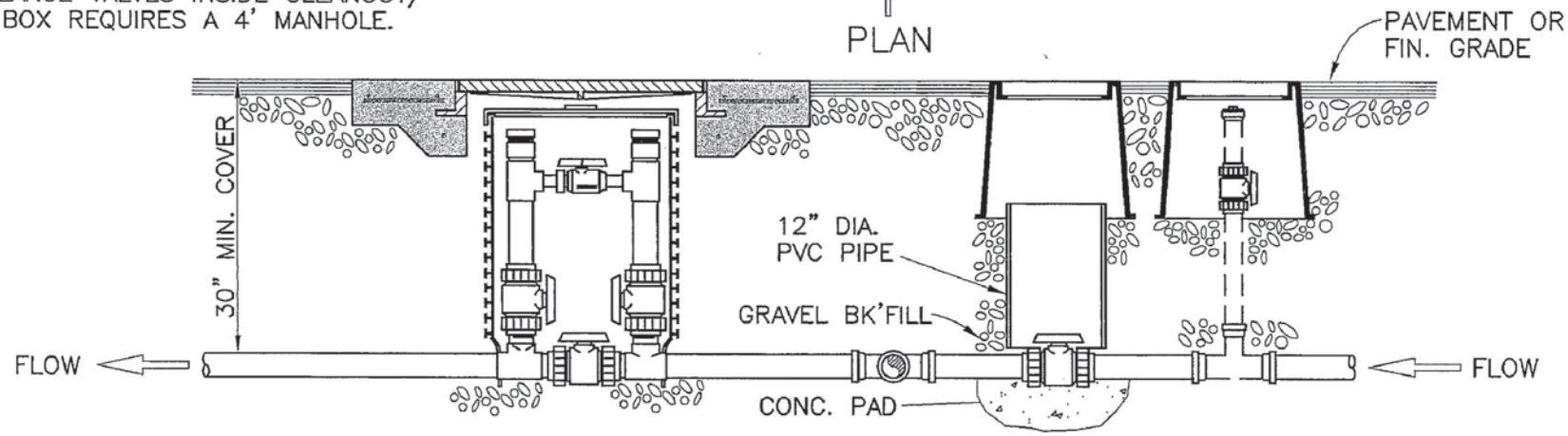
NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD LOW PRESSURE SEWER DRAWING	LP-04



NOTES:

1. USE PVC FITTINGS WITH THREADED PLUGS OR CAPS FOR CLEANOUTS.
2. SINGLE BOX MAY BE USED FOR VALVE AND CLEANOUT ON LINE SMALLER THAN 2"
3. USE PLASTIC METER BOX IN NON–TRAFFIC AREAS, TRAFFIC TYPE METER BOX WHERE VEHICLE TRAFFIC WILL BE ENCOUNTERED.
4. FOR LINES 4" AND SMALLER C.O. SHALL BE SAME AS LINE SIZE. FOR LINES LARGER THAN 4" C.O. SHALL BE 4".
5. USE THRUST BLOCKS AS REQUIRED.
6. 4" AND LARGE VALVES INSIDE CLEANOUT/ PIGGING BOX REQUIRES A 4' MANHOLE.

