

**DECATUR COUNTY
CONSTRUCTION & DEVELOPMENT
STANDARDS MANUAL**

**SECTION 02730
SANITARY SEWERS**

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1.00 General

1.01 Description

A. This section covers all work necessary for the installation of gravity sanitary sewers and related items complete, including manholes, junction chambers, diversion chambers, house services, and miscellaneous concrete structures. This section also describes the definitions, policies and procedures for the construction of sanitary sewers in Decatur County.

B. All sanitary sewers constructed in Decatur County are to meet the following specifications, state and federal regulations and the Recommended Standards for Wastewater Facilities.

C. All easements for collection system sewers must prohibit the construction of any permanent structure over the sanitary sewer and must also provide enough access for maintenance with mechanical equipment.

D. A sanitary sewer construction permit, where required, shall be obtained from the Indiana Department of Environmental Management (IDEM). An IDEM sanitary sewer construction permit shall not be required for the following:

1. A storm sewer that transports only surface run-off.
2. Construction of a house connection for a single-family dwelling or residence.
3. Construction of a building connection for a multi-unit residence building, commercial, manufacturing, or industrial building, provided that no toxic or other pollutants that are incompatible with the publicly owned treatment works and collection system are present in the wastewater serviced by the sewer or that are incapable of being treated to an acceptable quality.

E. All required permits or exemptions from other federal, state, and local units must be obtained prior to the commencement of construction of any sanitary sewer.

F. The Superintendent of the receiving Wastewater Treatment Plant is to be notified twenty-four (24) hours before installation of any sanitary sewer.

1.02 Definitions

A. Backfill: Material placed in trench from the top of bedding to finish grade, or subbase of pavement.

B. Bedding: Material placed in trench to support pipe and conduit.

C. Building Drain: That part of the lowest horizontal piping of a building drainage system which receives the discharge from soil, waste, and other drainage pipes inside the

walls of the building and conveys it to the building sewer, beginning two (2) feet outside the inner face of the building wall.

D. Building Sewer: The extension from the building drain to the Service Lateral or other place of disposal also called house connection.

E. Excavation: Removal of earth and rock to from a trench for the installation of a gravity sanitary sewer.

F. Earth: Unconsolidated material in the crust of the Earth derived by weathering and erosion.

G. Earth includes:

1. Materials of both inorganic and organic origin.
2. Boulders less than $\frac{1}{3}$ cubic yard in volume, gravel, sand, silt, and clay.
3. Materials, which can be excavated with a backhoe, trenching machine, dragline, clamshell, bulldozer, highlight, or similar excavating equipment without the use of explosives, rock tippers, rock hammers, or jackhammers.

H. House Connection: Means the pipe carrying the wastewater from a single-family dwelling to a common public sewer.

I. Sanitary Sewer: Means a sewer that conveys liquid and water-carried wastes from residences, commercial building, industrial plants, and institutions, and to which storm surface, and ground water are not intentionally allowed to enter.

J. Rock: A natural aggregate of mineral particles connected by strong and permanent cohesive forces.

K. Rock includes:

1. Limestone, sandstone, dolomite, granite, marble, and lava.
2. Boulders $\frac{1}{3}$ cubic yard or more in volume.
3. Materials, which cannot be excavated by equipment, which is used to remove earth overburden without the use of explosives, rock tippers, rock hammers, or jack hammers.

L. Service Lateral: The pipe that conveys wastewater from the property and/or easement line to the public sanitary sewer.

M. Sanitary Superintendent: The Superintendent of the receiving Wastewater Treatment Plant or his representative.

N. Subgrade: Undisturbed bottom of trench.

O. Topsoil: Earth containing sufficient organic materials to support the growth of grass.

P. Wastewater: Liquid and water carried industrial wastes and sewage from residential dwellings, commercial building, industrial and manufacturing facilities, and institutions, whether treated or untreated, which are contributed to the POTW.

Q. Undercutting: Excavation of rock and unsuitable earth below the bottom of the pipe or conduit to be installed in the trench.

1.03. Pipe Marking

A. Each length of pipe shall bear the name or trademark of the manufacturer, the location of the plant, and the date of manufacture. Each length shall likewise be marked to designate the class or strength of the pipe. The marking shall be made on the exterior or interior of the pipe barrel near the bell or groove end and shall be plainly visible.

1.04 Quality Assurance

A. Performance Tests: The Contractor shall test all gravity sewers constructed. The Contractor shall constantly check horizontal and vertical alignment. Testing for vertical deflection in the case of non-rigid pipe and sewer watertightness testing in the case of all gravity sewers and hydrostatic testing of ductile iron pipe shall be as specified in this Section.

B. Line and Grade Requirements: The Contractor shall provide assurance to the receiving wastewater utility that the sewer is laid accurately to the required line and grade as shown on the drawings. The Contractor shall utilize a laser beam instrument to lay and check the alignment and grade between manholes. Before proceeding with the next section of sewer, the last section shall be checked for proper line and grade. Variations from a uniform line and grade as shown on the drawings and described below shall be cause for the line to be rejected.

1. Variance from established line and grade shall not be greater than $1/32$ of an inch per inch of pipe diameter and not to exceed $1/2$ inch, provided that such variation does not result in a level or reverse sloping invert; provided also that the variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed $1/64$ inch per inch of pipe diameter or $1/2$ inch maximum.
2. Subsequent Performance Testing: After the initial performance test and leakage test and as work progressed, the receiving wastewater utility may designate additional sections for testing as conditions in their opinion warrant. If a review of the Contractor's workmanship leads the Utility to question whether or not the tolerances and standards specified are being met, the Utility reserves the right to select other locations and lengths to be tested. The Utility shall notify the Contractor of the location where a test is to be required not later than 15 days after the sewer installation has been completed. Unless otherwise authorized, the Contractor shall arrange to commence the test within 15 days after the sewer has been installed or 15 days after receiving notification by the Utility, whichever date is later.

3. Final Performance Testing for Acceptance: Before acceptance for all new sanitary sewers, the Contractor and the Utility shall check all sewers, even if previously checked, for accurate alignment and grade. Also, all sanitary sewers shall be tested as specified in Articles 3.10 through 3.14 of this Section for watertightness. The program of testing whether by infiltration, exfiltration, air testing, or vacuum testing shall be determined by the Utility.
4. All tests to be performed are to be witnessed by the design engineer (or their representative) and the Wastewater Treatment Plant Superintendent (or their representative). The Superintendent shall be notified at least twenty-four (24) hours prior to testing.

1.05 Length of Open Trench

A. Not more than 100 feet of trench shall be opened at any one time. Not more than 30 feet of trench may be opened in advance of the completed pipe laying operation, and not more than one street crossing may be obstructed by the same trench at any one time.

1.06 Relation to Water Mains

A. Sewers must be laid at least 10 feet horizontally from any existing or proposed water main. The distance is to be measured edge to edge. Should specific conditions prevent this separation, the Contractor shall notify the design Engineer for specific instructions regarding the treatment of the separation. Special conditions may allow installation of the sewer closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the water main is at least 18 inches above the top of the sewer. It may be necessary to install 150 psi water main pipe and joints as sewer pipe for the congested areas.

B. Whenever the sewer crossed a water main, it should be laid at least 18 inches below the main, or the water main should be relayed with fittings to cross over the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints.

C. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the sewer shall be designed and constructed equal to water pipe, and shall be pressure tested to assure watertightness prior to backfilling. Maximum distance between sewer pipe joints and water pipe shall be provided where vertical separation is a problem.

1.07 Collection System Near Surface Water Bodies

A. Sanitary sewers and lift stations shall be separated from existing or proposed water bodies by ten (10) feet horizontally measured from the outside edge of the sanitary sewer to the edge of the water line at normal pool elevation.

B. Sanitary sewers located above surface water bodies shall be in accordance with the following:

1. Supported and anchored at each point.
2. Protected from damage and freezing with any of the following:
 - a. Insulation
 - b. Increased slope
 - c. Accessible for repair or replacement

C. Sanitary sewers located under surface water bodies shall be constructed with ductile iron pipe or, PVC having a SDR ratio of 21 and in conformance with ASTM D2241-96b, Standard Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe, with mechanical joints rated to two hundred (200) pounds per square inch.

D. Backfilled with stone, gravel, or coarse aggregate and covered in accordance with the following:

1. Below the channel pavement if the channel is paved.
2. Twelve (12) inches of cover shall be provided where the sewer is located in rock.
3. Thirty-six (36) inches of cover shall be provided in all other areas.

E. Sanitary sewers that cross streams or rivers shall be in accordance with the following:

1. Cross perpendicular to the stream flow
2. Have no change in grade

F. Sanitary lift stations shall be capable of remaining fully operational and accessible during a twenty-five (25) year flood.

G. Sanitary lift stations, structures, and electrical and mechanical equipment shall be protected from physical damage potentially caused by a one hundred (100) year flood.

2.00 Products

2.01 General

A. All pipe, fittings and appurtenances shall be new, unused and as shown non the drawings or as required by the manufacturer and ANSI/AWWA or ASTM specifications.

2.02 Sewer Pipe 18 Inches and Larger

A. Sewers 18-inches through 27-inches in diameter shall be large diameter polyvinyl chloride pipe.

B. Large Diameter Polyvinyl Chloride Pipe

1. Large diameter solid wall polyvinyl chloride pipe shall conform to ASTM F679, SDR 35.

2. Joints shall be the integral bell type with a locked in sealing ring meeting the requirements of ASTM D3212.

2.03 Sewers 15 Inches or Smaller

A. Sewers 15 inches in diameter or smaller shall be polyvinyl chloride pipe, or ductile iron pipe.

B. Polyvinyl Chloride Pipe and Fittings

1. Polyvinyl chloride pipe and fittings shall conform to ASTM D3034 SDR 35, Type PSM, latest revision.
2. Maximum diameter of PVC sewer pipe to be used is 15 inches.
3. Joints on PVC sewer pipe shall be the integral bell type gasketed joint designed so that when assembled the elastomeric gasket inside the bell in compressed radially on the pipe spigot to form a positive seal. The joint shall be so designed to avoid displacement of the gasket when installed in accordance with manufacturer's recommendations. The joint shall comply with the physical requirements of ASTM D3212, and the gasket shall be the only element depended upon to make the joint flexible and watertight.
4. All PVC Pipe entering a manhole shall have a manhole waterstop gasket as supplied by the manufacturer firmly clamped around the pipe at the manhole. If flexible entry type manhole system is used, the waterstop gasket is not required.

C. Ductile Iron Pipe and Fittings: Ductile iron pipe and fittings shall conform to the requirements of ANSI/ASTM A746, Ductile Iron Gravity Sewer Pipe.

1. Thickness class requirements of ductile iron pipe to be used in conveyance of sanitary sewage by gravity shall be minimum thickness of Class 350 unless otherwise noted for standard length pipe.
2. Outside surfaced of the pipe and fittings shall be bituminous coated complying with ANSI/AWWA A21.51/C151 and ANSI/AWWA A2110/C110.
3. Inside surfaces of all pipes, fittings and adapters shall be lined with cement mortar and a bituminous seal coat. Cement mortar lining and bituminous seal coat shall meet the requirements of ANSI/AWWA A21.4/C104.
4. Ductile iron pipe and fittings shall be push-on type conforming to ANSI A21.11 (AWWA C111), latest revision. Fittings shall be ductile iron and shall comply with ANSI Specification A21.10, latest revisions, with mechanical joints for 150 psi working pressure.

D. Fittings

1. Fittings such as wyes, tees, and bends shall be made in such a manner as will provide strength and watertightness at least equal to the class of the adjacent main line pipe to which they are jointed and shall conform to all other requirements specified for pipe of corresponding class and internal diameter. Joints shall be of the same type as used on the adjoining pipe.

2. Fabricated branches for wyes and tees shall be securely attached to the wall of the pipe in a watertight manner and shall be flush with the inside surface of the pipe. The branches shall have their axes perpendicular to the longitudinal axis of the pipe. Wye branches shall have their axes approximately 60 degrees for clay pipe and 45 degrees for concrete pipe from the longitudinal axis of the pipe, measured from the bell end. Pipe reinforcement shall not be interrupted beyond a radial distance of 3 inches outside of the fitting.

