

TOWN OF PITTSBORO STANDARD SPECIFICATIONS

SECTION 4

SEWER SYSTEM CONSTRUCTION

01. **MATERIALS:** All materials shall conform to applicable industry standards including American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), Ductile Iron Pipe Research Association (DIPRA), American Association of State Highway and Transportation Officials (AASHTO), and American National Standards Institute (ANSI).
- A. Ductile Iron Pipe (Gravity): Ductile iron pipe shall be in accordance with AWWA C150 and C151; cement-mortar lining and seal coat in accordance with AWWA C104. Joints shall be in accordance with AWWA C111 and include rubber compression gasket. All ductile iron pipe shall be marked "Ductile" and bear the name of the manufacturer. Minimum Class 50 pipe shall be specified and greater pipe thickness may be required based on depth of bury and laying conditions. Gravity sewer pipe larger than 12-inch diameter shall be ductile iron.
1. Pipe Joints:
- i. Slip-Type: AWWA C111 rubber gaskets and lubricant.
 - ii. Restrained Joints: Joint restraint mechanisms shall be AWWA C111 and consistent with the pipe manufacturer's recommendation. Joint restraint mechanisms for aerial applications shall be Mech-Lok by Griffin Pipe Co. or an approved equal.
 - iii. Flanged Pipe: Flanged pipe shall be used only in above-ground and aerial applications. All flanged pipe shall be of ductile iron with ductile iron flanges per AWWA C115/ANSI A21.15. Flanges shall be standard ANSI B16.1, Class 125.
- B. Polyvinyl Chloride (PVC) Pipe (Gravity): PVC pipe shall be in accordance with ASTM D-3034, Type PSM, SDR 35. Joints shall be slip-type with rubber gaskets in accordance with ASTM F-477. Glued fittings shall not be allowed in sewer piping except for piping for service connections. Gravity sewer pipe larger than 12-inch diameter shall be ductile iron.
- C. Services: PVC sewer pipe for services shall be Schedule 40 PVC, including the clean-out stack. Saddles and adapters shall be per ASTM D-3034. Glued fittings are allowed on service piping only.
- D. Manholes: Manholes shall be precast reinforced concrete manufactured in accordance with ASTM C478. Minimum inside diameter shall be 4 feet; walls

shall be minimum 5 inches thick with minimum 6-inch base thickness. Concrete used for manhole manufacturing shall develop minimum 4,000 psi compressive strength after 28 days. Manholes shall be provided with preformed butyl rubber joint mastic per ASTM C990 for sealing between manhole sections. The exterior of each manhole joint shall be completely wrapped with 6-inch butyl resin tape before backfilling.

Manholes shall be made with precast inverts of equal width to the effluent pipe. Manholes shall be supplied with resilient rubber boots for connecting sewer piping to the manhole. The boot and clamp shall conform to ASTM C923 and shall be provided with the manhole.

Eccentric cones shall be used on all manholes with the following exception; slab tops may be used upon adequate justification by the Engineer.

Manholes shall be supplied without interior steps.

Standard manhole frames and covers shall be minimum Class 30 gray iron castings to the standards of ASTM A48. All traffic bearing castings shall be minimum Class 35. Covers shall be cast with the words "SANITARY SEWER" in the center. Frames and covers shall be machined smooth at contact points and smooth-fitting between rim and cover. Frames and covers shall be thoroughly cleaned of slag and coated by hot application of quick drying asphaltic material.

The following minimum diameter manholes shall be specified dependent upon the size of sewer main and depth of installation. The more stringent parameter will dictate; i.e., the larger diameter manhole will be used:

<u>MH Diameter</u>	<u>Main Size</u>	<u>Depth of Installation</u>
4'-0"	8" – 12"	0' – 12'
5'-0"	15" – 30"	12' – 20'
6'-0"	36" – 54"	greater than 20'

Where buoyancy may be a factor, manholes shall be precast with a sufficient extended base to fully counter any buoyancy.

Where drop structures are required, drop structures shall be constructed of ductile iron pipe and fittings meeting these specifications.

Sealed manholes shall be vented at least two feet over the 100-year flood elevation. Vent pipes shall be 4-inch factory manufactured, epoxy coated or hot-dipped galvanized pipes. Field fabricated vents shall not be allowed.

Sealed manholes shall have the interior surface field coated with an approved epoxy liner system. Epoxy system shall be 100% solids, solvent-free two-

component epoxy resin with select fillers to minimize permeability and provide sag resistance per the following minimum requirements:

Hardness, Shore D	ASTM D-2240	88
Tensile Strength	ASTM D-638	>7000 psi
Flexural Strength	ASTM D-790	>10000 psi

Epoxy liner shall be Raven 405, manufactured by Raven Lining Systems or approved equal.

- E. Force Mains and Appurtenances: All piping and valves used for construction of force mains shall meet specifications for Water Main Construction. Force mains shall be designed with adequate combination air and vacuum release valves, placed at the high points throughout the force main route.
- F. Air/Vacuum Release Valves: Combination air/vacuum valves shall provide automatic escape of bulk air during pipe filling, release of entrained air during normal service, and provide automatic vacuum release when the force main drains or is under negative pressure. Combination valves shall be rated for maximum 300 psi operation. Combination valves shall be sized in accordance with the specific application, taking into consideration the pumping capacity and the force main size. Engineers shall demonstrate proper sizing and placement of combination air and vacuum release valves.