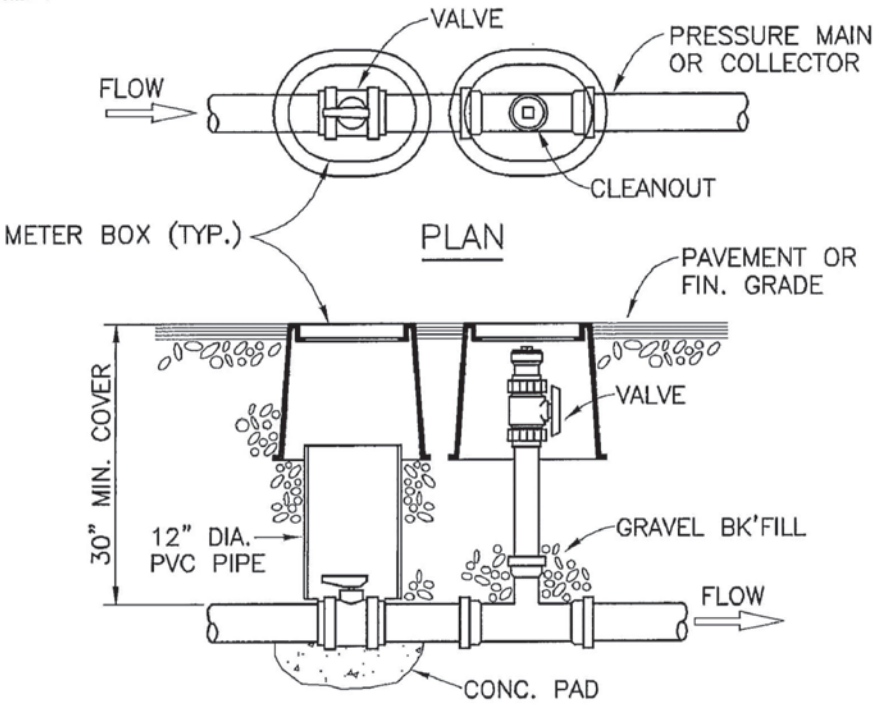


VALVE BOX & CLEANOUT ARRANGEMENTS AT JUNCTION OF PRESSURE MAINS

NOT TO SCALE

JONESBOROUGH, TENNESSEE
STANDARD LOW PRESSURE SEWER DRAWING
NO. LP – 05

NOTE:
1. USE BALL VALVES FOR 3–INCH AND SMALLER PIPING. USE PLUG VALVES FOR GREATER THAN 3–INCH PIPING.
2. USE THRUST BLOCKING AS REQUIRED.



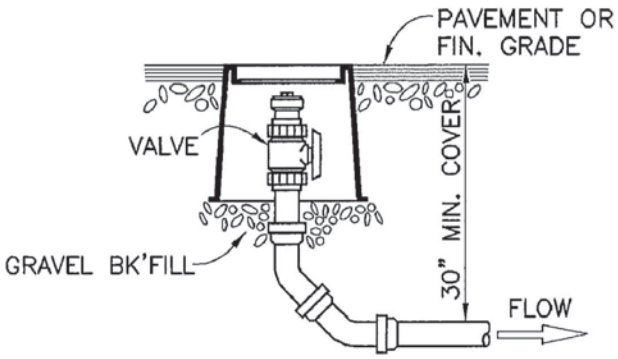
IN–LINE CLEANOUT & VALVE

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD LOW PRESSURE SEWER DRAWING	LP–06

NOTES:

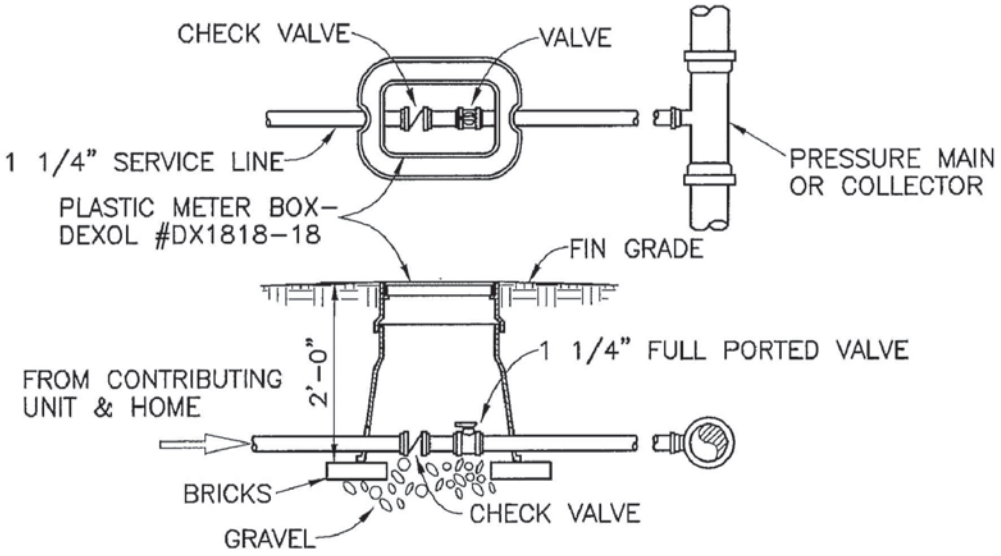
1. USE PVC FITTINGS WITH THREADED PLUGS OR CAPS FOR CLEANOUTS.
2. USE PLASTIC METER BOX IN NON-TRAFFIC AREAS & TRAFFIC TYPE METER BOX WHERE VEHICLE TRAFFIC WILL BE ENCOUNTERED.
3. USE BALL VALVES FOR 3-INCH AND SMALLER PIPING. USE PLUG VALVES FOR GREATER THAN 3-INCH PIPING.
4. USE THRUST BLOCKING AS REQUIRED.