2.04 Manholes and Other Structures

A. Manholes shall be constructed of monolithic concrete or precast manhole sections. Precast manhole sections shall conform to requirements of ASTM Specification C478, latest revision.

B. Openings in manhole sections for sewer connections shall be cast into the manhole as specified by the connector manufacturer. A flexible pipe-to-manhole connector shall be employed in the connections of the sanitary sewer pipe to precast manholes. The connector shall be the sole element relied on to assure a flexible, watertight seal of the pipe to the manhole. The connector shall be constructed solely of polyisoprene or natural rubber, and shall meet and/or exceed the requirements of ASTM C923. The resilient connectors shall be A-Lok Products, Inc., Press-Seal Gasket Corp., or similar manhole connectors approved by the design Engineer.

C. In the field, any additional openings needed shall be made by core drilling and booted as approved by the design Engineer. A flexible pipe-to-manholes connector shall be employed in the connection of the sanitary sewer pipe to precast manholes. The connector assembly shall be the sole element relied on to assure a flexible watertight seal of the pipe to the manhole. The rubber gasket shall be constructed solely of polyisoprene or natural rubber and shall meet/exceed the requirements of ASTM C923. If metal, the internal expansion sleeve and the external compression clamps shall be constructed of Series 304 and Series 305 nonmagnetic stainless, and shall utilize no welds in its construction.

D. Materials for manholes, junction chambers, diversion chambers, and miscellaneous concrete structures shall comply with the following:

- a. Concrete for precast manhole sections shall be 3000 psi concrete. Monolithic manholes shall use 4000 psi concrete. Ready-mix concrete shall conform to ASTM C94 Alternate 2. Maximum size of aggregate shall be 1 ½ inches. Slump shall be between 2 and 4 inches.
- b. Forms for chamber and structures shall be plywood or other approved material. Steel forms shall be used for the inside face of monolithic concrete manholes.
- c. Reinforcing steel shall conform to ASTM A615, Grade 40 deformed bars, or ASTM A616, Grade 40 deformed bars.
- d. Mortar Materials

- (1) Sand - ASTM Designation C144, passing a No. 8 sieve.
 - (2) Cement - ASTM Designation C150, Type 1.
 - (3) Water - shall be potable.
- e. All joints shall be fully sealed and waterproofed. Rubber gaskets for precast concrete manhole sections shall meet the requirements of ASTM C443. The gasket shall be the sole element depended upon to make the joint flexible and watertight.
 - f. The manufacturer of the precast manholes shall provide core-drilled openings to produce a smooth, uniform, cylindrical hole of the proper size to accommodate a resilient connector meeting the requirements of ASTM C923 for all sewers entering and leaving the manhole. The resilient connectors shall be either Press-Seal Gasket Corp., which provides PSX gasket or Press Wedge II; or similar flexible manhole sleeves furnished by Kor-N-Seal by NPG Systems, Inc.; or equal.
 - g. Precast manhole sections shall be steam cured and shall not be shipped from the point of manufacture for at least five (5) days after having been cast. The exterior surface of each section shall be thoroughly coated with a coal tar epoxy type coating as manufactured by TNEMEC Co., Tnemec-46H413 Hi-Build Tneme-Tar; or approved equal by the Engineer. Final dry mils thickness shall be a minimum of 12 mils. Monolithic concrete manholes and other concrete structures shall be cured for a minimum of seven days and then coated in the field with a coal tar epoxy type coating as mentioned above.
 - h. Manhole castings shall be of good quality cast iron and/or ductile iron, conforming to ASTM Designation A48. Castings shall have a total weight of not less than 375 pounds and shall conform to the design of the manhole casting as shown on the standard detail sheet. Castings shall have four bolt holes equally spaced around base of frame and shall be securely anchored to cone section to provide a water tight-fit with three $\frac{3}{8}$ inch stainless steel bolts and expansion shields. Unless specifically designated otherwise, manhole castings shall be the non-locking type.
 - i. Manhole steps shall be made from a steel reinforcing rod encapsulated in a copolymer polypropylene resin. The manhole steps shall equal or exceed OSHA requirements. Manhole steps manufactured by M.A. Industries, Inc., PS-1-PF, Clay & Bailey Mfg. Co., or equal, are acceptable. Steps shall be places as shown in Standard Detail.
 - j. Manholes shall have grade adjustment rings sealed with non-shrinking grout in conformance with ASTM C978, latest revisions for Precast Reinforced Concrete Manhole Sections. The maximum height of adjustment rings shall not exceed twelve (12) inches. The exterior of the adjustment rings shall be coated $\frac{1}{4}$ " Butyl Rubber Trowelable grade back plaster material.

- k. The Contractor may, at his option, furnish and install a combination precast concrete base and first section with precut openings for services. Detailed drawings shall be submitted to the design Engineer prior to manufacture.
- l. Precast manhole section shall have a lifting eye cast into the wall for lifting the section. Lifting holes through the precast section will not be allowed.

E. Grease Trap: Grease trap tank shall be constructed of 6000 psi concrete. All tank joints shall be sealed watertight with butyl rubber extrudible preformed gasket material. All outside riser ring surfaces shall be waterproofed $\frac{1}{8}$ " with trowelable grade butyl rubber back plaster.

3.00 Execution

3.01 Inspection and Rejection of Pipe

A. The quality of all materials, the process of manufacture, and the finished pipe shall be subject to inspection and approval by the receiving wastewater utility and design Engineer. Such inspection may be made at the place of manufacture or on the work after delivery, or at both places; and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification's requirements even though sample pipes may have been accepted as satisfactory at the place of manufacture.

B. Prior to being lowered into the trench, each pipe shall be carefully inspected, and those not meeting the specifications shall be rejected and at once removed from the work.

C. The receiving wastewater utility or its representatives shall have the right to cut cores from such pieces of the concrete pipe as their desires for such inspection and test as they may wish to apply.

D. Holes left by the removal of cores shall be filled in an approved manner by and at the expense of the manufacturer of the pipe.

E. The receiving wastewater utility or its representatives shall also have the right to take samples of concrete after it has been mixed, or as it is being placed in the forms or molds, and to make such inspection and tests thereof as they may wish.

F. Any pipe which has been damaged after delivery will be rejected and replaces solely at the Contractor's expense.

3.02 Handling Pipe

A. Each pipe section shall be handled into its position in the trench only in such manner and by such means as the design Engineer approves as satisfactory. As far as practicable, the Contractor will be required to furnish slings, straps, and other approved devices to permit satisfactory support of all parts of the pipe when it is lifted.

3.03 Notice To Wastewater Superintendent

A. The Wastewater Superintendent shall be notified when the pipes are to be laid in the trench. At least 15 feet of the pipe shall, under ordinary circumstances, be laid before covering begins.

3.04 Laying Pipe

A. All pipe shall be reinspected for soundness and damage due to handling immediately before being lowered into the trench. Any pipe found to be unsound or damaged will be rejected and shall be removed immediately from the site of the work.

B. All pipe shall be laid accurately to the required line and grade as shown on the drawings, and in the manner prescribed by the pipe manufacturer and appropriate ASTM Specifications, to form a close, concentric joint with the adjoining pipe and to bring the invert of each section to the required grade. The supporting of pipe on block will not be permitted.

C. Pipe laying shall proceed upgrade, beginning at the lower end of the sewer.

D. Practically watertight work is required, and the Contractor shall construct the sewers with the type of joint specified.

E. All pipe shall be laid to the line and grade as shown on the drawings. Variations from a uniform line and grade as shown on the drawings shall be cause for the line to be rejected.

F. The ends of the pipe shall be satisfactorily cleaned just before laying, and the joint shall be made in a satisfactory manner in accordance with the recommendations of the manufacturer on particular type of joint and the directions of the design Engineer. All joint work shall be done by experienced workmen.

G. PVC (polyvinyl chloride) gravity sewer pipe and fittings, ASTM Designation D3034 SDR 35, shall be installed in accordance with the directions contained in ASTM Designation D2321. Only materials classified as Class I will be acceptable for bedding, haunching, and initial backfill of the pipe placed and compacted in accordance with ASTM D2321.

H. Joints on PVC pipe shall be the integral bell type gasketed joint designed so that when assembled the elastomeric gasket inside the bell is compressed radially on the pipe spigot to form a positive seal. The joint shall be so designed to avoid displacement of the gasket when installed in accordance with the manufacturer's recommendations. The gasket shall be the only element depended upon to make the joint flexible and watertight.

I. All PVC pipe entering a manhole shall have manhole waterstop gasket as supplied by the manufacture firmly clamped around the pipe. If flexible entry type manhole system is used, the waterstop gasket is not required.

J. All PVC pipe shall have a deflection test performed by the Contractor in the presence of the design Engineer or his representative.

K. All pipe shall be bedded as described in this specification under Pipe Bedding. Bell holes shall be excavated in advance of pipe laying so the entire pipe barrel will bear uniformly on the prepared subgrade.

L. Each length of pipe shall be mechanically pulled "home" with a winch or come-along against the section previously laid and held in place until the trench and bedding are prepared for the next pipe section. Care shall be taken in laying the pipe so not to damage the bell end of the pipe. Mechanical means consisting of a cable placed inside the pipe with a winch, jack, or come-along shall be considered to pull the pipe home where pushing the pipe will not result in a joint going completely home and staying in place. Pushing the pipe home shall be done by means of a block and push bar. Use of hydraulic excavating equipment as the means of pushing or moving the pipe to grade will not be permitted.

M. The Contractor shall use laser beam equipment to maintain accurate alignment and grade. A qualified operator shall handle the equipment during the course of construction. If bending of the laser beam due to air temperature variations or dust in the air is apparent "within the pipe" units, a fan shall be provided to circulate the air. However, air velocity shall not be so excessive as to cause pulsating or vibrating of the beam. Survey instruments may be used for checking alignment and grade if questions arise about the accuracy of the work.

N. Open excavation shall be satisfactorily protected at all times. At the end of each day's work, the open ends of all pipes shall be protected against the entrance of animals, children, earth, or debris by bulkheads or stoppers. The bulkheads or stoppers shall be perforated to allow passage of water into the installed pipe line to prevent flotation of the pipe line. Any earth or other material that may find entrance into the main sewer or into any lateral sewer through any such open end of unplugged branch must be removed at the Contractor's expense. The cost of all such plugs, and the labor connected therewith, must be included in the regular bid for the sewers.

O. The Contractor shall conduct a leakage test as described in Sewer Tests of the specification on the first section of sewer of each size and type sewer material installed. No additional sewer pipe shall be installed until the first reach of sewer of each size and each type sewer material has satisfactorily passed the leakage test.

P. The Contractor shall prevent all ground water and surface water from entering the existing sewer system during construction of a new sewer or force main extension.

3.05 Pipe Bedding, Haunching and Backfilling

- A. Each pipe section shall be laid in a firm foundation of bedding material and haunched and backfilled with care.
- B. Prior to pipe installation, carefully bring bedding material to grade along the entire length of pipe to be installed. To provide adequate support for the pipe, the following bedding procedures are recommended.
1. When Class I material is used for bedding, little or no compaction is necessary due to the nature of the angular particles. A depth of 4 to 6 inches is generally sufficient to provide uniform bedding.
- C. Bedding material shall have a minimum thickness beneath the pipe of 4 inches or one-eighth of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe one-sixth of the outside diameter of the pipe.
- D. For rigid pipe, such as concrete or ductile iron, backfill between the bedding material and a plane 12 inches over the top of the pipe shall be hand-placed finely divided earth, free from debris and stones, or granular backfill if required.
- E. For flexible pipe such as PVC, the placement of embedment material, consisting of bedding, haunching, and initial backfill, must be done with care. The ability of the pipe to withstand loading in a trench depends a large part on the method employed in its installation. Class I material, as defined in specification Section 02222, Article 2.01, paragraph A, shall be used as embedment material for flexible pipe. Bedding thickness shall be as specified in paragraph C of this Section. The haunching material (the material from the pipe springline to a plane 12-inches over the top of pipe), shall be hand placed. Care must taken to not cause damage by compacting the material directly over the pipe.
- F. In yielding subsoils, the trench bottom shall be undercut to the depth necessary and backfilled with graded, crushed stone to form a firm foundation.
- G. Where excavation occurs in rock or hard shale, the trench bottom shall be undercut and minimum of 6 inches crushed stone bedding placed prior to pipe installation.
- H. For backfilling requirements for sanitary sewers, refer to Section 02222 of these Standards.

