City of Winston-Salem, North Carolina
Department of Public Works
Engineering Division

Technical Specifications and Detail Drawings for Water Line and Sanitary Sewer Line Construction

April 2017
City of Winston-Salem
Water and Sanitary Sewer Technical Specifications

All references to specifications by the following institutes, associations, and societies shall be made to the latest revision of each specification:

ANSI - American National Standards Institute
ASTM - American Society for Testing Materials
AWWA - American Water Works Association
AASHTO - American Association of State Highway and Transportation Officials
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SECTION A - MATERIALS
All materials shall be new and are subject to approval by the Engineer. Only materials meeting specifications and/or the Engineer's approval will be used.

**BRASS FITTINGS:** All brass fittings shall be manufactured in accordance with AWWA C800 and ASTM B-584. All brass components in contact with potable water must be made from CDA/UNS Brass Alloy C89833 with a maximum lead content of .25% by weight. Brass alloys not listed in ANSI/WWA C800 Paragraph 4.1.2 are not approved. All fittings shall be UL classified to NSF/ANSI 61 and NSF/ANSI 372 standards and stamped or embossed with a mark or name indicating that the product is manufactured from the low-lead alloy as specified.

**BRICK:** All brick used on the work will be hard, tough, sound clay or shale brick, of first-class quality, thoroughly vitrified and especially suitable to the class of work for which it is to be used. All brick will meet ASTM C32, Grade MS or higher.

**CASING SPACERS:** Casing spacers shall be made of Type 304 stainless steel (including risers and hardware). Each shell shall be PVC lined and shall have bolted flanges. Casing spacer runners shall be constructed of ultra high molecular weight polymer (minimum 1 ½” wide) with a friction coefficient of not more than .12. Risers shall be 10 gauge. Risers and runners for top and bottom shells shall be of equal height. With approval of the Engineer, unequal height risers and runners may be used to obtain proper grade for sanitary sewer mains. Casing spacers must be designed to ensure that only the runners of the spacer are in contact with the steel encasement pipe. The bell of the carrier pipe will not be allowed to be in contact with the encasement. Approved casing spacers are as follows:

(1) Cascade Waterworks Manufacturing Company  
(2) Advance Products and Systems, Inc.  
(3) BWM Company  
(4) Black Widow by Spider Manufacturing, Inc.

**CAST IRON SOIL PIPE AND FITTINGS:** All cast iron soil pipe and fittings will conform to ASTM A74 and be classified as SV (service weight). Single or double hub is acceptable. No-hub pipe shall not be used. All pipe and fittings shall be uniformly coated with bituminous coating. Joints will be rubber gasket. Rubber gaskets shall conform to ASTM C564. 4" x 4" combination wye and eighth bends shall be short pattern - Fig. No. SV-32 by Charlotte Pipe and Foundry (or approved equal). 4" cleanouts shall consist of a 4" service weight cast iron ferrule (with 3” iron pipe size tap) and a 3” brass plug. The plug shall have a low raised square head (Southern Code). Cleanouts shall be Part Number 184 by Jumbo Manufacturing Company (or approved equal).

**CONCRETE:** Class AA concrete will have a minimum 28-day compressive strength of 4,500 pounds per square inch and a slump not to exceed 3-1/2 inches.

Class A concrete will have a 28-day compressive strength of 3,000 pounds per square inch and a slump not to exceed 3-1/2 inches.

**COPPER PIPE:** All copper pipe will conform to ASTM B88. All copper shall be Type K, soft copper and all joints shall be compression.
CORPORATION COCKS: All corporation cocks shall be made of brass in accordance with the brass specification contained herein. All corporation cocks shall also be of the ball valve type with AWWA inlet threads.