TERMINAL CLEANOUT & BOX

NOT TO SCALE

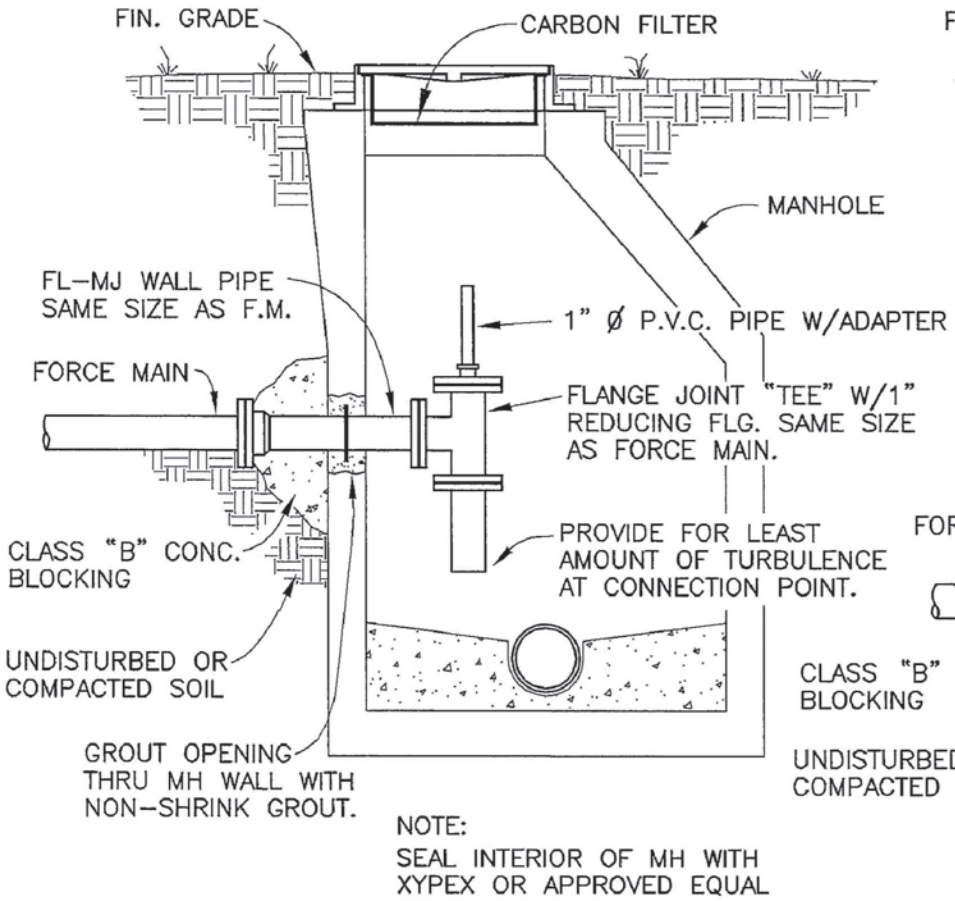
JONESBOROUGH, TENNESSEE	NO.
STANDARD LOW PRESSURE SEWER DRAWING	LP-07



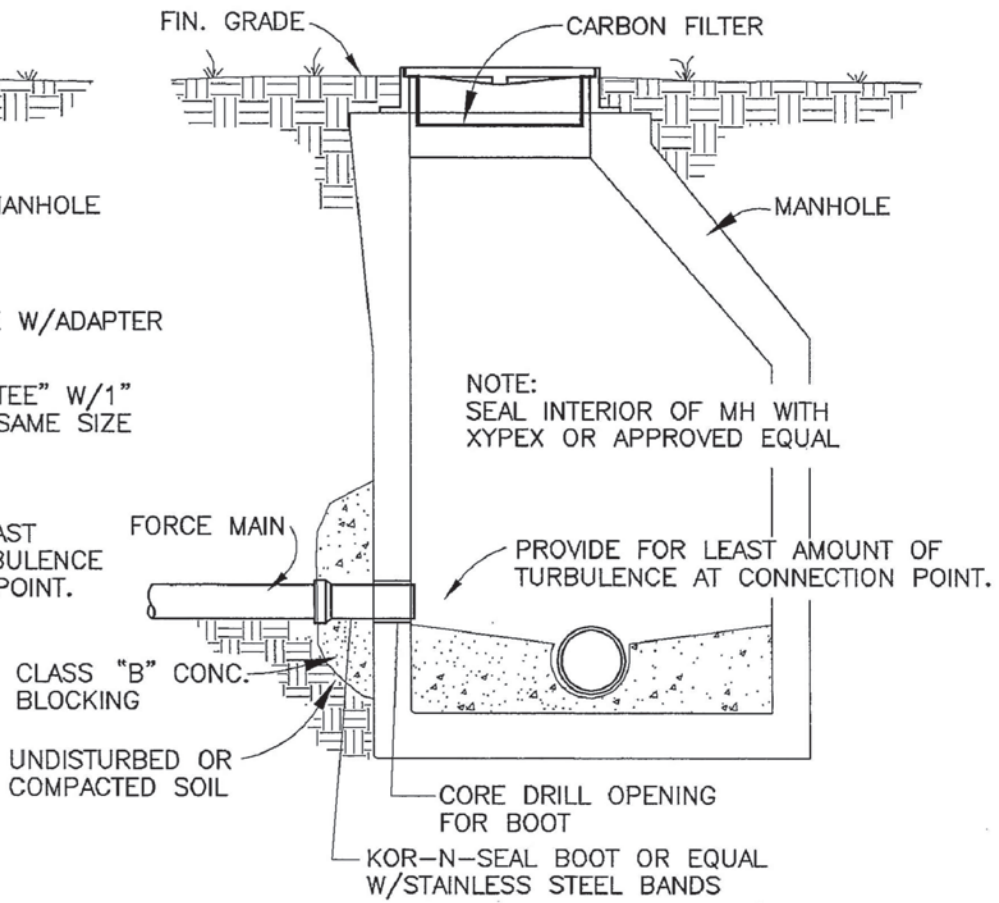
TYPICAL SERVICE LINE CONNECTION

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD LOW PRESSURE SEWER DRAWING	LP–08