3.06 Manholes and Other Structures

- A. Manholes and other structures are to be constructed at locations shown on the drawings and in accordance with the following specifications.
1. Precast concrete manhole sections shall conform to ASTM Designation C478, except as modified herein:

- a. The joint design of the precast sections shall consist of a bell or groove on one end of the unit of pipe and a spigot or tongue on the adjacent end of the joining section.
 - b. The joint shall consist of a round rubber gasket confined in a groove in the spigot end of the precast manhole section and shall conform to Sections 6.1.6, 6.1.7 and 9 of ASTM Designation C443, latest revisions and a flexible butyl rubber joint sealant between joints.
2. Manholes bases shall be cast-in-place concrete, reinforced as shown on the Standard Detail Sheet, or monolithic base and first section combination. Manhole bases shall be cast or placed on a minimum of 6 inches of compacted crushed stone.
 3. Manhole channels or inverts shall be performed and poured with Class "B" concrete to the spring line of the connecting pipe. The finished invert shall be a semi-circular shaped smooth channel directing the flow to the downstream sewer.
 4. The bench shall have a surface slope of not less than four percent (4%), and receive not discharge onto the surface of the bench from a lateral, service connection or drop manhole pipe.
 5. Any additional holes cut in the field shall be drilled with a core-drill or in a manner approved by the design Engineer.
 6. The joint between the casting frame and cone section shall be sealed with a pliable butyl rubber and coated with a coal tar epoxy coating upon reaching its final set to become a watertight joint.

3.07 Service Connection

- A. The Contractor shall install 6-inch diameter house/building service sewer as shown on the Standard Detail Sheets. The house/building service shall extend from a "wye" or "tee" fitting in the main sewer line to the right of way or easement line, unless stated otherwise.
- B. Fittings for house/building service connections on a main line sewer shall be tees or 45-degree wyes and shall be of the same material as the main line sewer, unless otherwise approved by the Wastewater Superintendent.
- C. Six-inch lateral pipe shall connect to the main line sewer at an angle of 15 degrees to 45 degrees from the spring line and shall include the necessary bends and straight pipe sections to reach the right of way line at the elevations specified. A pipe stopper or a bell cap shall be placed on/in the last bell. This stopper or bell cap should be compatible with the type of infiltration/exfiltration test performed on the sewer.
- D. The Contractor shall furnish and use the proper fittings, couplings, and adapters suited to make the transition between different pipe materials which will maintain the structural integrity and the watertightness of the entire sewer system.

E. At the discretion of the Wastewater Superintendent, when and where he feels that improper installation practices are suspected, or questionable bedding materials and methods are employed, or where the installations are severe, the Contractor will have to perform deflection testing on the 6-inch house laterals as specified in Article 3.09.

F. Backfill around fittings and lateral pipe shall be carefully placed and compacted to prevent damage from backfill settlement and shall be installed in same manner as described for sewer installation.

G. The Contractor shall mark the end of each house lateral with a $\frac{5}{8}$ inch steel rod 5 feet long placed vertically over the end of the lateral. The rod shall be painted green and left sticking above the existing ground not more than 1 inch.

H. The Contractor shall keep accurate horizontal and vertical location measurements of each house/building service installed. The location of all house/building services shall be shown on record drawings as noted in Section 1.17 Record Drawings. The accuracy of the measurements shall be the Contractor's responsibility.

3.08 Stubs, Connections, Bulkheads and Miscellaneous Items of Work

A. Where special junction chambers are to be constructed or where existing sewers carrying sanitary sewage are encountered, the Contractor shall provide and maintain temporary connections to prevent a nuisance. All such temporary connections, pumping, and diversion shall be included in the price bid for this work.

B. Where called for shop connections and stubs for future sewer connections shall be provided.

C. New sewer connections to existing manholes shall be neatly made by cutting a hole in the existing structure, concreting the sewer in place, and providing a watertight connection.

D. The Contractor shall not connect any existing sewers or house/building services prior to the completion of the exfiltration/infiltration tests, air tests, and acceptance of the sewer without the written permission of the Engineer.

3.09 Vertical Deflection Testing

A. For PVC pipe, the entire length of installed mainline pipe shall be tested for acceptance with an approved go-no-go mandrel under the observation of the Wastewater Superintendent or their representative. The testing shall be conducted after the final backfill has been in place for at least 30 days. No pipe shall exceed a deflection of 5%. The deflection test shall be run using a mandrel having a diameter equal to 95% of the inside diameter of the pipe in accordance with ASTM D-3034 Appendixes. The pipe shall be measured in compliance with ASTM D-2122. All pipe exceeding the allowable deflection shall be replaced, repaired, and retested.

3.10 Infiltration Limits

A. Maximum infiltration/exfiltration limits for all new sanitary sewers shall not exceed 200 gallons per inch of diameter per mile of pipe per 24 hours. This standard is for the overall project and includes all manholes and house service connections. All sections of the sewer shall be tested, and any sections not meeting this infiltration standard shall be repaired and retested.

B. The Contractor shall note the special provision under Article 3.04, paragraph 0., that the first section of sewer of each size and type of sewer shall be given a satisfactory leakage test before proceeding with any additional construction.

3.11 Sewer Watertightness Testing

A. Tests for watertightness shall be conducted on all installed sewers in the presence of and in the manner accepted by the design Engineer. The Contractor shall furnish all equipment necessary and conduct the sewer tests.

B. Watertightness tests shall be conducted on short sections of the sewer as soon as the manholes have been constructed and the backfilling completed.

C. Where the section tested is in excess of the allowable limits, the Contractor shall correct the construction of the sewer so that the section tested is within the allowable limit. All methods and materials used in the repair shall be approved by the design Engineer.

D. The program of testing shall fit the conditions as determined by the design Engineer using Air Test for Leakage. When ductile iron pipe with push-on type joints are used for sewer construction, a hydrostatic pressure test shall be performed.

1. The Air Test for Leakage.
 - a. The air test for leakage shall be used to test sewer watertightness on all sewer pipe unless otherwise noted.
 - b. The ends of the sewer section being tested shall be sealed and properly blocked. The seal at one end shall have an orifice through which to pass air into the pipe. An air supply shall be connected to the orifice at one end of the section. The air supply line will contain an off-on gas valve and a pressure gauge having a range from 0 to 25 psi. The gauge shall have minimum divisions of 0.10 psi and shall have an accuracy of the nearest ± 0.1 psi. The seals at each manhole shall be properly blocked to prevent displacement while the line is under pressure.
2. Procedure for Conducting a Low Pressure Air Test
 - a. Clean pipe to be tested by propelling a snug fitting inflated ball through the pipe by water pressure or other adequate method. This step is important because it not only flushes out construction debris, but the water used to flush the ball through the pipe

dampens the pipe wall. The rate of air loss through pipe wall permeation can be significant on dry pipes.

- b. Plug all pipe outlets with pneumatic plugs having a sealing length equal to or greater than the diameter of the pipe to be tested. The pneumatic plug shall be able to resist internal testing pressures without requiring external bracing.
- c. The groundwater level surrounding the section of sewer under testing shall be determined by one of the procedures previously outlined in paragraph D(1). If the groundwater table is above the pipe, then test pressures shall be increased by the corresponding increment (e.g., if the groundwater table is above the lowest crown of the pipe, the air pressure should be increased 0.43 times each foot of water).
- d. Once the pipe outlet plugs are securely in place, pressurized air is introduced to the system. The air shall be fed through a single control panel with three individual hose connections as follows:
 - (1) from control panel to pneumatic plugs for inflation in sewer pipe;
 - (2) from control panel to sealed line for introducing the pressurized air;
 - (3) from sealed line to control panel. This line will enable continuous monitoring of the air pressure rise in the sealed line.
- e. The air shall be introduced slowly to the section of pipe under evaluation until the internal air pressure is raised to 4.0 psig greater than the hydrostatic pressure head created by the existence of groundwater that is over the pipe section.
- f. A minimum of two minutes shall be provided for the air pressure to stabilize to conditions within the pipe. (This stabilization period is necessary for variation in temperature to adjust to the interior pipe conditions.) Air may be added slowly to maintain a pressure to 3.5 to 4.0 psig for at least two minutes.
- g. After the stabilization period, when the pressure reaches exactly 3.5 psig, the stopwatch shall be started; and when the pressure reaches 2.5 psig, it is stopped. The portion of the line being tested shall be acceptable if the time in minutes for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than the time shown in the following table:

Pipe Diameter (Inches)	Time (Minutes)
4	2.0
6	3.0
8	4.0
10	5.0
12	5.5
15	7.5
18	8.5
21	10.0
24	11.5

- h. In areas where the groundwater is above the top of the pipe, the test pressures shall be increased by 0.433 per foot of groundwater (e.g., if the groundwater is 11 ½ feet, the 3.5 to 2.5 pressure drip will be increased by 5 psi; the time then will be measured for a pressure drop from 8.5 psi to 7.5 psi.)
3. Safety Precautions During Air Test
- a. The air test may be dangerous if, because of ignorance or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Inasmuch as a force of 250 pounds is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.
- b. As a safety precaution, pressurizing equipment should include a regulator set at perhaps 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

3.12 Hydrostatic Testing

- A. A hydrostatic test on ductile iron pipe with push-on type joints has two purposes: one is to set the gaskets in place, and the other is to provide a leakage test.
- B. Said test shall include all ductile iron sewer pipe with push-on type joints installed by the Contractor in this Contract. The Contractor shall make arrangement with the Engineer for scheduling the test after the sewer pipe has been accepted as being ready for testing. The test shall be performed in the presence of the Engineer on the day mutually agreed upon.
- C. Water for testing shall be obtained by the Contractor. The Contractor shall furnish all necessary equipment, piping pumps, fittings, gauges, and operating personnel to properly conduct the test.

D. Hydrostatic test on ductile iron pipe with push-on type joints installed as gravity sewers and siphons shall be in accordance with the following provisions:

1. The ends of the sewer section being tested shall have test plugs or caps adapted with a tap of adequate diameter to fill and pressurize the system with water.
2. When a section is terminated at a manhole with a plain end (spigot), the pipe must extend into the manhole of sufficient length to accommodate a restraining cap. The benchwall shall be formed in the manhole after the test section has been approved.
3. Water shall be introduced into the section to be tested at the lower end. The upper end shall have an orifice at the top of the plug or cap to expel air when filling the system with water. All air shall be expelled from the pipe.
4. The test plugs or caps shall be capable of withstanding an internal pressure of 175 psi.
5. The system shall be tested in conformance with Section 13 of AWWA Specifications 600, at 50 pounds per square inch over a period of not less than one hour. The system will not be acceptable until all leaks have been repaired.
6. Hydrostatic test may be dangerous if, because of ignorance or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed in such a way as to prevent blowouts. Inasmuch as a force of 2500 pounds is exerted on an 8-inch plug by an internal pipe pressure of 50 psi, it should be realized that sudden expulsion of a poorly installed plug or cap can be dangerous. As a safety precaution, no one shall be allowed in the manholes when the pipe is pressurized.

E. A hydrostatic test on ductile iron pipe with push-on type joints installed as force main shall be in accordance with Article 3.12, paragraph D., with the following exception:

1. The force main shall be subjected to an internal pressure equal to 50% more than the maximum operating pressure, but in no case less than 50 psig or greater than 120 psig.