Valve inlets shall be NPT screwed (1" minimum) or ANSI Class 125 flanged. Valve bodies, tops and inlets shall be cast iron. All interior parts and mechanisms of the valve shall be stainless steel. The seat shall be BUNA-N. Air release valves shall be Crispin or an approved equal.

A gate valve of equal size to the inlet of the combination valve shall be installed between the main and the combination valve. The connection to the main shall be made with a tapping saddle threaded NPT for brass pipe. The top of the combination valve shall be fitted with a brass vent pipe of equal size to the combination valve. The vent pipe shall be turned downward at the top to prevent debris from entering valve. All piping and fittings in the combination valve assembly shall be brass.

Combination valve assemblies shall be placed at the high point(s) along the force main route and installed in a manhole. The manhole shall be constructed in a manner to allow drainage away from the manhole frame and cover and prevent flooding of the manhole. The manhole shall be adequately sized to accommodate the valve assembly and permit room for maintenance and repairs.

- G. Steel Encasement Pipe: Steel pipe for encasing pipe beneath roads or railroads shall be high strength spiral welded or seamless grade "B" steel with minimum yield strength of 35,000 psi. The inside diameter of the casing pipe shall be at least 6 inches greater than the largest outside diameter of the carrier pipe at the

bell, allowing for at least 3 inches of annular space around the circumference of the carrier pipe.

Minimum casing pipe thickness shall be as follows, except where NCDOT or railroad specifications supercede, and in such cases, those shall be considered the minimum requirements.

<u>Casing Pipe Diameter</u>	<u>Minimum Wall Thickness (Roadways)</u>	<u>Minimum Wall Thickness (Railways)</u>
10"	0.188	0.188
12"	0.188	0.251
16"	0.250	0.312
18"	0.250	0.313
20"	0.250	0.375
24"	0.250	0.407
30"	0.312	0.469
36"	0.375	--

Carrier pipe within casing shall be ductile iron pipe supported by spiders at both the bell and spigot of each joint of pipe.

- H. Grease Traps: Grease traps shall be required for facilities where food preparation may reasonably be expected. Grease traps shall be of a design to allow full access for maintenance, inspection and effluent sampling, i.e., there shall be a manway entrance accessible from the outside of the facility located over the inlet and outlet of the trap. Grease traps shall be sized for the expected flow but shall be minimum 1000 gallon capacity. Grease traps shall be of precast concrete construction with a baffle wall for trapping floating solids and grease. Both the inlet and outlet piping shall include a PVC sanitary tee.

Site and building plumbing shall be installed such that all fixtures and drains from kitchen and food preparation areas route through the grease trap. Domestic wastewater shall not be routed through the grease trap.

02. **INSTALLATION AND EXECUTION:** The Owner or Contractor shall provide all materials, labor, tools, equipment and incidentals required for excavation, installation and backfilling of water mains and associated appurtenances shown on approved plans.

A. **Plugging Sewers During Construction:** Mechanical plugs shall be used to isolate new construction from existing infrastructure to keep ALL extraneous water from entering the existing collection system. Pneumatic plugs shall not be used.

Plugs shall be installed on the downstream-most section of new piping, immediately upstream from existing collection piping. Plugs shall be securely tied off within the manhole using steel cable. A permanent tag shall be attached to the plug identifying the owner. Plugs shall be checked daily by the Contractor and shall be maintained functioning as intended throughout the project. Accumulated water shall be pumped from the sewer and properly disposed. In no case shall water be discharged into the downstream sewers or stormwater systems.

Upon final acceptance by the Town of Pittsboro, sewer plugs shall be removed by the Contractor. Projects shall not be placed in service without the removal of sewer plugs.

B. **Trench Preparation and Maintenance:** Trenching shall be performed as outlined in General Provisions for Utility Construction and:

1. **For Ductile Iron Sewer Pipe:** Natural soil in trench bottom shall be shaped to fully support pipe. "Bell holes" shall be dug to accommodate pipe bells. Backfilling may be accomplished with excavated soil free of rocks and boulders, so long as the soil is not unsuitable material.

2. **For SDR 35 PVC Sewer Pipe:** The trench bottom shall be prepared with minimum 4-inch thickness of #67 bedding stone and bell holes shall be prepared in the bedding.

C. **Pipe Installation:** All sewers mains and manholes shall be installed to the line and grade shown on approved plans. Pipe shall be laid from the tie-in point with the existing system, proceeding uphill. Pipe bells shall point uphill (in the direction of pipe laying). Piping shall be installed in accordance with manufacturer's intentions and to applicable standards. Pipe shall be installed on even grades and straight alignments, and all joints shall be properly fitted. All pipe, manholes and accessories shall be properly lowered into the trench with suitable equipment so as to prevent damage to materials. Pipe or accessories shall not be dropped or dumped into the trench. Damaged or defective materials shall be permanently marked and removed from the project.

All foreign matter or dirt shall be removed from the interior and machined ends of pipe and accessories before it is lowered into position in the trench.

Pipe jointing shall be accomplished according to manufacturer recommendations. Bell and spigot shall be cleaned and lubricated before jointing. Pipe installation shall progress with bell ends facing the laying direction. Ends of pipes shall be plugged with mechanical joint plugs or caps when pipe laying is not in progress. Trench water shall never be allowed to enter pipe.

Field pipe cutting shall be square and neat, performed by an experienced pipe cutter using appropriate equipment according to manufacturer recommendations. Where required by the pipe manufacturer, pipe shall be properly chamfered when field cut.