CONNECTION ABOVE FLOW LINE



CONNECTION AT GROUT LINE

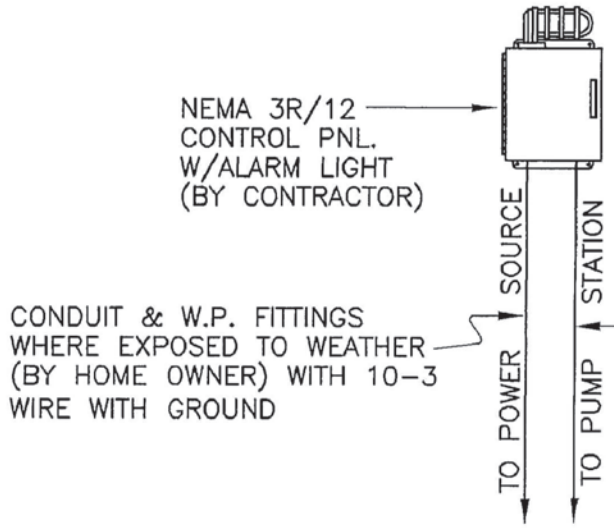
LOW PRESSURE FORCE MAIN CONNECTION AT MANHOLE

NOT TO SCALE

JONESBOROUGH, TENNESSEE
STANDARD LOW PRESSURE SEWER DRAWING
NO. LP–09

NOTES:

1. AUDIO & VISUAL ALARM REQUIRED AT DUPLEX SITES.



ELECTRICAL NOTES

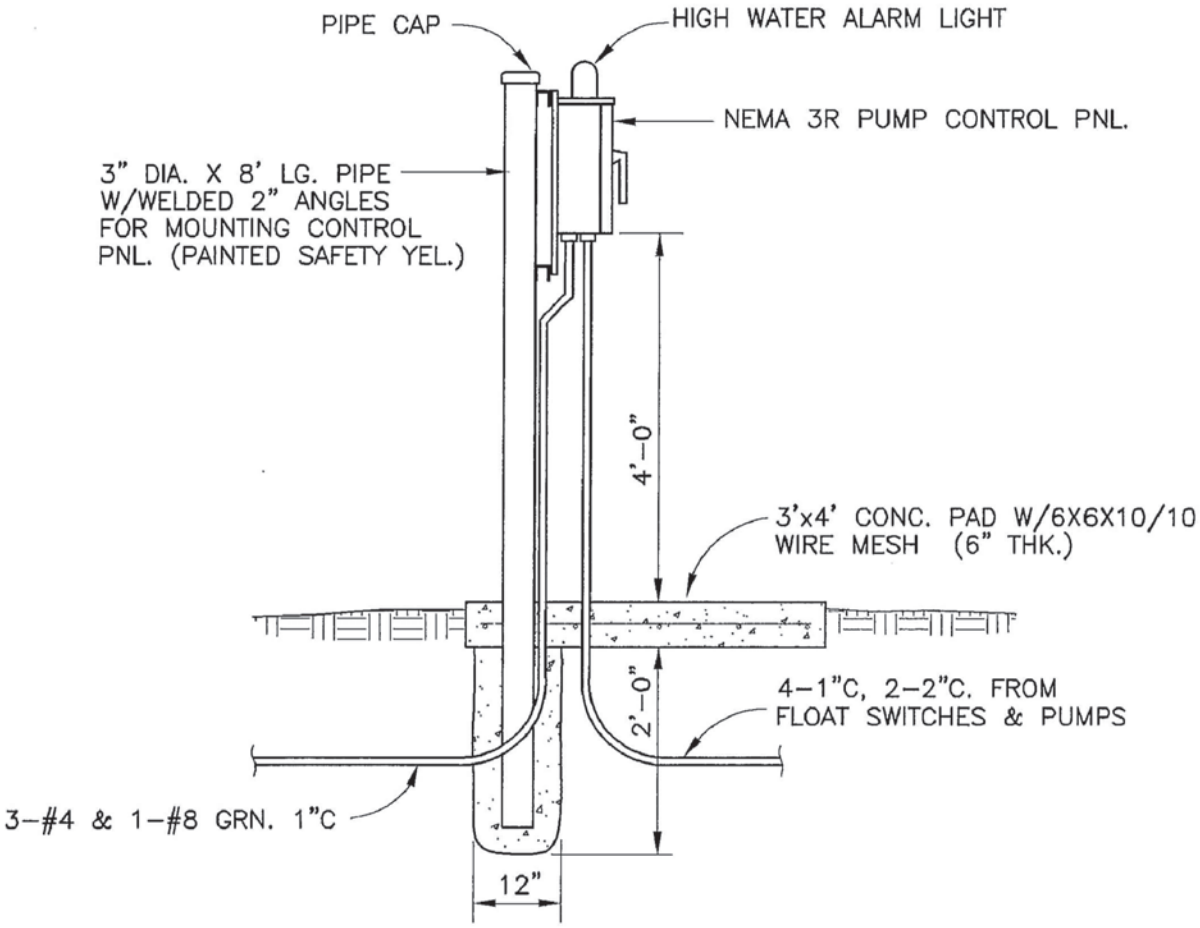
1. WIRE: COPPER - THW
2. CONDUIT: RIGID GALVANIZED STEEL
3. CODES: N.E.C. & LOCAL AUTHORITY
4. CONTROL PANELS SHALL BE MOUNTED ON SIDE OF HOUSE AT CLOSEST POINT TO PUMP. EXACT LOCATION WILL BE CONFIRMED BY THE ENGINEER PRIOR TO INSTALLATION

HOMEOWNER TO PROVIDE WIRING BETWEEN ELECT. BOX & POWER SOURCE ACCORDING TO N.E.C. & LOCAL AUTHORITY. CONTRACTOR SHALL PROVIDE ALL WIRING REQ'D. FOR HOOK-UP AT L.M.I. RESIDENCES.