3.13 Manhole Vacuum Testing

A. A vacuum test shall be conducted by the Contactor on all manholes to ensure watertightness and manhole integrity.

B. The equipment required to conduct a vacuum test on manholes includes inflatable pipe plugs, test head, vacuum pump, flexible air hose, and a vacuum gage. The test equipment shall be capable of drawing a vacuum of 10-inch Hg. The equipment shall be designed specifically for the purpose of testing manholes and shall be as manufactured by P.A. Glazier, Inc., Worchester, Massachusetts 10002, or equal.

C. The procedure for conducting an air test on manholes shall be in accordance with the following procedure:

1. Each manhole shall be tested immediately after assembly and prior to setting the casting or backfilling around the structure.
2. All lift holes shall be plugged with non-shrink grout.
3. All pipes entering the manhole shall be securely plugged and adequately braces against the inside of the manhole to prevent being drawn out of the pipe.
4. The test head shall be placed on the inside of the cone section and sealed with an inflatable seal.
5. A vacuum of 10 inches of mercury (Hg) shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than the following:

<u>Manhole Size</u>	<u>Minimum Test Time</u>
48"	60 seconds
60"	75 seconds
72"	90 seconds
84"	105 seconds

3.14 Closed Circuit Television Inspection

A. All sections of sewers requiring an IDEM construction permit shall be inspected by closed circuit televisions and shall be repaired as directed by the design Engineer and/or the Wastewater Superintendent prior to acceptance.

B. The Contractor shall furnish a qualified television technician, a trained supervisor, and sufficient personnel to perform all the work required in the inspection operation.

C. The Contractor shall furnish spare cameras and related equipment to prevent delays due to equipment breakdowns. Cameras shall be equipped with remote-control focusing devices, remote-control devices to adjust the light intensity, and enough cable shall be furnished to inspect 1,000 linear feet of sewer in a continuous operation. One camera shall be small enough to pass through a 6-inch opening.

D. The Contractor shall clean the sewer, where required, one section at a time. After the sewer is cleaned, the television camera shall be attached to end of a rod or line so that it can be pulled through the pipe line. The camera shall trail a line of steel cable which will be attached to a winch of sufficient size to be able to pull back or retrieve the camera whenever necessary.

E. The camera shall transmit a continuous image to the television monitor. This image shall be clear and sharp enough to enable those viewing the monitor to be able to easily see the interior condition of the pipe line being inspected.

F. For each television inspection unit being used, the Contractor shall provide a mobile air conditioned viewing room large enough to accommodate at least three people for the purpose of viewing the monitor while the inspection is in progress. Minimum size

of the monitors shall be 17 inches, measured diagonally across the viewing screen. Electrical power to operate the equipment shall be provided by the Contractor.

G. The Contractor shall furnish all equipment required for making a continuous video tape of the view which appears on the monitor.

H. The design Engineer and the Wastewater Superintendent or their representative shall be present at all times during television inspection of the sewers and will indicated to the Contractor whatever data may be required to be logged and prepared for record purposes. The Contractor shall prepare and furnish to the receiving wastewater utility one (1) copy of the complete record, video tape, and report of all inspection work done.

3.15 Record Drawings

A. The Contractor shall prepare or be responsible for the preparation and submittal of record drawings to the design Engineer and receiving wastewater utility superintendent.

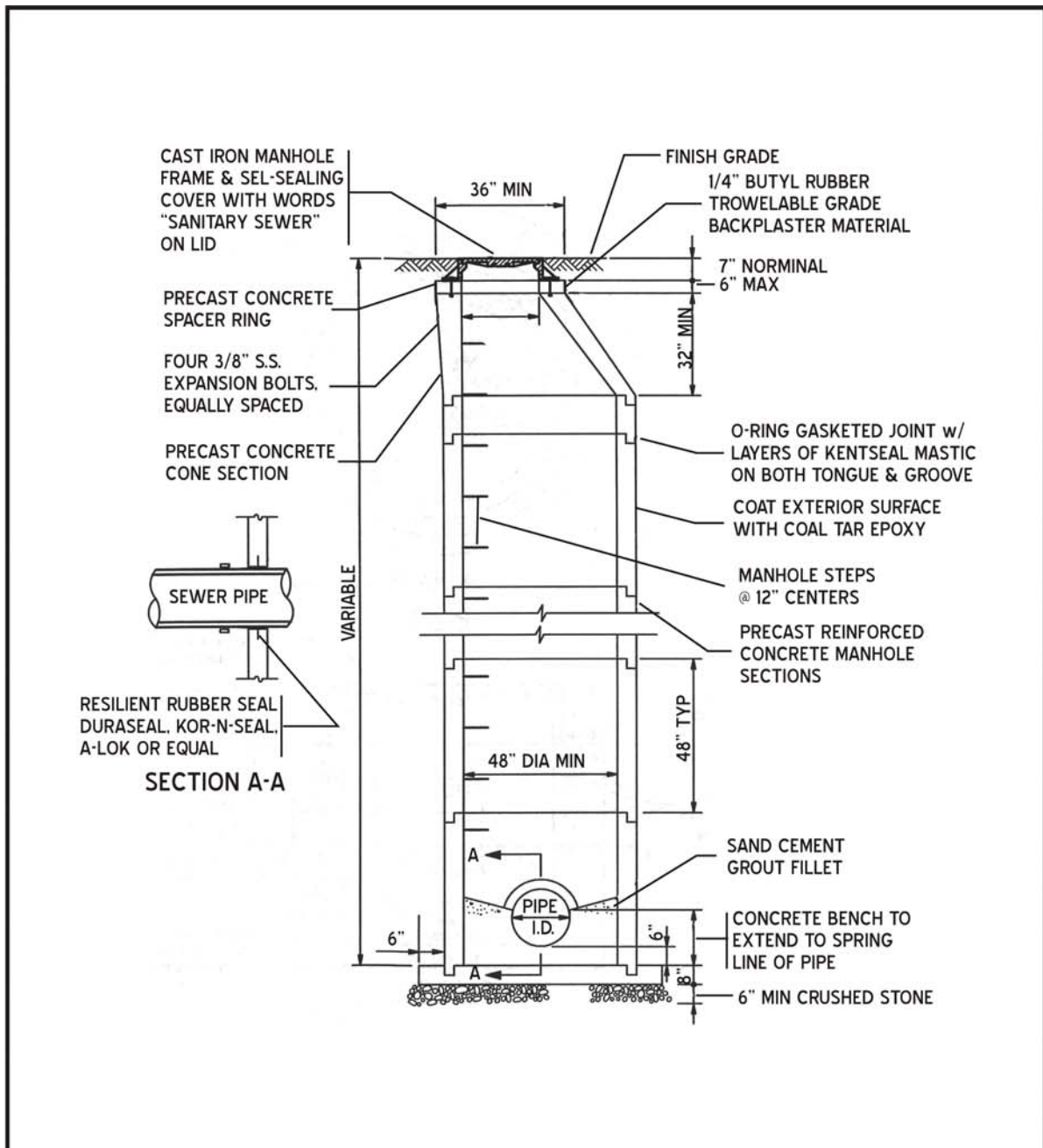
B. Record drawings shall be certified by a Registered Professional Engineer.

PART 4 - FIGURES

4.1 STANDARD DETAILS

<u>Figure</u>	<u>Description</u>
S-1	Standard Sanitary Manhole Detail
S-2	Standard Sanitary Manhole Spacer Ring Detail
S-3	Standard Sanitary Manhole Frame and Cover Details
S-4	Force Main Discharge Detail
S-5	Sewer Pipe Bedding Details
S-6	Concrete Encasement Detail
S-7	Drop Pipe Details
S-8	Alternate Drop Pipe Details
S-9	Jacking and Boring Detail
S-10	House/Building Service Detail-1
S-11	House/Building Service Connection Detail-2
S-12	House/Building Service Bedding Detail
S-13	House/Building Service Clean-out Detail
S-14	Grease Trap Detail

END OF SECTION 02730



Decatur County DWG #SS-1



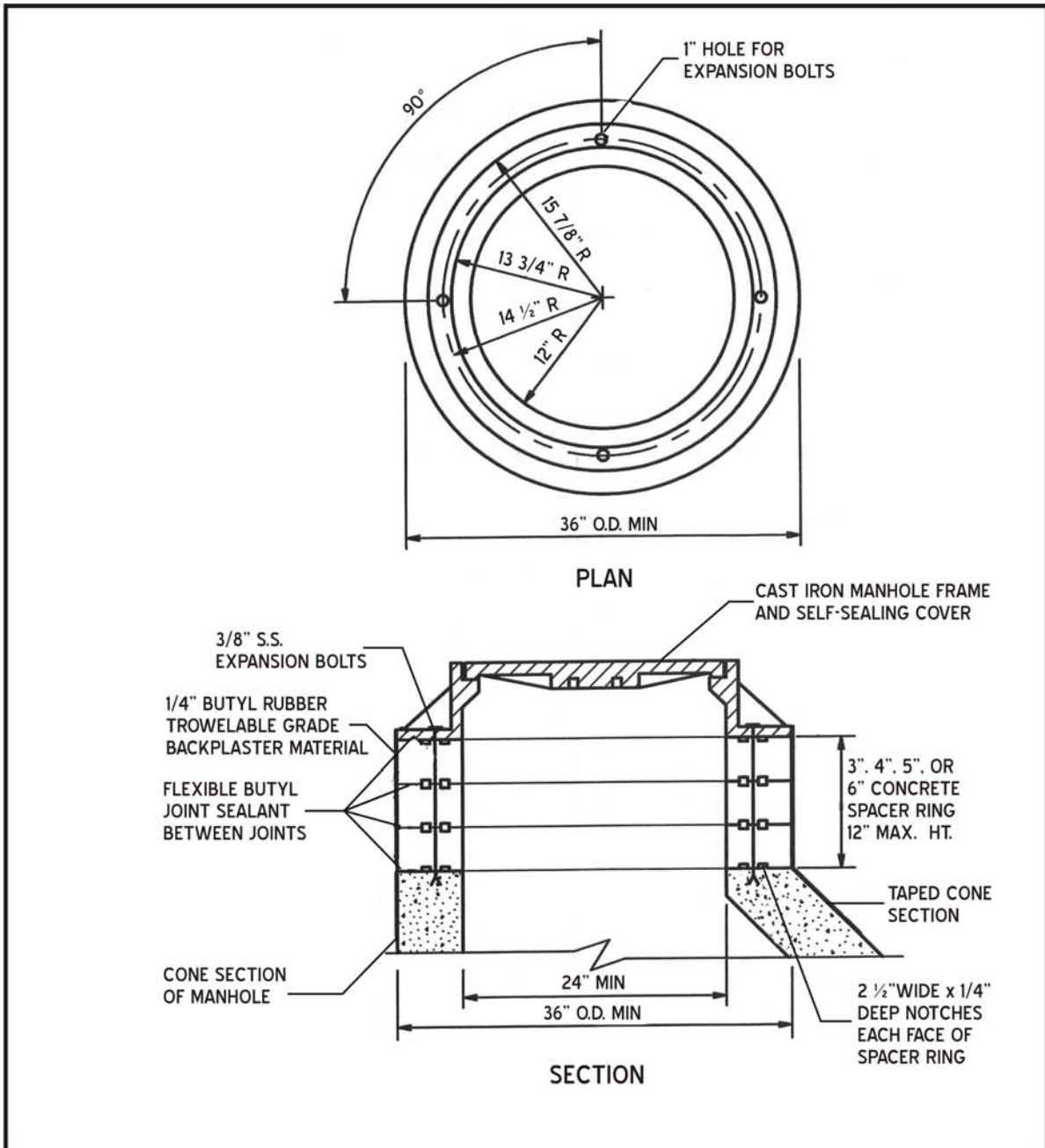
**SANITARY SEWER
STANDARD SANITARY MANHOLE
DETAIL**