The following are acceptable:

\[\frac{3}{4}", 1", 1\frac{1}{2}" and 2" - FBI000-G-NL by Ford or 74701BT by McDonald\]

DUCTILE IRON PIPE: Ductile iron pipe shall be designed to conform to ANSI A21.50 (AWWA C150) and shall be manufactured to conform to ANSI A21.51 (AWWA C151). The interior of pipe for water will be cement lined in accordance with ANSI A21.4 (AWWA C104). The interior of pipe for sanitary sewer will be lined with 40 mils of Protecto 401 Ceramic Epoxy. All bells and spigots for sanitary sewer pipe must be lined with a minimum of 8 mils of Protecto 401 Joint Compound or approved equal. The exterior of all pipe shall be coated with a bituminous coating. Pipe joints will be single rubber gasket push-on type or mechanical joint type unless otherwise specified or otherwise shown on the Engineer's drawings. Rubber gasket joints shall conform to ANSI A21.11 (AWWA C111). Pipe design laying condition will be Type 2, flat-bottom trench with backfill lightly consolidated to centerline of pipe. Pipe for sanitary sewer shall be minimum thickness Class 50. Pipe for water shall be pressure Class 350 for 3" - 16" and pressure Class 250 for 18" and above. Any deviations in class shall be otherwise specified or otherwise shown on the Engineer's drawings. If for any reason the Engineer finds any or all ductile iron pipe unacceptable, the Contractor shall be responsible for obtaining acceptable pipe. The Engineer's acceptance or rejection of all pipe will be final.

DUCTILE IRON FLEXIBLE RESTRAINED JOINT PIPE AND FITTINGS: All restrained joint pipe and fittings shall have flexible push-on joints unless otherwise approved by the Engineer. At locations where field cutting of restrained joint pipe is required for fittings, the TR Flex Gripper Ring may be used. Field welding will not be allowed. Restricted joint pipe and fittings with a gripping gasket as the only means of restraint will not be allowed. Pipe and fittings shall be Flex-Ring by American, TR Flex by U.S. Pipe, or TR Flex by McWane. If for any reason the Engineer finds any or all ductile iron flexible restrained joint pipe unacceptable, the Contractor shall be responsible for obtaining acceptable pipe. The Engineer's acceptance or rejection of all pipe will be final.

FENCE GATES: Fence gates will be five panel type, fabricated using 4 ½", 24 gauge galvanized, steel forms or an approved tubular type gate. Gates will be mounted on 6" diameter, 8 foot long, pressure treated posts at the hinged ends. Hinges will utilize 5/8" pins screwed into posts, turned up at the bottom and turned down at the top. Female receivers mounted on gate frames will rotate on pins. All hinges, pins, etc. shall be hot-dip galvanized.

Slide latches will be provided to slide into receivers attached to 6" diameter, 8 foot long, pressure treated posts. Minimum retention for treated posts shall be .4 lbs. of chromated copper arsenate per cubic foot of wood.

For locking purposes, a 5/16" link chain 28" long, will be furnished and attached to the latch posts. Furnished with each gate will be a Corbin padlock number 2863, master keyed to the City of Winston-Salem's Utilities Division standard. The City will provide the Corbin padlock.
**FENCING (OUTFALLS):** Fencing shall be 2” x 4” galvanized woven wire fabric. Posts shall be 4” x 4” pressure treated lumber (6 feet long). Minimum retention for treated posts shall be 0.4 lbs. of chromated copper arsenate per cubic foot of wood.

**FIRE HYDRANTS:** All fire hydrants shall be dry-barrel fire hydrants which comply with ANSI/AWWA C502. All hydrants will have a dry top with O-ring seals which permanently seal off the stem operating threads from water and keep the lubricant in. All hydrants shall be opened by turning the operating nut on top of the hydrant counterclockwise. The main valve shall be a compression type valve with a valve opening of 4 ½” or 5 1/4” unless otherwise specified. Each hydrant will have two hose nozzles and one steamer nozzle. The 2 ½” hose nozzles and the 4 1/4” steamer nozzle shall have Winston-Salem standard threads as shown on the City of Winston-Salem’s detail drawings for “2 ½” Hose Nozzle for Hydrants” and “4 ¼” Steamer Nozzle for Hydrants”. The nozzle shall be fastened into the hydrant barrel by mechanical means, but shall not be leaded into the barrel. Nozzle caps shall be chained to the barrel. All hydrants will be furnished with a breakable traffic feature that will break upon impact. The feature shall consist of a breakable safety flange on the barrel and a breakable safety coupling in the main valve stem. Hydrants must have a bronze main valve seat ring that threads into a bronze drain ring. Each hydrant shall have at least two bronze drain outlets. All hydrants will have 6” mechanical joint base connections unless otherwise specified by the Engineer. Hydrants shall be designed for a minimum working pressure of 250 psi. Assembled hydrants shall be subjected to hydrostatic tests of twice the rated working pressure in accordance with ANSI/AWWA C502. All exterior iron surfaces below ground level shall be covered with two coats of asphaltic varnish or fusion bonded epoxy. All exterior iron surfaces above ground level shall be painted yellow to the satisfaction of the Engineer. Yellow paint shall be Rust-Oleum 7446, Rust-Oleum V2148, or Kimball Midwest 80-942. All interior iron surfaces of the hydrant shoe which are in contact with water (including the lower valve plate and nut) shall be coated with a minimum of 8 mils of fusion bonded epoxy or liquid epoxy in accordance with ANSI/AWWA C550. All hydrants shall have a thrust or anti-friction washer in the operating area of the hydrant bonnet. A weather cap around the operating nut on top of the hydrant is required. Hydrants accepted by the City of Winston-Salem are as follows:

1. Super Centurion 250, manufactured by Mueller Company
2. MK-73-5, manufactured by American Flow Control
4. Medallion, manufactured by Clow Valve Company

**FITTINGS (DUCTILE IRON):** Ductile iron fittings shall meet all requirements of ANSI A21.10 (AWWA C110) and will be of the mechanical joint type unless otherwise specified. All glands shall be ductile iron, not gray iron. The interior of fittings for water will be cement lined in accordance with ANSI A21.4 (AWWA C104). The interior of fittings for sanitary sewer will be lined with 40 mils of Protecto 401 Ceramic Epoxy. All bells and spigots for sanitary sewer fittings must be lined with a minimum of 8 mils of Protecto 401 Joint Compound or approved equal. The exterior of all fittings shall be coated with a bituminous coating. Fittings coated on the interior and exterior with 8 mils of fusion bonded epoxy in accordance with ANSI/AWWA C116 and ANSI/AWWA C550 are acceptable. Fittings will have a minimum pressure rating of 250 psi unless otherwise specified by the Engineer. Rubber gasket joints shall conform to ANSI A21.11 (AWWA C111). Ductile iron compact fittings conforming to ANSI A21.53 (AWWA C153) are
acceptable. "DI" or "Ductile" shall be cast on each fitting. All Fittings are subject to approval by the Engineer, and their acceptance or rejection shall be final.

**FLEXIBLE MANHOLE CONNECTOR:** Flexible manhole connectors shall conform to ASTM C923. Connectors shall be manufactured by Press-Seal Gasket Corporation, Hamilton Kent, NPC Inc. or approved equal.

**INCIDENTAL STONE BASE:** Incidental stone base shall be ABC stone. This stone shall be used for driveways, streets, parking lots, etc.

**IRON AND STEEL (MISCELLANEOUS):** All miscellaneous iron and steel such as angle iron, checkered plate covers, valve stem guides and supports, etc. will be galvanized. Galvanizing will be by the hot-dip process after the materials have been cut, assembled and all holes punched. Any field welds or bolts which may be used to fasten iron or steel together will be painted immediately after installation with two coats of cold galvanizing compound.

**MANHOLE CHECK VALVES:** Manhole check valves shall be Series 35 flanged check valves by Red Valve Company with stainless steel backup rings or approved equal.

**MANHOLE RINGS AND COVERS (TYPE 1):** Type 1 manhole rings and covers will be made of cast iron and will conform to ASTM A48, Class 35B. In addition, all manhole rings and covers shall be designed to support an H-20 wheel load. All castings will conform to the shape and dimensions shown on the City of Winston-Salem detail drawing for “Manhole Ring and Cover (Type 1)” and will be free from holes, cracks or any other defects. Rings and covers will have machined seats so that the cover will not rattle. Rings will weigh a minimum of 190 pounds and covers a minimum of 120 pounds. The name of the manufacturer and the part number shall be cast permanently on the ring and the cover. Castings that do not meet specifications shall be rejected. Rings and covers furnished under these specifications shall be manufactured by one of the following:

1. East Jordan Iron Works, Inc. (Ring - Part No. V-1384-1; Cover - Part No. V-1384)
2. U.S. Foundry & Manufacturing Corp. (Ring - Part No. 669; Cover - Part No. KL)