SIMPLEX GRINDER PUMP CONTROL PANEL

NOT TO SCALE

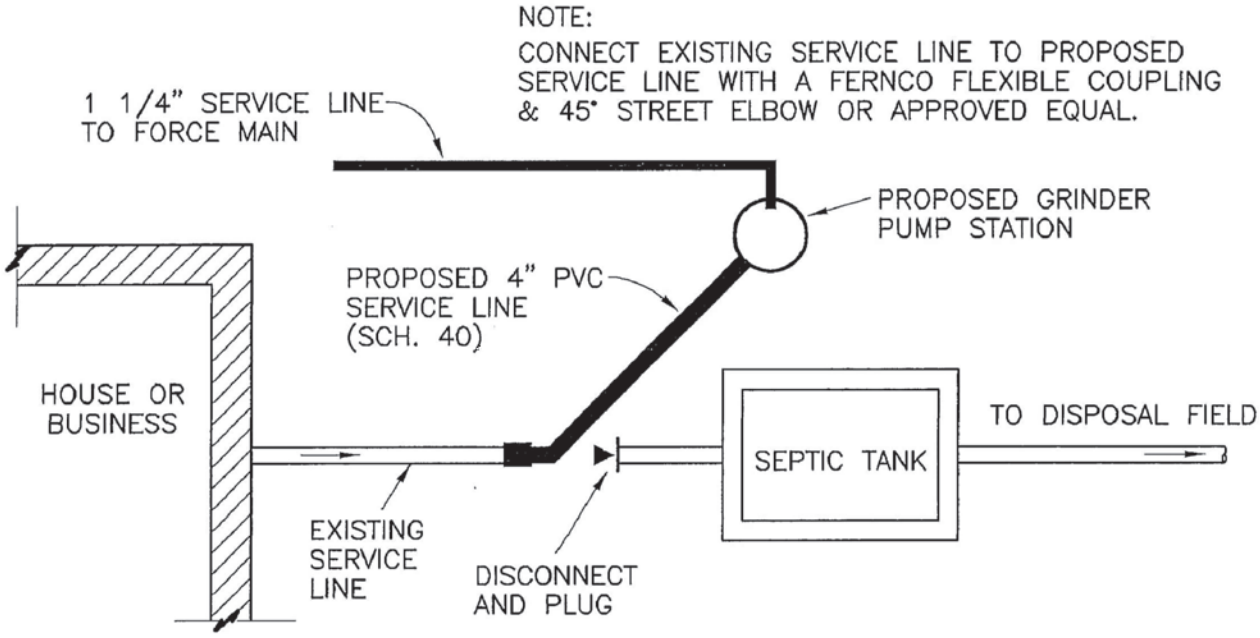
JONESBOROUGH, TENNESSEE	NO.
STANDARD LOW PRESSURE SEWER DRAWING	LP-10



DUPLEX GRINDER PUMP CONTROL PANEL

NOT TO SCALE

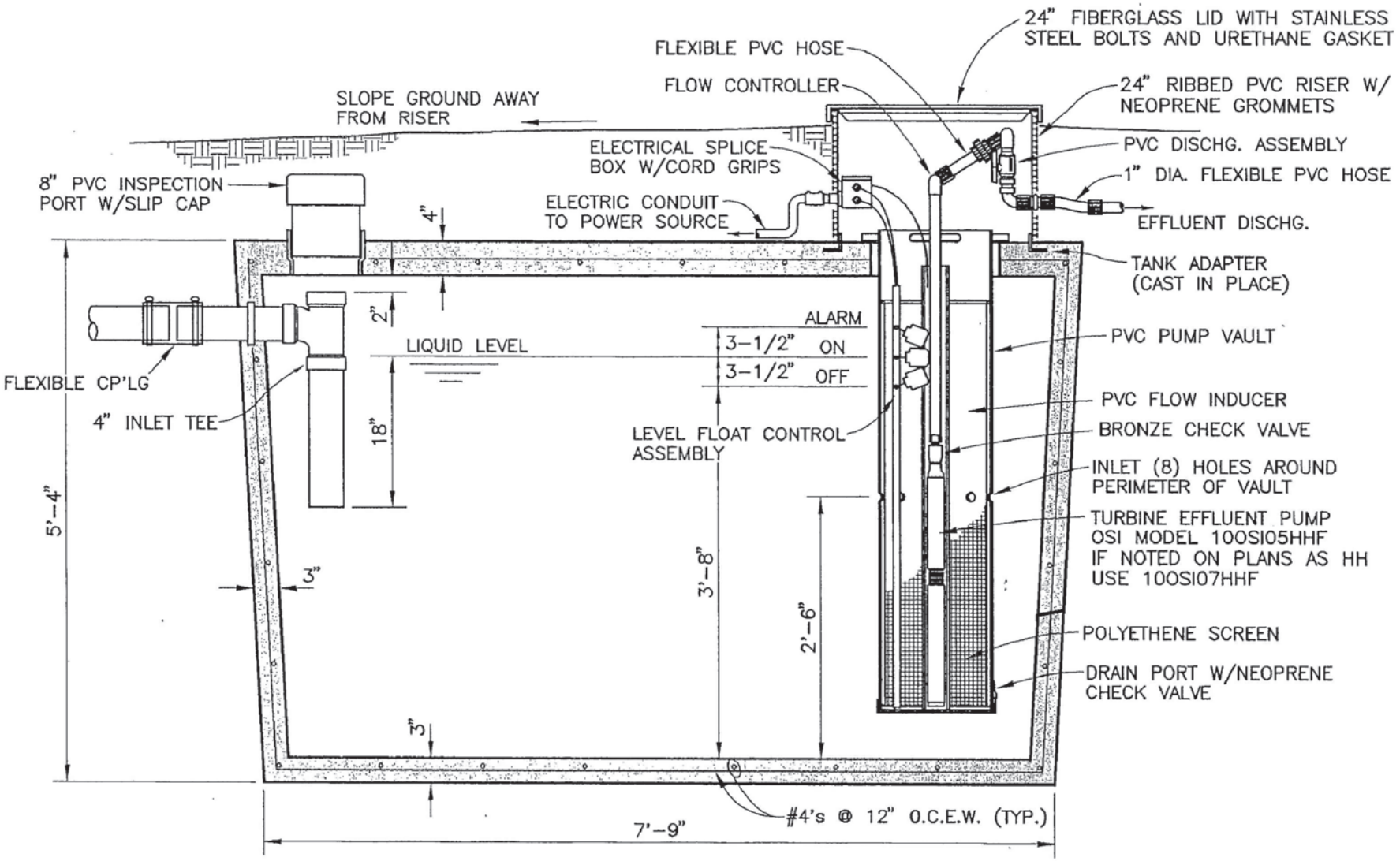
JONESBOROUGH, TENNESSEE	NO.
STANDARD LOW PRESSURE SEWER DRAWING	LP-11