1. For Ductile Iron Sewer Pipe: Pipe haunching at least to the springline of the pipe may be with excavated soil free of rocks and boulders, so long as the soil is not unsuitable material. Unsuitable material shall not be used and shall be replaced with suitable material or #67 stone. Soil backfill shall be thoroughly compacted.
 2. For SDR 35 PVC Sewer Pipe: Pipe haunching with #67 stone shall be provided at least to the springline of the pipe. PVC pipe shall then be covered 6 inches above the crown of pipe with #67 stone. Deeper bury sections may require more stringent backfill criteria. The Engineer shall provide considerations for such cases.
- D. Manhole Construction: Manholes shall be installed to line and grade as shown in approved plans. Manholes shall be as described in the "Materials" section of these specifications.
1. Prior to constructing a manhole, a minimum 9-inch compacted #67 stone base shall be installed as a foundation to the manhole.
 2. Manholes shall be constructed plumb. Riser sections shall be joined with manufacturer-supplied preformed butyl rubber mastic per ASTM C990 for sealing between manhole sections. Manhole joints shall be completely sealed on the outside with 6-inch butyl mastic tape. Manhole joints shall be completely and neatly sealed on the inside with non-shrink grout.
 3. Piping shall be joined to the manhole by proper connection with a rubber boot. The transition from pipe to invert within the manhole shall be smooth and watertight and finished with non-shrink grout. All connections to manholes shall be by precast holes. In the event that other connections must be made to a manhole, appropriate sized holes shall be professionally cored in the manhole using a concrete coring machine. The pipe connection shall then be sealed using an approved rubber boot and non-shrink grout.

4. Manhole frames for manholes not in paved streets shall be bolted to the cone section using stainless steel expansion bolts and washers. Frames on slab tops shall either be bolted as above or integrally cast in the concrete. Frame-to-cone connection shall include butyl mastic joint sealant. The interior frame to cone joint shall be finished with non-shrink grout.
 5. Manholes in roadways or rights-of-way shall be installed flush with finished grade. All other manholes shall be installed between 2 and 3 feet above finished grade, notwithstanding the requirements for 100-year flood protection. Manholes taller than three (3) feet above finished grade shall be constructed with steps cast into the exterior of the manhole.
 6. At the discretion of the Town of Pittsboro, inflow collector dishes may be required for manholes installed in low areas.
 7. Grade adjustment rings are allowed only in roadway sections. A maximum of 2 grade adjustment rings are allowed on any manhole. Grade adjustment rings are not allowed on outfall manholes or manholes otherwise located in easements.
 8. Manholes installed in streets or roadways shall be constructed with a concrete ring 6-inch thick and 5-foot minimum o.d. securing the frame. The concrete ring shall lie embedded in the gravel base course and below the pavement.
- E. Service Laterals: Sewer laterals shall be 4-inch minimum. Minimum 1% grade shall be maintained for 4-inch and 6-inch service laterals. Connections to sewer mains shall be made using in-line wye fittings. Lateral connection at the main shall be backfilled using #67 stone. Laterals 6-inch and larger shall connect to the main at manholes. Connections to manholes shall be to the same standards as sewer main connections to manholes.

Laterals shall be constructed with a wye and vertical clean-out placed at the right-of-way line. The clean-out stack and the stub end of the service shall each be equipped with a watertight cap. Service lateral piping and fittings shall be installed and joined per manufacturers recommendations to create a watertight joint. Inspectors shall verify the installation of plugs prior to backfilling laterals. Laterals must be installed prior to pressure testing of sewer mains.

Trenching, bedding and backfill shall be performed using the same standards as those for PVC sewer pipe. Where lateral installation is performed by boring, ductile iron service pipe shall be used and all applicable jurisdictions shall be recognized (NCDOT, railroad, etc.).

Service laterals installed to existing sewer mains shall be made using an approved tap and saddle. The tap shall be cut with a hole coring saw intended for use on utility piping. The hole shall be made in the upper quadrant of the pipe and angled to point downstream. The new service connection shall be backfilled with #67 stone.

Service connections (4-inch) are allowed only on 8, 10 and 12-inch sewer mains. On sewer mains larger than 12-inch, laterals shall be connected only at manholes.

- F. Infiltration-free Installation: Sewer piping shall be installed and pipe joints made such that no perceptible infiltration is observed. If active running water is observed during construction, the source of the infiltration shall be found and appropriate repairs made.
- G. Manhole Vacuum Testing: Prior to being approved for service, all new manholes shall be vacuum tested by the installer. Equipment used for vacuum testing shall be manufactured and intended specifically for manhole vacuum testing and shall be used and operated per manufacturers recommendations.

The vacuum test shall be performed by first plugging all sewer mains coming into the manhole (service laterals will be included in vacuum tests) and then applying a vacuum of 10 inches of mercury. The test shall then consist of observing the time for the vacuum to fall to 9 inches. This time shall be compared to the chart below to determine acceptability. If the time to fall to 9 inches is at least as shown in the chart below, the manhole passes the vacuum test. If not, the manhole fails the vacuum test. If the manhole fails the vacuum test, necessary repairs shall be made using non-shrink grout, maintaining as much vacuum as possible.

<u>Manhole Depth</u>	<u>Manhole Diameter</u>		
	<u>4'0"</u>	<u>5'0"</u>	<u>6'0"</u>
10' or less	60 sec.	75 sec.	90 sec.
10' to 15'	75 sec.	90 sec.	105 sec.
15' or greater	90 sec.	105 sec.	120 sec.