**MANHOLE RINGS AND COVERS (TYPE 2):** Type 2 manhole rings and covers shall meet all specifications for Type 1 rings and covers and shall conform to the City of Winston-Salem detail drawing for “Manhole Ring and Cover (Type 2)”. Rings and covers furnished under these specifications shall be manufactured by one of the following:

1. East Jordan Iron Works, Inc. (Ring - Part No. V-2384; Cover - Part No. V-1385)
2. U.S. Foundry & Manufacturing Corp. (Ring - Part No. 669-2; Cover - Part No. KL-2)

**MANHOLE RINGS AND COVERS (TYPE 3):** Type 3 manhole rings and covers shall meet all specifications for Type 1 rings and covers, except that rings will weigh a minimum of 136 pounds and covers a minimum of 120 pounds. All rings and covers shall conform to the City of Winston-Salem detail drawing for “Manhole Ring and Cover (Type 3)”. Rings and covers furnished under these specifications shall be manufactured by one of the following:
MANHOLE STEPS: All manhole steps shall conform to current OSHA standards and ASTM C478. The approved step shall conform to the City of Winston-Salem detail drawing for “Polypropylene Manhole Step”. All other steps must be approved by the Engineer prior to being installed.

METER BOXES (CAST IRON - 5/8” AND 1” METERS): Cast iron meter boxes will conform to ASTM A48, Class 30B and to the shape, dimensions and weights shown on the City of Winston-Salem detail drawing for “Cast Iron Meter Box for 5/8” and 1” Meters” and will be free from holes, cracks or any other defects. All boxes shall be thoroughly coated with an asphaltic varnish. The name of the manufacturer shall be permanently cast on each piece. Meter boxes that do not meet specifications shall be rejected. Cast iron meter boxes furnished under these specifications shall be manufactured by one of the following:

(1) Sigma Corp.
(2) SIP Industries
(3) DSI International
(4) Star Pipe Products

METER BOXES (POLYMER CONCRETE - 1 1/2” AND 2” METERS): Meter boxes for 1 1/2" and 2" meters shall be manufactured by Quazite (Strongwell Corporation). All boxes will conform to the shape, dimensions and installation requirements shown on the City of Winston-Salem detail drawing for “Polymer Concrete Meter Box for 1 1/2” and 2” Meters”. The box shall have two 4" x 4" mouse hole openings (one on each end) with a 4" x 4" knockout above each opening. The cover shall be non-locking with a 6" x 9” steel meter lid centered on the cover. The meter lid must open to at least the vertical position. The cover shall also have two pull slots (1” wide), a skid resistant surface and the word "Water" cast into the cover. Meter boxes that do not meet specifications shall be rejected. Part numbers are as follows:

Box: PG2436B500
Cover: PG2436WAP1-50

METER YOKES AND ACCESSORIES: All brass shall conform to the brass specification contained herein. The following parts are acceptable:

A. 3/4” Water Connection
   1. Meter yoke - Y501 by Ford, H-5010 by Mueller or 14-1 by McDonald
   2. Angle ball valve with padlock wings - BA94-313W-G-NL by Ford (City side)
   3. Angle ball valve without padlock wings - BA94-313-G-NL by Ford (property side)

B. 1” Water Connection
   1. Meter Yoke - Y504 by Ford
   2. Angle ball valve with padlock wings - BA94-444W-G-NL by Ford – two required
C. 1 ½" Water Connection – 70 Series Coppersetter with ball valve bypass and ball valves on inlet and outlet (VBB76-12B-11-66-NL by Ford) as per City of Winston-Salem detail drawing for “1 ½” & 2” Water Connection”.

D. 2" Water Connection - 70 Series Coppersetter with ball valve bypass and ball valves on inlet and outlet (VBB77-12B-11-77-NL by Ford) as per City of Winston-Salem detail drawing for “1 ½” & 2” Water Connection”.

**POLYETHYLENE ENCASEMENT**: Polyethylene encasement shall conform to ANSI A21.5 (AWWA C105). The polyethylene shall have a minimum thickness of 8 mil, shall be manufactured of virgin material. The tape used for installation of polyethylene tubing shall be plastic-backed adhesive with a thickness of 12 mils and a minimum width of 1 ½”. The tape shall be capable of bonding to metal, bituminous coating and polyethylene at a temperature range of 32 to 120 degrees F.