Decatur County, Indiana

Construction Standards

DCAP Adopted - 01/07



Decatur County DWG #SS-2



BARTH & ASSOCIATES

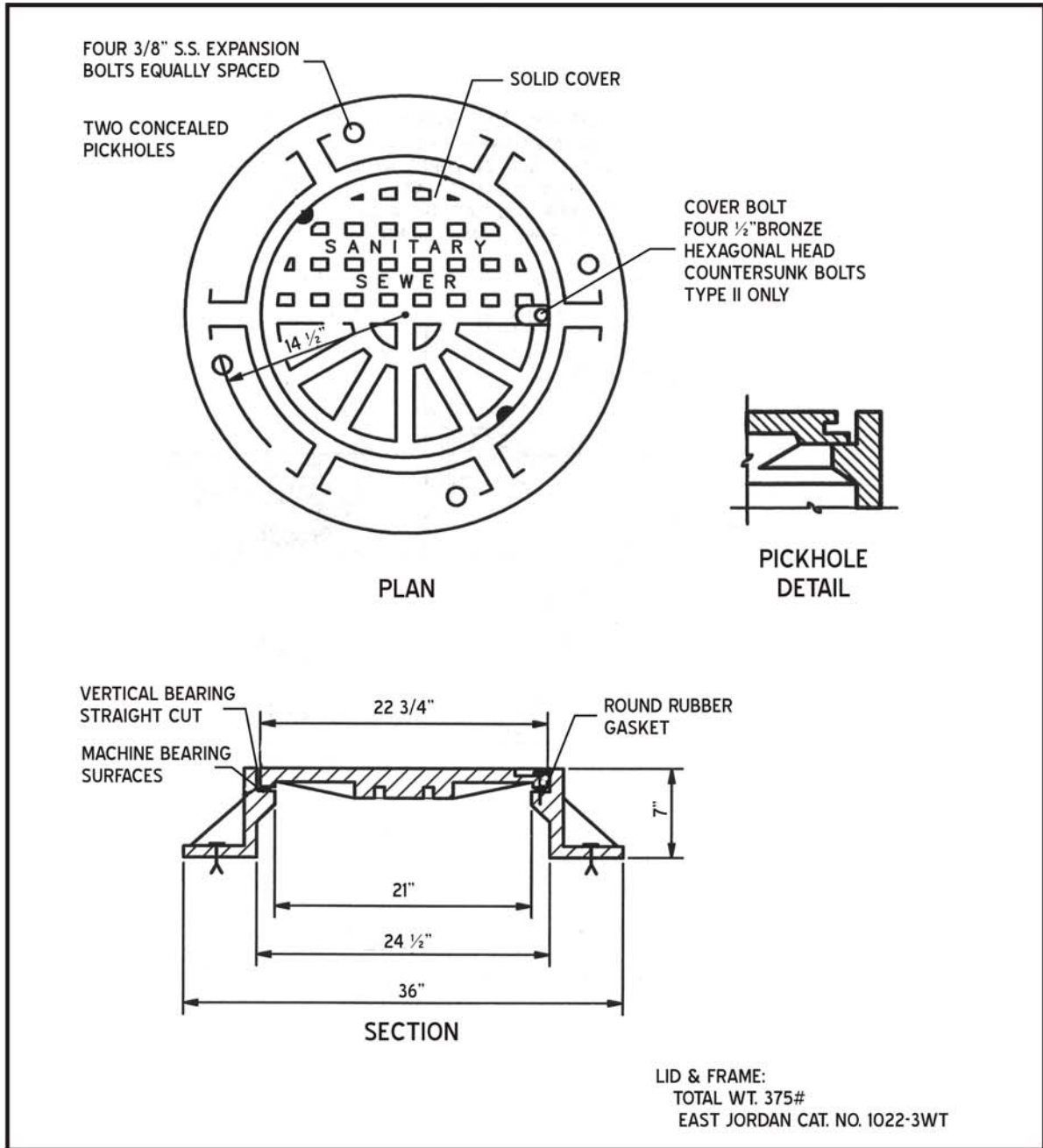
SANITARY SEWER STANDARD SANITARY MANHOLE SPACER RING DETAIL



Decatur County, Indiana

Construction Standards

DCAP Adopted - 01/07



Decatur County DWG #SS-3



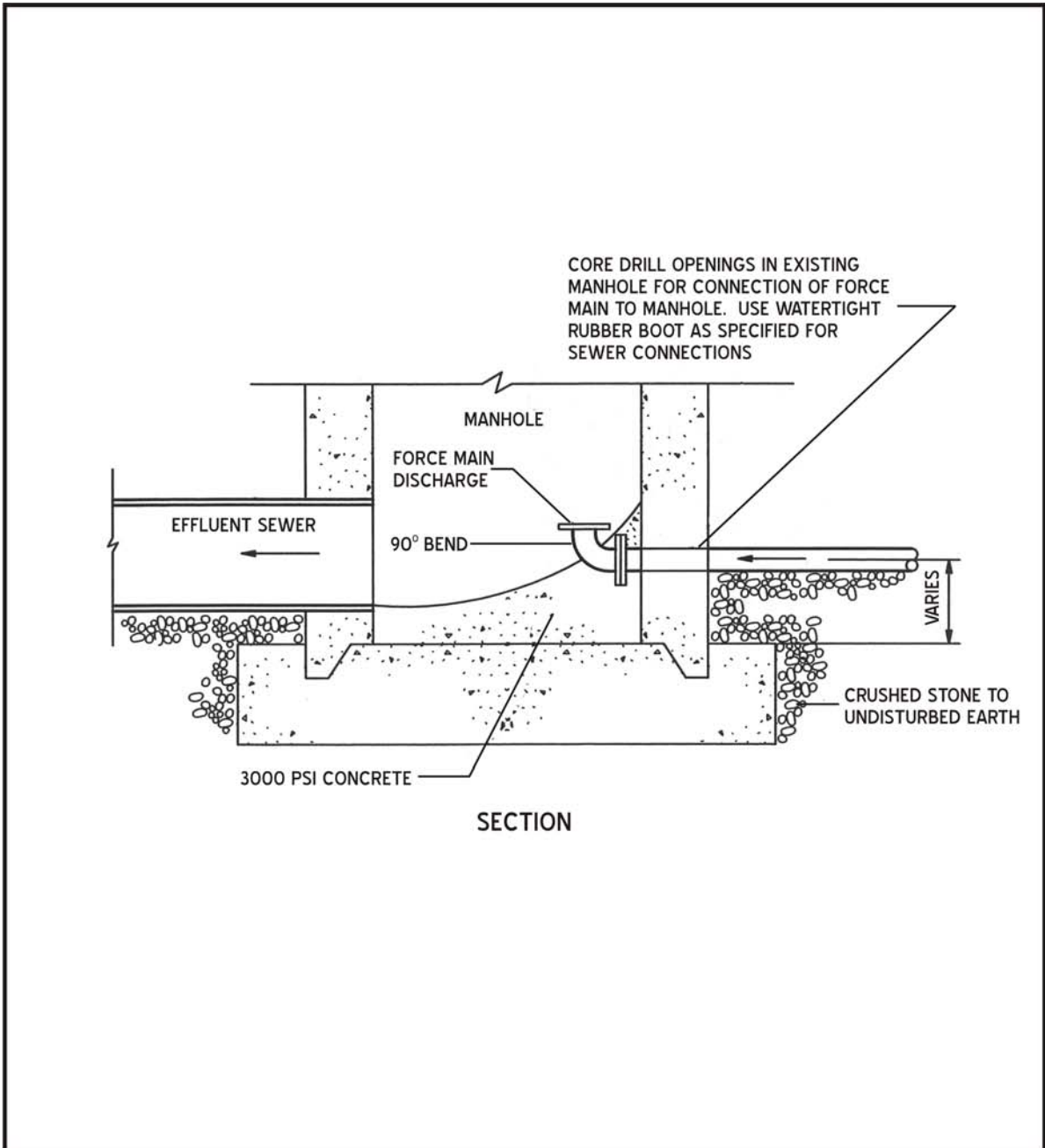
**SANITARY SEWER
STANDARD SANITARY MANHOLE
FRAME DETAIL**



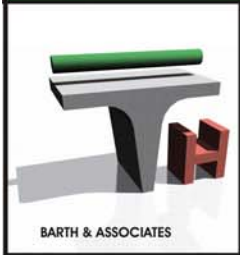
Decatur County, Indiana

Construction Standards

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Decatur County DWG #SS-4



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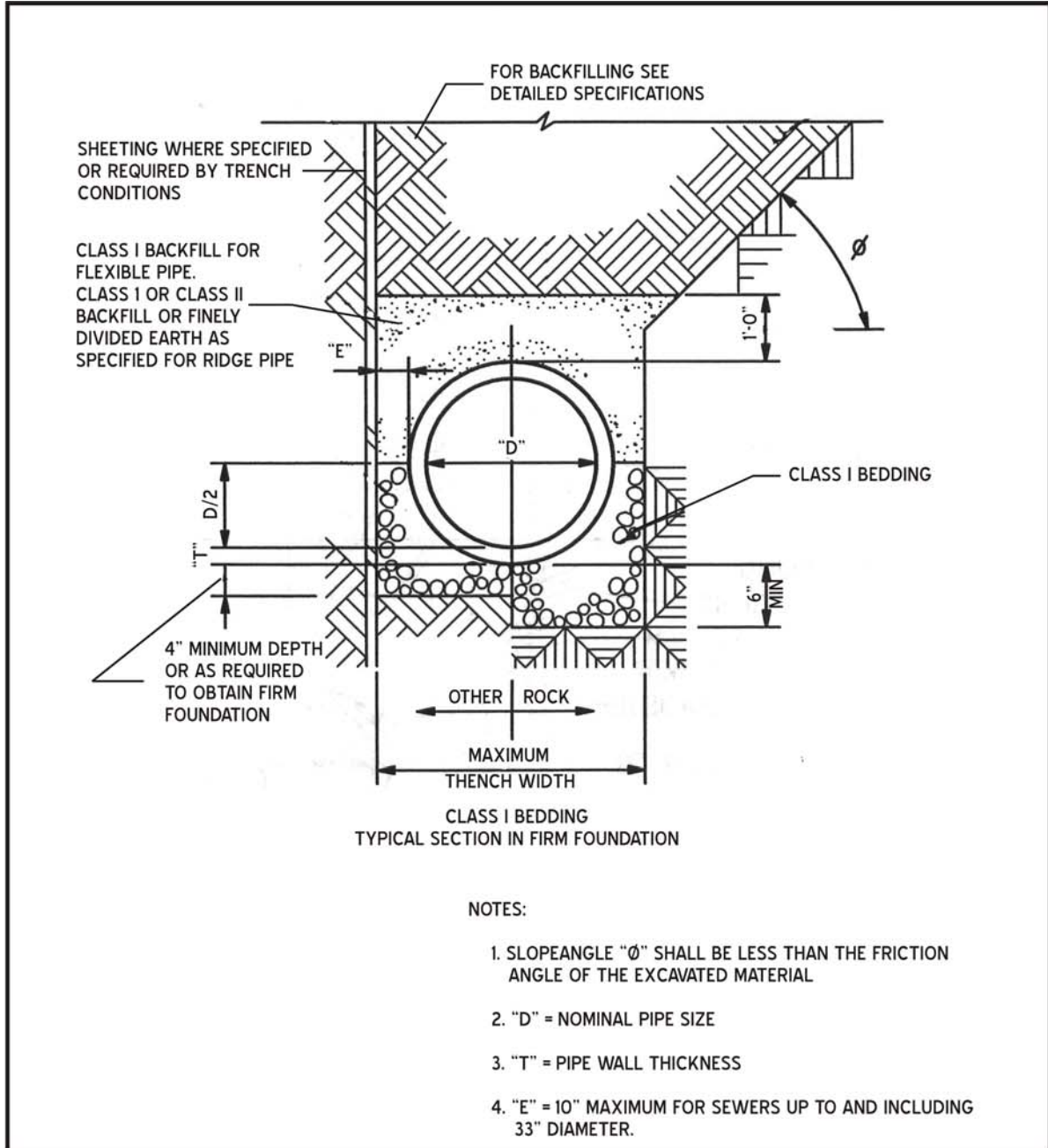
**SANITARY SEWER
FORCE MAIN
DISCHARGE DETAIL**