Vacuum tests will not be considered acceptable and will not be approved without a representative of the Town of Pittsboro present. Ample notice shall be provided to the Town prior to vacuum testing. Excessive site visits will not be tolerated. In the event that more than two site visits are required for a manhole (or group of manholes) to pass vacuum testing, the Town of Pittsboro shall bill the Owner for the additional visits at a rate of \$75 per hour.

- H. Flushing Sewer Mains: Prior to testing sewer mains, manholes and sewer mains shall be flushed clean of all dirt and debris. Flush water shall be

removed at a downstream manhole and removed from the system. Flush water shall not be allowed into the receiving sewer system.

- I. Pressure Testing Sewer Mains: All sewer lines shall pass low pressure air testing. Sewer laterals shall be included in air testing. Air test shall be performed on piping between manholes (manholes shall not be included in sections of piping being tested). Proper plugs shall be installed to isolate the test section. The pipe segment shall be pressurized with air to 4 psi. The test shall not begin until the pressure has stabilized at 4 psi. The test shall then consist of observing the time for the pressure to fall one psi. This time shall be compared to the chart below to determine acceptability. If the time for the pressure to fall one psi is at least as shown in the chart below, the pipe segment passes the pressure test. If not, the pipe segment fails the pressure test. If the pipe segment fails the test, necessary repairs shall be made and the segment shall then be retested until it passes the air test.

Pipe Diameter (inches)	Test Time (min./100')	Pipe Diameter (inches)	Test Time (min./100')
4	0.3	21	3.0
6	0.7	24	3.6
8	1.2	27	4.2
10	1.5	30	4.8
12	1.8	33	5.4
15	2.1	36	6.0
18	2.4	42	7.3

Pressure tests will not be considered acceptable and will not be approved without a representative of the Town of Pittsboro present. Ample notice shall be provided to the Town prior to pressure testing. Excessive site visits will not be tolerated. In the event that more than two site visits are required for a segment of pipe to pass pressure testing, the Town of Pittsboro shall bill the Owner for the additional visits at a rate of \$75 per hour.

- J. Deflection Testing for Sewer Mains: No sooner than 30 days after backfilling, deflection testing shall be performed on PVC sewer mains by pulling an appropriate-sized mandrel through the sewer lines. Minimum 9-pronged mandrels shall be used. Mandrel diameter shall be minimum 95% of the base inside diameter. Pipe segments that do not allow passage of the mandrel shall be corrected and subjected to retesting.

Lamp tests shall be performed on all sewer mains from manhole to manhole. Lines shall exhibit a reasonably circular pattern. Confined space equipment

shall be supplied by the Contractor along with adequate number of workmen, lamps and mirrors.

- J. CCTV Inspection: Prior to final acceptance by the Town of Pittsboro, all sewer mains shall be visually inspected using pan-and-tilt closed circuit television equipment. All services and defects shall be documented in the inspection. Immediately prior to CCTV inspection, each sewer main shall be flushed or otherwise charged with water so that sag areas will be evidenced by standing water. All CCTV inspections shall be continuously logged at a rate no more than 30 feet per minute and recorded on a digital format. A copy of the video inspection shall be provided to the Town of Pittsboro on DVD discs.

TOWN OF PITTSBORO

STANDARD SPECIFICATIONS

SECTION 4

SEWER SYSTEM CONSTRUCTION

01. **MATERIALS:** All materials shall conform to applicable industry standards including American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), Ductile Iron Pipe Research Association (DIPRA), American Association of State Highway and Transportation Officials (AASHTO), and American National Standards Institute (ANSI).
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1. **Pipe Joints:**
- i. **Slip-Type:** AWWA C111 rubber gaskets and lubricant.
 - ii. **Restrained Joints:** Joint restraint mechanisms shall be AWWA C111 and consistent with the pipe manufacturer's recommendation. Joint restraint mechanisms for aerial applications shall be Mech-Lok by Griffin Pipe Co. or an approved equal.
 - iii. **Flanged Pipe:** Flanged pipe shall be used only in above-ground and aerial applications. All flanged pipe shall be of ductile iron with ductile iron flanges per AWWA C115/ANSI A21.15. Flanges shall be standard ANSI B16.1, Class 125.
- B. **Polyvinyl Chloride (PVC) Pipe (Gravity):** PVC pipe shall be in accordance with ASTM D-3034, Type PSM, SDR 35. Joints shall be slip-type with rubber gaskets in accordance with ASTM F-477. Glued fittings shall not be allowed in sewer piping except for piping for service connections. Gravity sewer pipe larger than 12-inch diameter shall be ductile iron.
- C. **Services:** PVC sewer pipe for services shall be Schedule 40 PVC, including the clean-out stack. Saddles and adapters shall be per ASTM D-3034. Glued fittings are allowed on service piping only.
- D. **Manholes:** Manholes shall be precast reinforced concrete manufactured in accordance with ASTM C478. Minimum inside diameter shall be 4 feet; walls shall be minimum 5 inches thick with minimum 6-inch base thickness. Concrete

used for manhole manufacturing shall develop minimum 4,000 psi compressive strength after 28 days. Manholes shall be provided with preformed butyl rubber joint mastic per ASTM C990 for sealing between manhole sections. The exterior of each manhole joint shall be completely wrapped with 6-inch butyl resin tape before backfilling.