**POLYVINYL CHLORIDE (PVC) PIPE FOR SANITARY SEWER FORCE MAINS**: 4" PVC pipe shall conform to AWWA C900, pressure Class 200 psi at 73.4 degrees Fahrenheit. The dimension ratio shall be 14. 3" and smaller PVC pipe shall conform to ASTM D2241, pressure Class 200 psi. The dimension ratio shall be 21. All pipe shall have an integral bell and a single gasketed joint.

**POLYVINYL CHLORIDE (PVC) PRESSURE PIPE AND FITTINGS (2 INCH ONLY)**: Pipe and fittings shall be manufactured and tested in the U.S.A. All two (2) inch PVC pipe shall have a hydrostatic minimum working pressure of 250 psi (SDR 17 or SDR 13.5) and pipe shall conform to ASTM D-2241 or the latest revision. PVC pipe shall have the National Sanitation Foundation (NSF) seal of approval. Pipe jointing shall be push on integral bell type with elastomeric joints and shall conform to ASTM D-3139. PVC pipe shall be furnished in standard lay lengths of twenty feet with one or both ends tapered for use with the integral bell. Any lubrication used shall conform to AWWA and the pipe manufacturer. Fittings shall be push on joint PVC with elastomeric joints and shall conform to ASTM D-3139. Fittings shall have a hydrostatic minimum working pressure of 200 psi (SDR 21). If for any reason the Engineer finds any or all PVC pipe unacceptable, the Contractor shall be responsible for obtaining acceptable pipe. The Engineer’s acceptance or rejection of all pipe will be final.


**SERVICE SADDLES (SEWER)**: Service saddles for 4" sewer connections may be used in lieu of wyes. Saddles shall be style "CB” sewer saddle by Romac Industries, Inc.
**SERVICE SADDLES (WATER):** Service saddles shall be used as follows:

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<th>Pipe Size</th>
<th>Maximum Size Direct Tap on Ductile Iron Pipe Without Saddle</th>
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<tbody>
<tr>
<td>4”</td>
<td>¾”</td>
</tr>
<tr>
<td>6”</td>
<td>1”</td>
</tr>
<tr>
<td>8”</td>
<td>1”</td>
</tr>
<tr>
<td>12”</td>
<td>1 ½”</td>
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**For Ductile Iron Pipe:** The saddle body shall be ductile iron with corrosion resistant paint. The body shall have a CC threaded outlet. Attached to the body shall be double U-bolt straps. Straps, washers and nuts shall be Type 305 or Type 316 stainless steel. Saddles shall be F202-SSB by Ford or 202SSU by Romac Industries, Inc.

**For ASTM D-2241 PVC Pipe:** The saddle body shall be no lead brass alloy per ASTM B62 and AWWA C800 requirements. The body shall have a CC threaded outlet. The gasket “O” ring design shall conform to ASTM D2000 requirements. Service saddles for use on ASTM D-2241 PVC pipe shall be Ford S70 type or approved equal.

**STEEL ENCASEMENT PIPE:** Steel encasement pipe shall be smooth wall pipe with welded joints. The pipe shall have a minimum yield strength of 35,000 psi. The encasement pipe must be capable of withstanding highway loadings and must have an inside diameter which will allow the carrier pipe to be removed subsequently without disturbing the encasement pipe.

Minimum wall thicknesses for steel encasement pipe are as follows:

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<tr>
<th>ENCASEMENT PIPE SIZE (Outside Diameter)</th>
<th>WALL THICKNESS (NCDOT)</th>
<th>WALL THICKNESS (Railroad)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16”</td>
<td>.250”</td>
<td>.281”</td>
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<tr>
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<td>.250”</td>
<td>.312”</td>
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<tr>
<td>48”</td>
<td>.500”</td>
<td>.688”</td>
</tr>
</tbody>
</table>

Encasement pipe installed on railway rights-of-way shall be subject to specifications by the American Railway Engineering Association. Pipe diameter shall be as shown on the Engineer's drawings.