Decatur County, Indiana

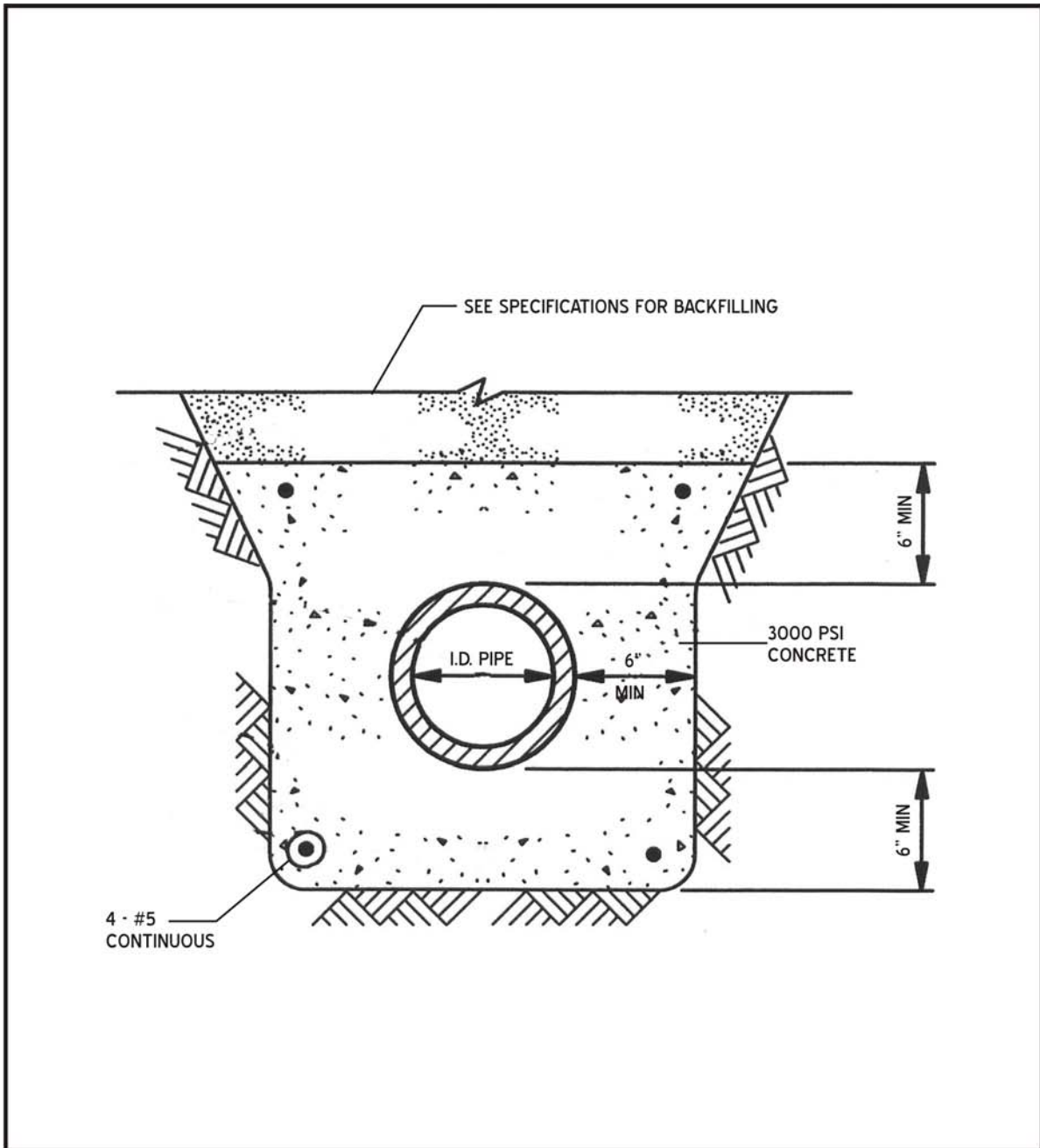
Construction Standards

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Decatur County DWG #SS-5

 <p style="font-size: small;">BARTH & ASSOCIATES</p>	<h2 style="margin: 0;">SANITARY SEWER SEWER PIPE BEDDING DETAIL</h2>	
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Decatur County DWG #SS-6



BARTH & ASSOCIATES

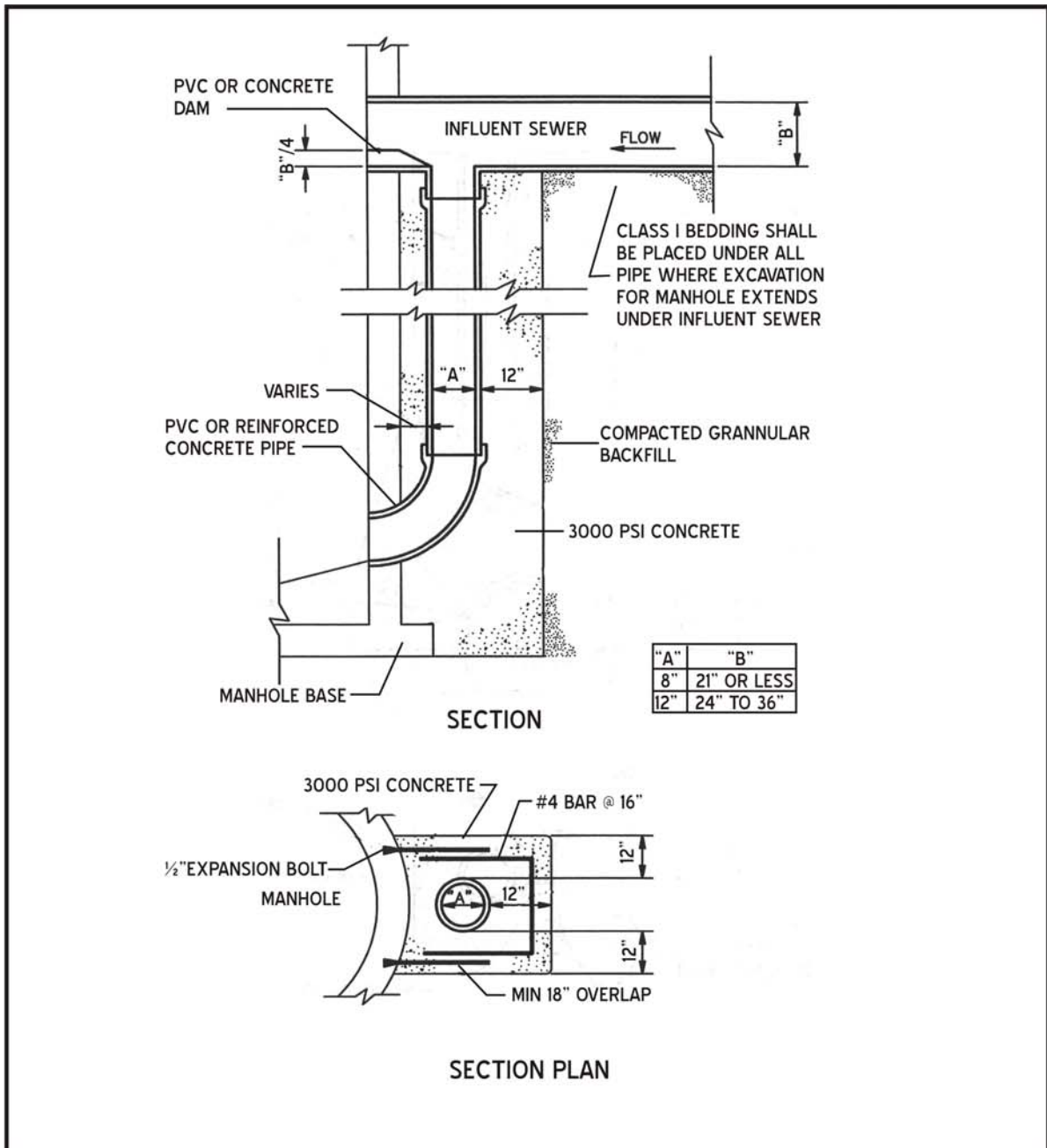
**SANITARY SEWER
CONCRETE ENCASEMENT
DETAIL**



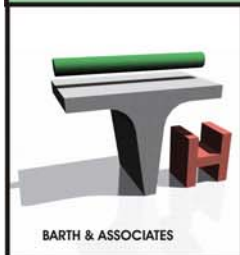
Decatur County, Indiana

Construction Standards

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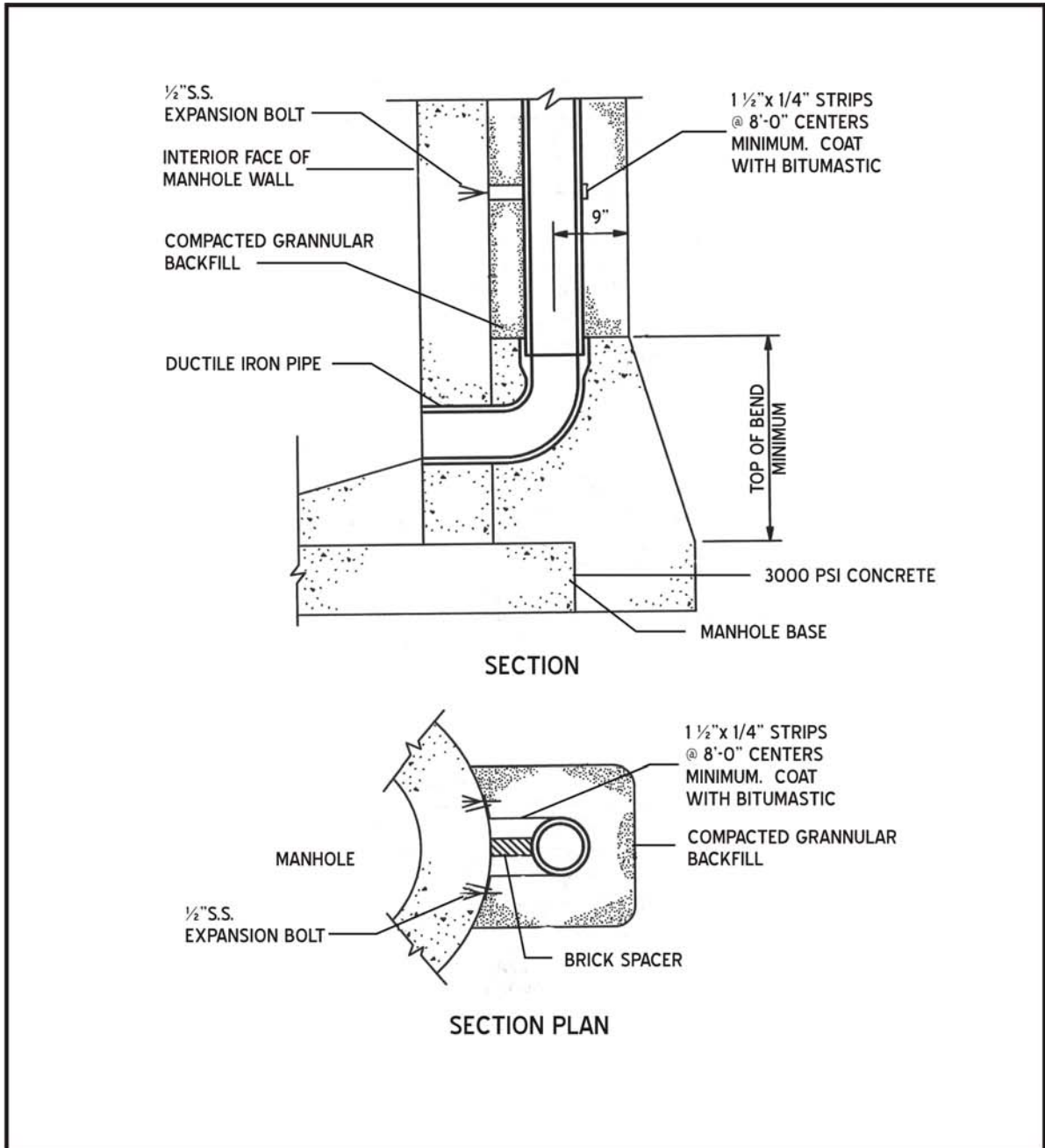