Manholes shall be made with precast inverts of equal width to the effluent pipe. Manholes shall be supplied with resilient rubber boots for connecting sewer piping to the manhole. The boot and clamp shall conform to ASTM C923 and shall be provided with the manhole.

Eccentric cones shall be used on all manholes with the following exception; slab tops may be used upon adequate justification by the Engineer.

Manholes shall be supplied without interior steps.

Standard manhole frames and covers shall be minimum Class 30 gray iron castings to the standards of ASTM A48. All manhole covers shall be manufactured in the United States. All traffic bearing castings shall be minimum Class 35. Covers shall be cast with the words "SANITARY SEWER" in the center. Frames and covers shall be machined smooth at contact points and smooth-fitting between rim and cover. Frames and covers shall be thoroughly cleaned of slag and coated by hot application of quick drying asphaltic material.

The following minimum diameter manholes shall be specified dependent upon the size of sewer main and depth of installation. The more stringent parameter will dictate; i.e., the larger diameter manhole will be used:

<u>MH Diameter</u>	<u>Main Size</u>	<u>Depth of Installation</u>
4'-0"	8" – 12"	0' – 12'
5'-0"	15" – 30"	12' – 20'
6'-0"	36" – 54"	greater than 20'

Where buoyancy may be a factor, manholes shall be precast with a sufficient extended base to fully counter any buoyancy.

Where drop structures are required, drop structures shall be constructed of ductile iron pipe and fittings meeting these specifications.

For FEMA floodplains, all manholes shall be sealed and vented with it's rim elevation at least two feet in elevation above the 100-year flood elevation. Vent pipes shall be 4-inch factory manufactured, epoxy coated or hot-dipped galvanized pipes. Field fabricated vents shall not be allowed.

Sealed manholes shall have the interior surface field coated with an approved epoxy liner system. Epoxy system shall be 100% solids, solvent-free two-

component epoxy resin with select fillers to minimize permeability and provide sag resistance per the following minimum requirements:

Hardness, Shore D	ASTM D-2240	88
Tensile Strength	ASTM D-638	>7000 psi
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Epoxy liner shall be Raven 405, manufactured by Raven Lining Systems or approved equal.

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- F. Air/Vacuum Release Valves: Combination air/vacuum valves shall provide automatic escape of bulk air during pipe filling, release of entrained air during normal service, and provide automatic vacuum release when the force main drains or is under negative pressure. Combination valves shall be rated for maximum 300 psi operation. Combination valves shall be sized in accordance with the specific application, taking into consideration the pumping capacity and the force main size. Engineers shall demonstrate proper sizing and placement of combination air and vacuum release valves.

Valve inlets shall be NPT screwed (1" minimum) or ANSI Class 125 flanged. Valve bodies, tops and inlets shall be cast iron. All interior parts and mechanisms of the valve shall be stainless steel. The seat shall be BUNA-N. Air release valves shall be Crispin or an approved equal.

A gate valve of equal size to the inlet of the combination valve shall be installed between the main and the combination valve. The connection to the main shall be made with a tapping saddle threaded NPT for brass pipe. The top of the combination valve shall be fitted with a brass vent pipe of equal size to the combination valve. The vent pipe shall be turned downward at the top to prevent debris from entering valve. All piping and fittings in the combination valve assembly shall be brass.

Combination valve assemblies shall be placed at the high point(s) along the force main route and installed in a manhole. The manhole shall be constructed in a manner to allow drainage away from the manhole frame and cover and prevent flooding of the manhole. The manhole shall be adequately sized to accommodate the valve assembly and permit room for maintenance and repairs.

- G. Steel Encasement Pipe: Steel pipe for encasing pipe beneath roads or railroads shall be high strength spiral welded or seamless grade "B" steel with minimum yield strength of 35,000 psi. The inside diameter of the casing pipe shall be at

least 6 inches greater than the largest outside diameter of the carrier pipe at the bell, allowing for at least 3 inches of annular space around the circumference of the carrier pipe.

Minimum casing pipe thickness shall be as follows, except where NCDOT or railroad specifications supercede, and in such cases, those shall be considered the minimum requirements.

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Carrier pipe within casing shall be ductile iron pipe supported by spiders at both the bell and spigot of each joint of pipe.

- H. Grease Traps: Grease traps shall be required for facilities where food preparation may reasonably be expected. Grease traps shall be of a design to allow full access for maintenance, inspection and effluent sampling, i.e., there shall be a manway entrance accessible from the outside of the facility located over the inlet and outlet of the trap. Grease traps shall be sized for the expected flow but shall be minimum 1000 gallon capacity. Grease traps shall be of precast concrete construction with a baffle wall for trapping floating solids and grease. Both the inlet and outlet piping shall include a PVC sanitary tee.

Site and building plumbing shall be installed such that all fixtures and drains from kitchen and food preparation areas route through the grease trap. Domestic wastewater shall not be routed through the grease trap.

- I. Tracer Wire: Tracer wire shall be installed on all sewer mains, services, and up the side of manholes (taped to the pipe crown, and side of manholes). Tracer wire shall be installed as outlined in the standard detail. Tracer wire shall be minimum 18 gauge copper wire, green plastic coated. During installation, electrical continuity shall be maintained between valves. If a wire is cut or otherwise requires splicing, the ends of the wire shall be bared, twisted together and connected with an electrical "twist cap".