CONNECTION OF EXISTING SEWER LINE TO PROPOSED GRINDER PUMP STATION

NOT TO SCALE

JONESBOROUGH, TENNESSEE	NO.
STANDARD LOW PRESSURE SEWER DRAWING	LP–12



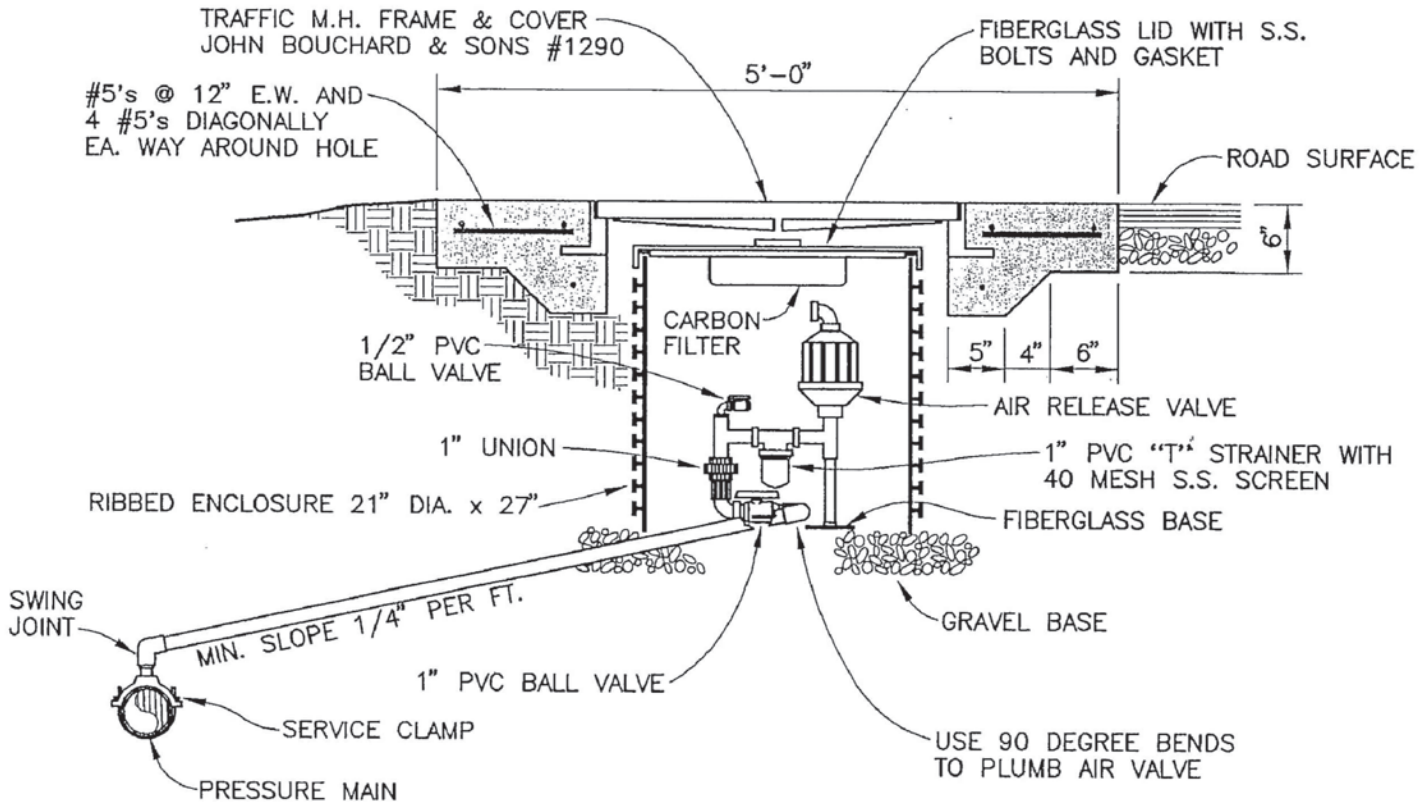
STEP (SEPTIC TANK EFFLUENT PUMP) SYSTEM

SIDE VIEW–TYPICAL PUMP TANK

SCALE: 3/4" = 1'-0"