Decatur County DWG #SS-7

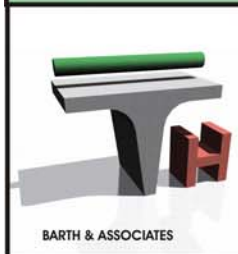


**SANITARY SEWER
DROP MANHOLE
DETAIL**





Decatur County DWG #SS-8



BARTH & ASSOCIATES

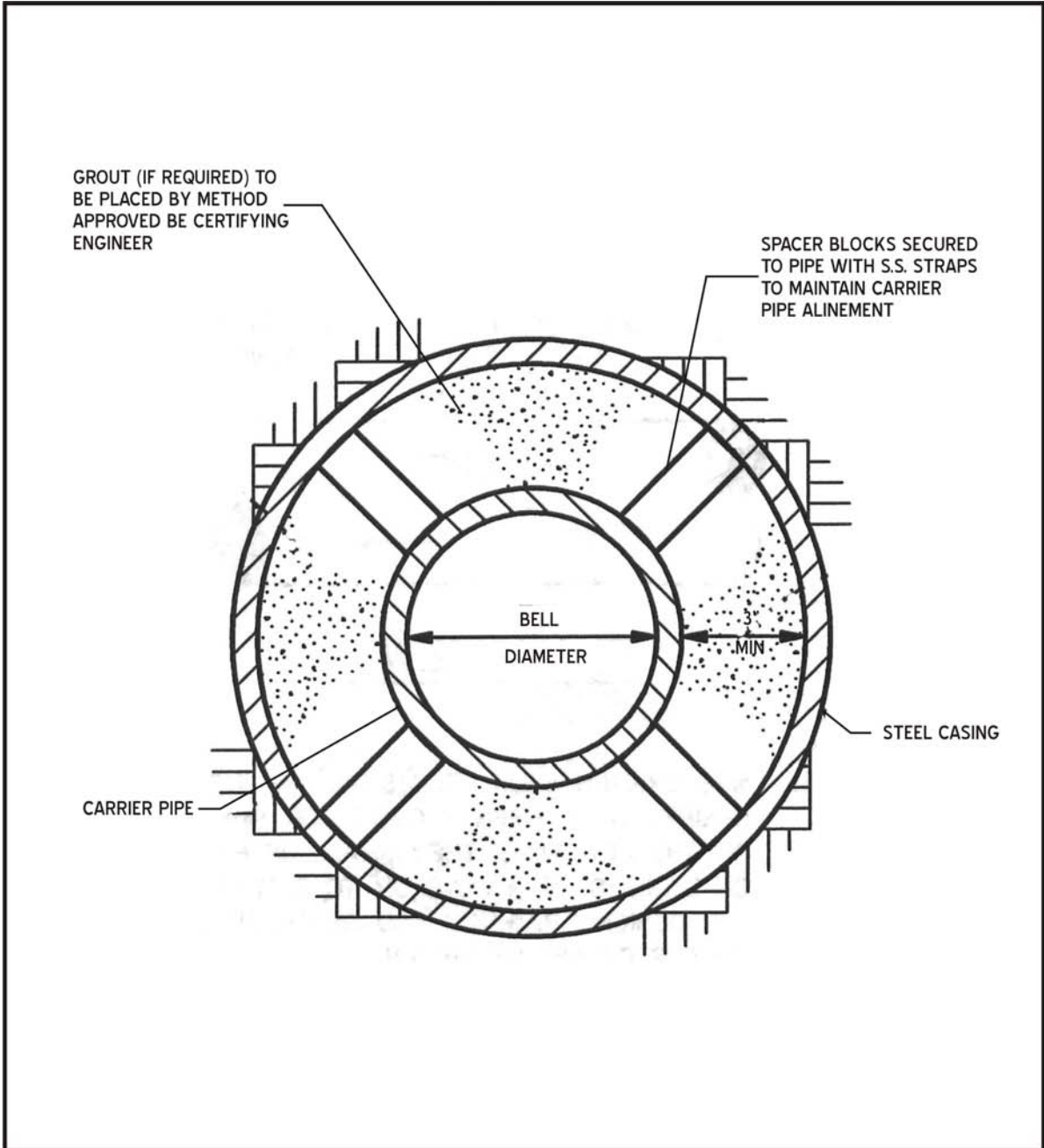
SANITARY SEWER ALTERNATE DROP MANHOLE DETAIL



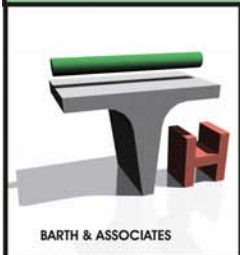
Decatur County, Indiana

Construction Standards

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Decatur County DWG #SS-9



BARTH & ASSOCIATES

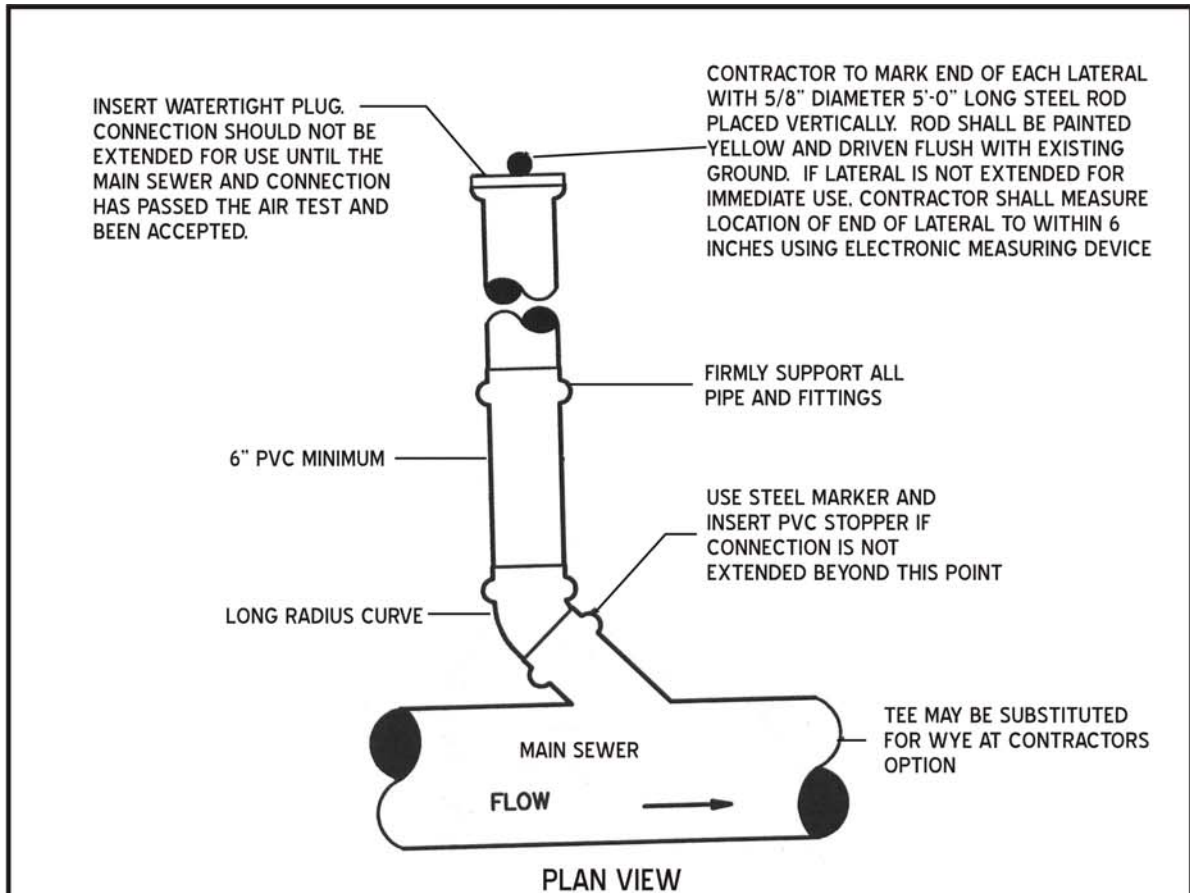
**SANITARY SEWER
JACKING & BORING
DETAIL**



Decatur County, Indiana

Construction Standards

DCAP Adopted - 01/07



NOTES:

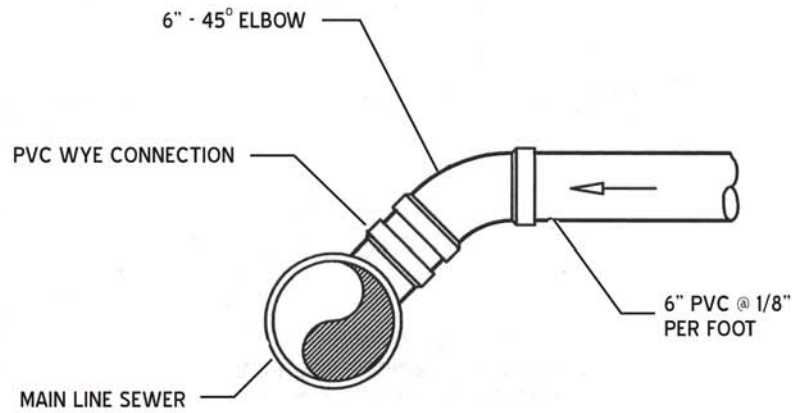
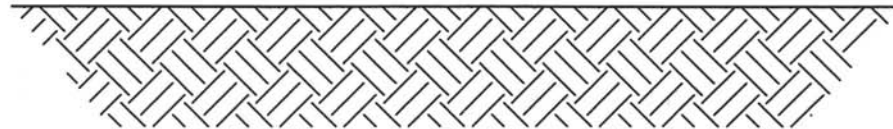
1. WYE BRANCHES OR TEES SHALL BE INSTALLED WHERE DESIRED BY PROPERTY OWNER OR WHERE INDICATED ON THE DRAWINGS. THEY SHALL BE EXTENDED TO RIGHT OF WAY LINE OF STREET OR ALLEY OR TO DISTANCES AS SHOWN ON THE DESIGN DRAWINGS AND SHALL BE PVC SDR 35 PIPE OF SIZE INDICATED ON DRAWINGS, BUT NO SMALLER THAN 6".
2. DEPTH AT RIGHT OF WAY LINE SHALL BE APPROXIMATELY 8'-0" UNLESS SEWER DEPTH IS LESS, IN WHICH EVENT A MINIMUM SLOPE OF 1/8" PER 1'-0" SHALL BE USED.
3. CONNECTION SERVICE PIPE SHALL BE PVC SDR 35 CONFORMING TO ASTM D3034 WITH GASKETED JOINTS CONFORMING TO ASTM D3212 UNLESS OTHERWISE INDICATED.
4. CONNECTION SERVICE PIPE SHALL BE INSTALLED PER SAME SPECIFICATIONS AND DETAIL AS FOR MAIN LINE SEWER.