J. Locator Tape: Locator tape shall be installed above all water mains. Locator tape, green in color, shall bear the words: "Warning – Sanitary Sewer Main Below". Locator tape shall be installed as outlined in the standard detail.

02. **INSTALLATION AND EXECUTION**: The Owner or Contractor shall provide all materials, labor, tools, equipment and incidentals required for excavation, installation and backfilling of water mains and associated appurtenances shown on approved plans.

A. Plugging Sewers During Construction: Mechanical plugs shall be used to isolate new construction from existing infrastructure to keep ALL extraneous water from entering the existing collection system. Pneumatic plugs shall not be used.

Plugs shall be installed on the downstream-most section of new piping, immediately upstream from existing collection piping. Plugs shall be securely tied off within the manhole using steel cable. A permanent tag shall be attached to the plug identifying the owner. Plugs shall be checked daily by the Contractor and shall be maintained functioning as intended throughout the project. Accumulated water shall be pumped from the sewer and properly disposed. In no case shall water be discharged into the downstream sewers or stormwater systems.

Upon final acceptance by the Town of Pittsboro, sewer plugs shall be removed by the Contractor. Projects shall not be placed in service without the removal of sewer plugs.

B. Trench Preparation and Maintenance: Trenching shall be performed as outlined in General Provisions for Utility Construction and:

1. For Ductile Iron Sewer Pipe: Natural soil in trench bottom shall be shaped to fully support pipe. "Bell holes" shall be dug to accommodate pipe bells. Backfilling may be accomplished with excavated soil free of rocks and boulders, so long as the soil is not unsuitable material.

2. For SDR 35 PVC Sewer Pipe: The trench bottom shall be prepared with minimum 4-inch thickness of #67 bedding stone and bell holes shall be prepared in the bedding.

C. Pipe Installation: All sewers mains and manholes shall be installed to the line and grade shown on approved plans. Pipe shall be laid from the tie-in point with the existing system, proceeding uphill. Pipe bells shall point uphill (in the direction of pipe laying). Piping shall be installed in accordance with manufacturer's intentions and to applicable standards. Pipe shall be installed on even grades and straight alignments, and all joints shall be properly fitted. All pipe, manholes and accessories shall be properly lowered into the trench with suitable equipment so as to prevent damage to materials. Pipe or accessories

shall not be dropped or dumped into the trench. Damaged or defective materials shall be permanently marked and removed from the project.

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Pipe jointing shall be accomplished according to manufacturer recommendations. Bell and spigot shall be cleaned and lubricated before jointing. Pipe installation shall progress with bell ends facing the laying direction. Ends of pipes shall be plugged with mechanical joint plugs or caps when pipe laying is not in progress. Trench water shall never be allowed to enter pipe.

Field pipe cutting shall be square and neat, performed by an experienced pipe cutter using appropriate equipment according to manufacturer recommendations. Where required by the pipe manufacturer, pipe shall be properly chamfered when field cut.

1. For Ductile Iron Sewer Pipe: Pipe haunching at least to the spring line of the pipe may be with excavated soil free of rocks and boulders, so long as the soil is not unsuitable material. Unsuitable material shall not be used and shall be replaced with suitable material or #67 stone. Soil backfill shall be thoroughly compacted.
 - a. Polyethylene Wrap shall be used on all buried ductile iron pipe, fittings, gate valves and other appurtenances that are subject to corrosion either in the soil, or surrounding condition. Shall either be wrapped with a green polyethylene membrane conforming to ANSI A21.5, or installed in accordance with AWWA C105. The polyethylene sheets shall be 10 mils thick, minimum and be stamped with "CAUTION SANITARY SEWER BURIED".

The Town of Pittsboro shall determine on a case by case basis if the pipe needs to be wrapped in polyethylene wrap. Soil corrosion is a geologic hazard that affects buried metals and concrete that is in direct contact with soil or bedrock. Soil corrosion is a complex phenomenon, with a multitude of variables involved. Pitting corrosion and stress-corrosion cracking (SCC) are a result of soil corrosion, which leads to underground oil and gas transmission pipeline failures. Such facilities that typically utilize impressed current cathodic protection are gas pipelines, such as owned by Colonial Pipeline, Cardinal Pipeline and Dixie Pipeline. Other potential sources that may create stray currents that contribute to accelerated pipeline corrosion are high voltage power transmission lines and railroad crossings.

The corrosivity of soils can be estimated by measuring soil resistivity. Sandy soils are high on the resistivity scale and therefore considered the least corrosive. Clay soils, especially those contaminated with saline water are on the opposite end of the spectrum. Factors that influence soil corrosion are:

- Porosity (aeration)
- Electrical conductivity or resistivity
- Dissolved salts, including depolarizers or inhibitors
- Moisture
- pH

Each of these variables may affect the anodic and cathodic polarization characteristics of a metal in soil. The most corrosive soils have high content of:

- Moisture
- Electrical conductivity
- Acidity
- Dissolved salts

External corrosion can occur at an accelerated rate in metallic pipelines such as steel and ductile iron when they are installed in aggressive soils or when they are installed near other structures or utilities that carry impressed currents.

In cases where metallic steel and ductile iron pipelines or encasement pipes are planned for installation in close proximity to any potential sources of stray current or aggressive soils, a field analysis (at no additional cost to The Town of Pittsboro) consisting of stray current evaluation and soil testing shall be conducted by an experienced technician, as certified by the National Association of Corrosion Engineers, (NACE), to determine the potential for external corrosion. In cases where stray current conditions and/or aggressive soils are prevalent, a corrosion specialist certified by the NACE or other applicable certification board shall be consulted regarding the design of pipeline protection measures.