JONESBOROUGH, TENNESSEE
STANDARD LOW PRESSURE SEWER DRAWING
NO. LP-13

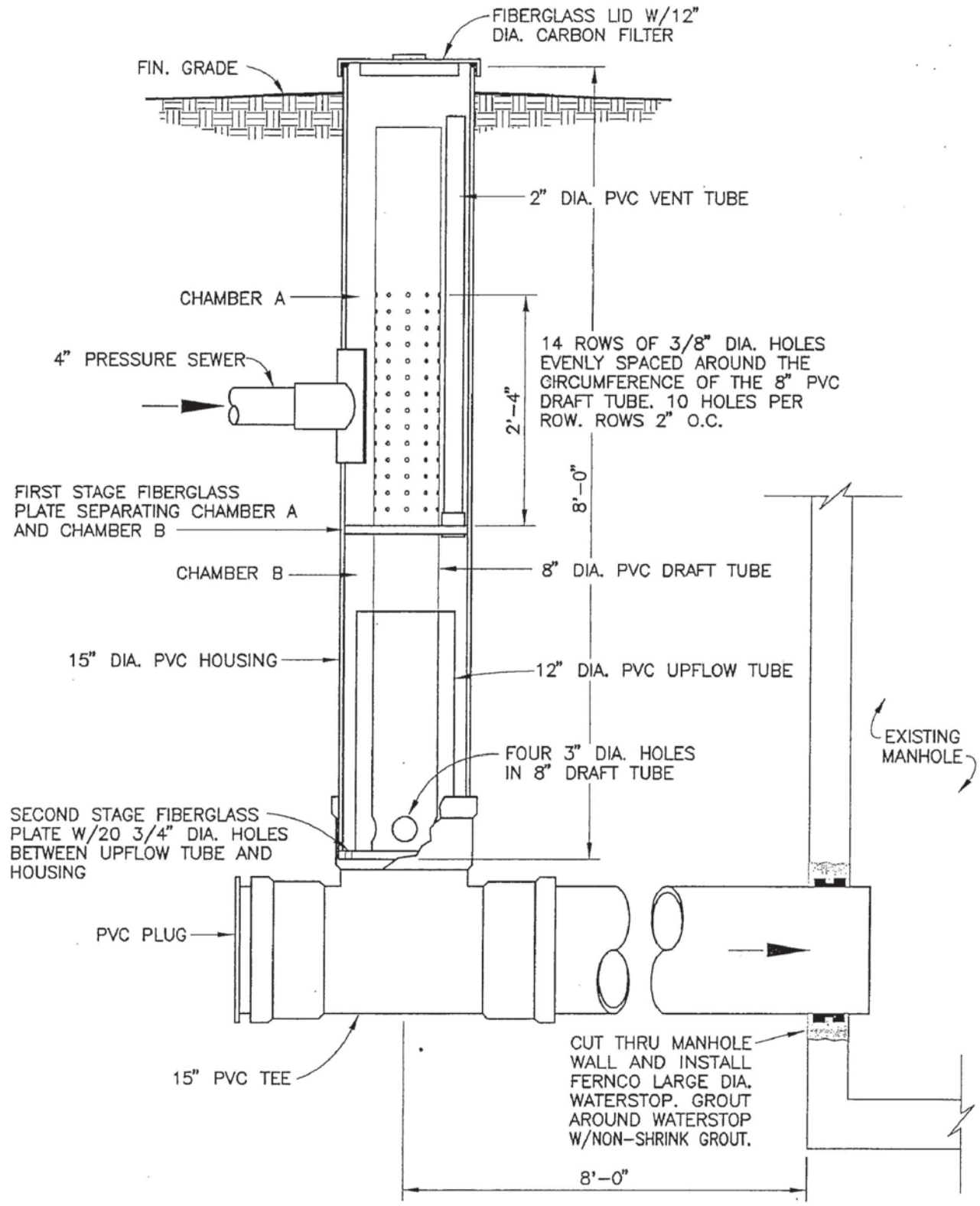
NOTE:
USE CONCRETE PAD WITH MANHOLE FRAME AND COVER IN TRAFFIC LOCATIONS



AIR RELEASE ASSEMBLY

SCALE: 3/4" = 1'-0"

JONESBOROUGH, TENNESSEE
STANDARD LOW PRESSURE SEWER DRAWING
NO. LP-14



AERATOR ASSEMBLY

SCALE: 3/4" = 1'-0"

JONESBOROUGH, TENNESSEE	NO.
STANDARD LOW PRESSURE SEWER DRAWING	LP-15