Decatur County DWG #SS-10



**SANITARY SEWER
SERVICE CONNECTION
DETAIL 1**





SECTION

Decatur County

DWG #SS-11



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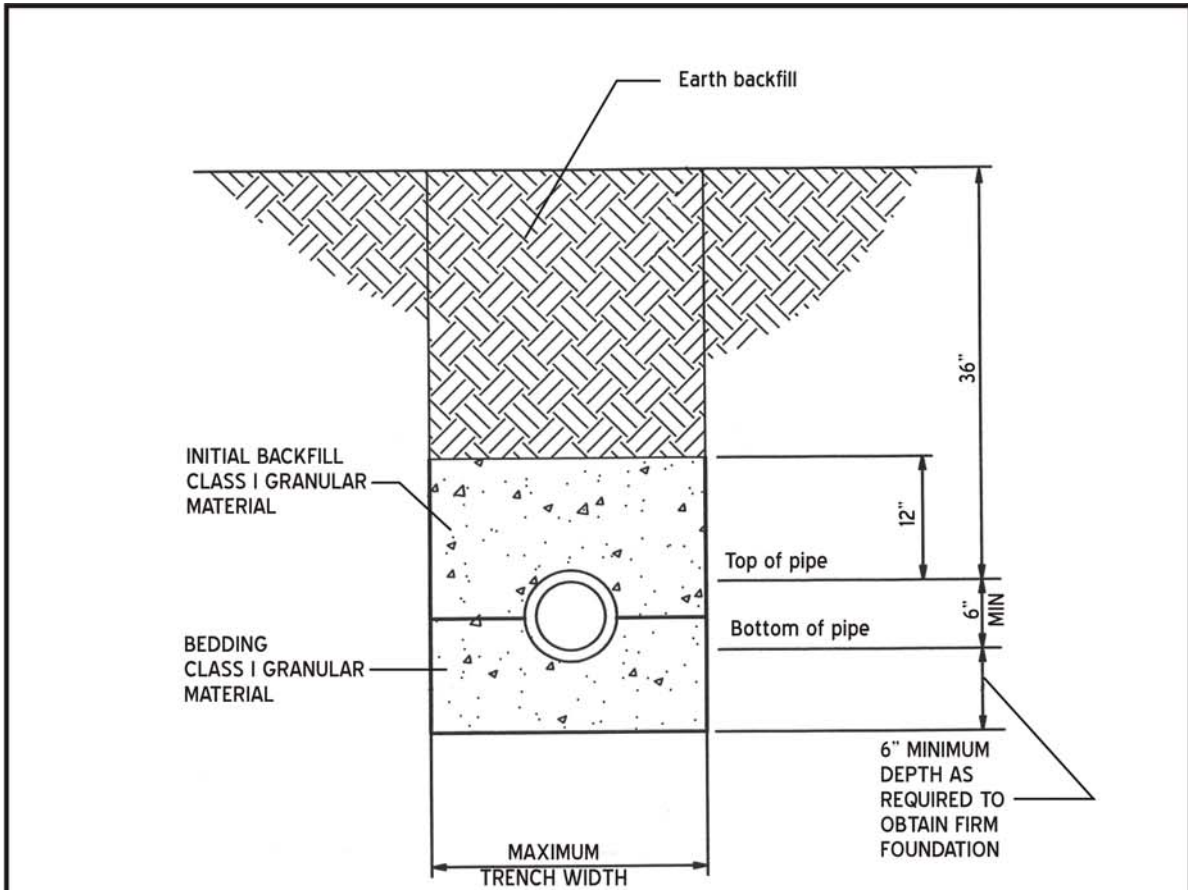
SANITARY SEWER SERVICE CONNECTION DETAIL 2



Decatur County, Indiana

Construction Standards

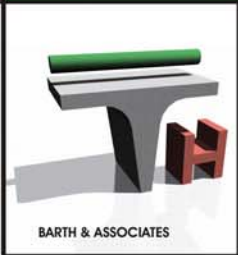
DCAP Adopted - 01/07



NOTES:

- 1. NOMINAL PIPE SIZE (6" MIN)
- 2. INSTALLATION OF FLEXIBLE PVC PIPE SHALL BE IN ACCORDANCE WITH SOECIFICATIONS CONTAINED IN ASTM D-2321.
- 3. CLASS I GRANULAR MATERIAL SHALL BE 1/4" TO 1 1/2" GRADED STONE, PER ASTM D-2321 (#8 CRUSHED STONE).
- 4. SEE SS-5 FOR MAIN LINE SEWERS PIPE BEDDING DETAILS.

Decatur County DWG #SS-12



BARTH & ASSOCIATES

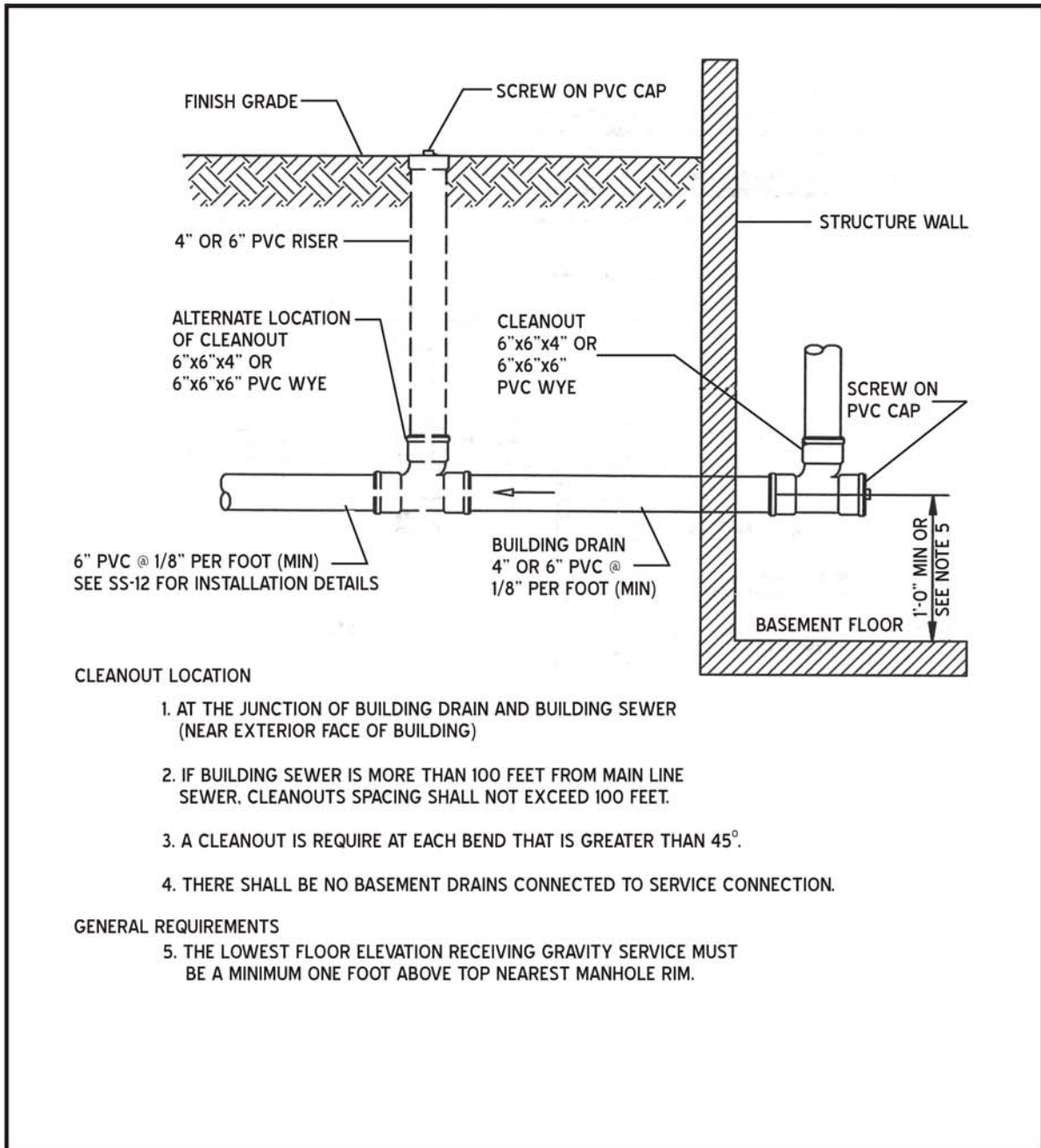
**SANITARY SEWER
SERVICE CONNECTION
BEDDING DETAIL**



Decatur County, Indiana

Construction Standards

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Decatur County DWG #SS-13



**SANITARY SEWER
SERVICE CLEANOUT
DETAIL**

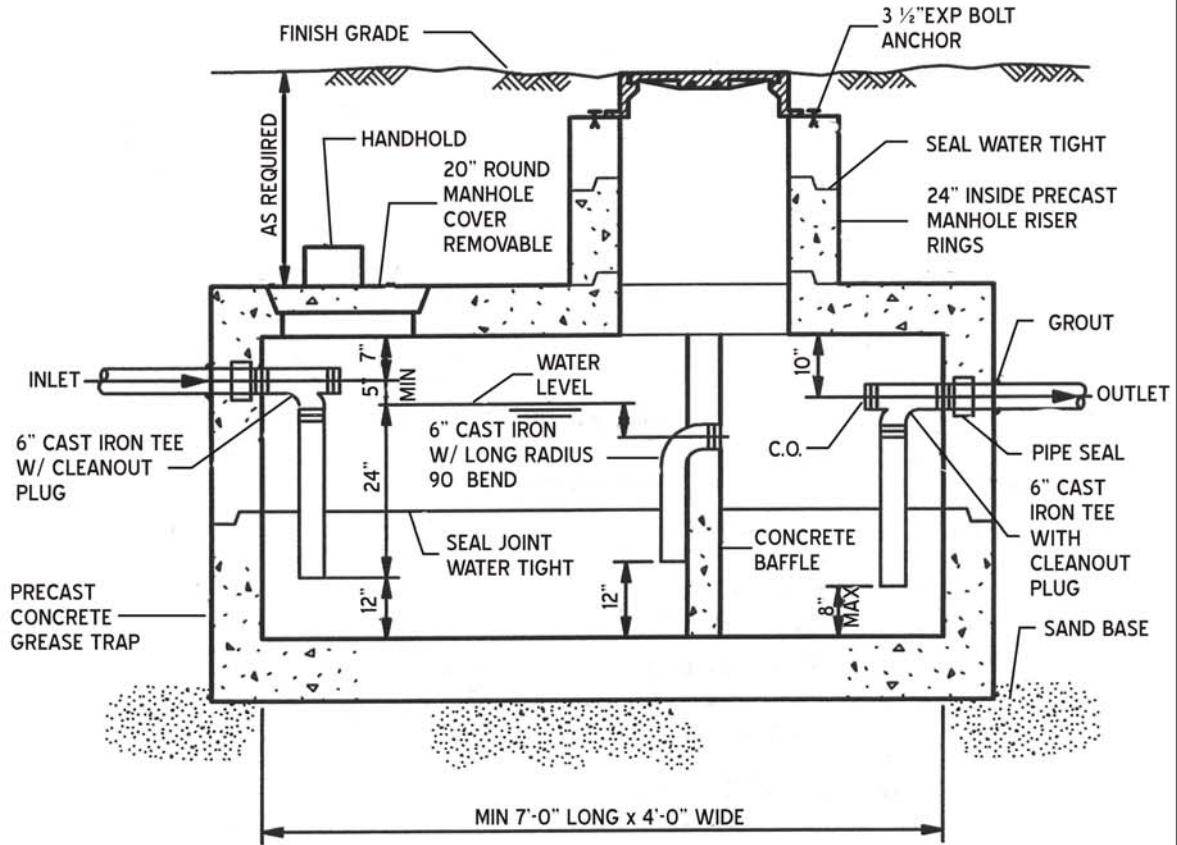


GENERAL NOTES:

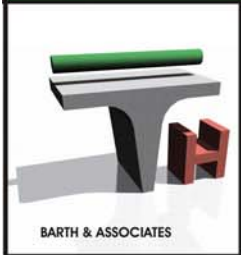
1. ALL TANK JOINTS SHALL BE SEALED WATERTIGHT WITH BUTYL RUBBER EXTRUDIBLE PREFORMED GASKET MATERIAL, HAMILTON KENT-SEAL OR EQUAL.
2. ALL OUTSIDE RISER RINGS SURFACES SHALL BE WATERPROOFED 1/8" WITH TROWLEABLE GRADE BUTYL RUBBER BACK PLASTER
3. PIPE SEALS SHALL BE TUF-TILE, POLYLOK OR EQUAL

NOTE:

ALL DIMENSIONS SHOWN SHALL BE VERIFIED WITH LOCAL AUTHORITY HAVING JURISDICTION



Decatur County DWG #SS-14



**SANITARY SEWER
GREASE TRAP
DETAIL**



Decatur County, Indiana

Construction Standards

DCAP Adopted - 01/07