At a minimum, all stray current protection systems should include bonded joints and sacrificial anodes with a 50-year or longer design life and test facilities in lieu of polyethylene encasement, unless otherwise approved by the Town of Pittsboro. The cathodic protection element of

the pipeline design package shall be sealed by Professional Engineer licensed in the State of NC.

Full impressed current cathodic protection shall only be utilized when extreme corrosion potential has been proven and/or as otherwise directed by the Town of Pittsboro Engineering Department and the certified corrosion engineer of record.

2. For SDR 35 PVC Sewer Pipe: Pipe haunching with screenings, #67 stone, or CLM flow able fill as required by The Town of Pittsboro, or Engineer of record shall be provided at least to the spring line of the pipe. PVC pipe shall then be covered 12 inches above the crown of pipe with screenings, #67 stone, or CLM flow able fill. Deeper bury sections may require more stringent backfill criteria. The Engineer shall provide considerations for such cases.
3. Before bedding, and backfilling, tracer wire shall be taped onto the crown of the pipe. During installation, electrical continuity shall be maintained between valves. If a wire is cut or otherwise requires splicing, the ends of the wire shall be bared, twisted together and connected with an electrical "twist cap".

While backfilling the water main trench, locator tape shall be placed immediately over the water main, approximately twenty (24") inches below ground surface. Locator tape shall bear the words: "Warning – Sanitary Sewer Main Below".

- D. Manhole Construction: Manholes shall be installed to line and grade as shown in approved plans. Manholes shall be as described in the "Materials" section of these specifications.
1. Prior to constructing a manhole, a minimum 9-inch compacted #67 stone base shall be installed as a foundation to the manhole.
 2. Manholes shall be constructed plumb. Riser sections shall be joined with manufacturer-supplied preformed butyl rubber mastic per ASTM C990 for sealing between manhole sections. Manhole joints shall be completely sealed on the outside with 6-inch butyl mastic tape. Manhole joints shall be completely and neatly sealed on the inside with non-shrink grout.
 3. Piping shall be joined to the manhole by proper connection with a rubber boot. The transition from pipe to invert within the manhole shall be smooth and watertight and finished with non-shrink grout. All connections to manholes shall be by precast holes. In the event that other connections must be made to a manhole, appropriate sized holes shall be professionally cored in the manhole using a concrete coring machine. The pipe connection shall then be sealed using an approved rubber boot and non-shrink grout.

4. Manhole frames for manholes not in paved streets shall be bolted to the cone section using stainless steel expansion bolts and washers. Frames on slab tops shall either be bolted as above or integrally cast in the concrete. Frame-to-cone connection shall include butyl mastic joint sealant. The interior frame to cone joint shall be finished with non-shrink grout.
 5. Manholes in roadways or rights-of-way shall be installed flush with finished grade. All other manholes shall be installed between 2 and 3 feet above finished grade, notwithstanding the requirements for 100-year flood protection. Manholes taller than three (3) feet above finished grade shall be constructed with steps cast into the exterior of the manhole.
 6. At the discretion of the Town of Pittsboro, inflow collector dishes may be required for manholes installed in low areas.
 7. Grade adjustment rings are allowed only in roadway sections. A maximum of 2 grade adjustment rings are allowed on any manhole. Grade adjustment rings are not allowed on outfall manholes or manholes otherwise located in easements.
 8. Manholes installed in streets or roadways shall be constructed with a concrete ring 6-inch thick and 5-foot minimum o.d. securing the frame. The concrete ring shall lie embedded in the gravel base course and below the pavement.
- E. Service Laterals: Sewer laterals shall be 4-inch minimum. Minimum 1% grade shall be maintained for 4-inch and 6-inch service laterals. Connections to sewer mains shall be made using in-line wye fittings. Lateral connection at the main shall be backfilled using #67 stone. Laterals 6-inch and larger shall connect to the main at manholes. Connections to manholes shall be to the same standards as sewer main connections to manholes.

In the Town of Pittsboro the sewer laterals are owned and maintained by the property owner.

The Town of Pittsboro will clear blockages that occur in the main sewer line or in the sewer lateral, from the main line to the clean out pipe. Homeowners are responsible for blockages that occur in the sewer lateral, located between the clean out pipe and the structure. If there is no clean out pipe at the edge of the property, the homeowner is responsible for blockages that occur anywhere in the sewer lateral.

All 4" sewer services may be tapped directly into 8, 10, and 12-inch mains or manholes. Taps can only be made by using a mechanical tapping machine or other approved device

Laterals shall be constructed with a wye and vertical clean-out shall be located at the right-of-way line or the easement boundary line, and one (1) on the private property per the North Carolina Plumbing Code. The clean-out stack and the stub end of the service shall each be equipped with a watertight brass cap. Service lateral piping and fittings shall be installed and joined per manufacturer's recommendations to create a watertight joint. Inspectors shall verify the installation of plugs prior to backfilling laterals. Laterals must be installed prior to pressure testing of sewer mains.

Trenching, bedding and backfill shall be performed using the same standards as those for PVC sewer pipe. Where lateral installation is performed by boring, ductile iron service pipe shall be used and all applicable jurisdictions shall be recognized (NCDOT, railroad, etc.).

Service laterals installed to existing sewer mains shall be made using an approved tap and saddle. The tap shall be cut with a hole coring saw intended for use on utility piping. The hole shall be made in the upper quadrant of the pipe and angled to point downstream. The new service connection shall be backfilled with #67 stone.

All 4" sewer services may be tapped directly into 8, 10, and 12-inch mains or manholes. Taps can only be made by using a mechanical tapping machine or other approved device. All sanitary sewer service connections 6 inches and larger shall be made into manholes only. On mains 15 inches and larger, service connections are allowed only at manholes. Service clean-outs shall be located at the right-of-way line or the easement boundary line. The maximum vertical drop for a 6-inch service into a manhole shall be 10 feet. 4-inch sanitary sewer services shall have no maximum vertical drop.

- F. Infiltration-free Installation: Sewer piping shall be installed and pipe joints made such that no perceptible infiltration is observed. If active running water is observed during construction, the source of the infiltration shall be found and appropriate repairs made.
- G. Manhole Vacuum Testing: Prior to being approved for service, all new manholes shall be vacuum tested by the installer. Equipment used for vacuum testing shall be manufactured and intended specifically for manhole vacuum testing and shall be used and operated per manufacturers recommendations.

The vacuum test shall be performed by first plugging all sewer mains coming into the manhole (service laterals will be included in vacuum tests) and then applying a vacuum of 10 inches of mercury. The test shall then consist of observing the time for the vacuum to fall to 9 inches. This time shall be compared to the chart below to determine acceptability. If the time to fall to 9 inches is at least as shown in the chart below, the manhole passes the vacuum test. If not, the manhole fails the vacuum test. If the manhole fails the vacuum

test, necessary repairs shall be made using non-shrink grout, maintaining as much vacuum as possible.

<u>Manhole Depth</u>	<u>Manhole Diameter</u>		
	<u>4'0"</u>	<u>5'0"</u>	<u>6'0"</u>
10' or less	60 sec.	75 sec.	90 sec.
10' to 15'	75 sec.	90 sec.	105 sec.
15' or greater	90 sec.	105 sec.	120 sec.

Vacuum tests will not be considered acceptable and will not be approved without a representative of the Town of Pittsboro present. A minimum 48 hour notice shall be provided to the Town Utility Inspector prior to vacuum testing. Excessive site visits will not be tolerated. In the event that more than two site visits are required for a manhole (or group of manholes) to pass vacuum testing, the Town of Pittsboro shall bill the Owner for the additional visits at a rate of \$105 per hour.

- H. Flushing Sewer Mains: Prior to testing sewer mains, manholes and sewer mains shall be flushed clean of all dirt and debris. Flush water shall be removed at a downstream manhole and removed from the system. Flush water shall not be allowed into the receiving sewer system.
- I. Pressure Testing Sewer Mains: All sewer lines shall pass low pressure air testing. Sewer laterals shall be included in air testing. Air test shall be performed on piping between manholes (manholes shall not be included in sections of piping being tested). Proper plugs shall be installed to isolate the test section. The pipe segment shall be pressurized with air to 4 psi. The test shall not begin until the pressure has stabilized at 4 psi. The test shall then consist of observing the time for the pressure to fall one psi. This time shall be compared to the chart below to determine acceptability. If the time for the pressure to fall one psi is at least as shown in the chart below, the pipe segment passes the pressure test. If not, the pipe segment fails the pressure test. If the pipe segment fails the test, necessary repairs shall be made and the segment shall then be retested until it passes the air test.

<u>Pipe Diameter</u> <u>(inches)</u>	<u>Test Time</u> <u>(min./100')</u>	<u>Pipe Diameter</u> <u>(inches)</u>	<u>Test Time</u> <u>(min./100')</u>
4	0.3	21	3.0
6	0.7	24	3.6
8	1.2	27	4.2
10	1.5	30	4.8
12	1.8	33	5.4
15	2.1	36	6.0
18	2.4	42	7.3

Pressure tests will not be considered acceptable and will not be approved without a representative of the Town of Pittsboro present. Ample notice shall be provided to the Town prior to pressure testing. Excessive site visits will not be tolerated. In the event that more than two site visits are required for a segment of pipe to pass pressure testing, the Town of Pittsboro shall bill the Owner for the additional visits at a rate of \$75 per hour.

- J. Deflection Testing for Sewer Mains: No sooner than 30 days after backfilling, deflection testing shall be performed on PVC sewer mains by pulling an appropriate-sized mandrel through the sewer lines. Minimum 9-pronged mandrels shall be used. Mandrel diameter shall be minimum 95% of the base inside diameter. Pipe segments that do not allow passage of the mandrel shall be corrected and subjected to retesting.

Lamp tests shall be performed on all sewer mains from manhole to manhole. Lines shall exhibit a reasonably circular pattern. Confined space equipment shall be supplied by the Contractor along with adequate number of workmen, lamps and mirrors.

- K. CCTV Inspection: Prior to final acceptance by the Town of Pittsboro, all sewer mains shall be visually inspected using pan-and-tilt closed circuit television equipment. All services and defects shall be documented in the inspection. Immediately prior to CCTV inspection, each sewer main shall be flushed or otherwise charged with water so that sag areas will be evidenced by standing water. All CCTV inspections shall be continuously logged at a rate no more than 30 feet per minute and recorded on a digital format. A copy of the video inspection shall be provided to the Town of Pittsboro on thumb drive, external hard drives or DVD disks.