**STEEL FOR REINFORCEMENT:** All reinforcement steel bars will conform to ASTM A615 (Grade 60) and all reinforcement welded steel wire fabric will conform to ASTM A185. All steel will be free from rust or other coatings which would destroy the bond between the steel and the concrete. Bars shall be tied together and supported to prevent damage by construction loads or pouring of concrete. On the ground and where necessary, concrete blocks cast of the same concrete as is to be poured will be used for the purpose of supporting the steel. On formwork, bar chairs and spacers approved by the Engineer shall be used for support. Where the concrete surface will
be exposed, the portions of all accessories in contact with the formwork will be galvanized or coated with plastic.

**STONE (STABILIZATION):** Stabilization Stone shall be Class VI select material (#57 stone). This stone shall be used in unstable soil, under or around pipe, under manholes, etc. as required.

**T-HEAD BOLTS AND HEXAGONAL NUTS:** All T-head bolts and nuts used for mechanical joint pipe, valves, hydrants or fittings shall be high-strength, low-alloy steel in accordance with ANSI A21.11 (AWWA C111). Cast iron bolts will not be accepted.

**VALVES (AIR RELEASE):** All air release valves shall conform to ANSI/AWWA C5l2. The air release valve shall be a Type 316 stainless steel (all parts), pressure air valve (operating pressure 0-200 psi) manufactured by Crispin or an approved equal. The bronze ball valve curb stops shall have a minimum working pressure of 200 psi.

**VALVES (GATE) - 3" THROUGH 16":** All gate valves shall be resilient-seated gate valves which meet the specifications of ANSI/AWWA C509 or ANSI/AWWA C515. The valve body, bonnet and seal plate shall be coated on all exterior and interior surfaces with a minimum of 8-10 mils of fusion bonded epoxy in accordance with ANSI/AWWA C550. The valve shall incorporate a guide system with guide lugs on the wedge or on the body. The wedge shall be gray or ductile iron, fully encapsulated with rubber (including guide lugs and stem nut holder). Non-rising stem valves shall have two O-ring seals above the stem thrust collar that can be replaced with the valve under pressure. Non-rising stem valves shall also have a thrust washer on the stem thrust collar. Valves used for buried service will have a non-rising stem, mechanical joint end connections, and a 2" square operating nut. The word "OPEN" and an arrow to indicate the direction of opening the valve shall be cast on the flanged base of the operating nut. Above ground valves, unless otherwise specified, will have an outside screw and yoke rising stem or a non-rising stem, flanged end connections, and a handwheel to operate the valve. The word "OPEN" and an arrow to indicate the direction of opening the valve shall be cast on the rim of the handwheel. All valves will open by turning the nut or handwheel counterclockwise. Valves installed in manholes will normally be considered to be buried service valves and valves installed in vaults will normally be considered to be above ground valves.

Resilient-seated gate valves shall be designed for a minimum working pressure of 250 psi. Each valve shall be seat tested at the rated working pressure and shell tested at twice the rated working pressure in accordance with ANSI/AWWA C509 - Section 5 or ANSI/AWWA C515 - Section 5. All valves shall be warranted for 10 years from date of purchase against defective materials and workmanship. Gate valves furnished under these specifications must be manufactured by one of the following:

1. Clow Valve Company
2. M & H Valve Company
3. American Flow Control
4. U.S. Pipe and Foundry Company
5. Mueller Company
6. Kennedy Valve Company
**TAPPING VALVES, SLEEVES AND SADDLES:** All tapping valves shall meet the specifications for "gate valves" except that the valve shall have an inlet flange (with centering ring) for connection to the flanged sleeve outlet. Tapping sleeves shall be a split sleeves with mechanical joint end connections and a flanged outlet. Sleeves shall be designed for a minimum working pressure of 200 psi.

Approved tapping sleeves, tapping saddles and tapping valves are as follows:

**Tapping Sleeves:**
- (1) Mueller Company
- (2) American Flow Control
- (3) Tyler Pipe Company
- (4) U.S. Pipe and Foundry Company
- (5) Kennedy Valve Company

**Tapping saddles:**
- (1) American Flow Control
- (2) U.S. Pipe and Foundry Company

**Tapping valves:**
- (1) Clow Valve Company
- (2) M & H Valve Company
- (3) American Flow Control
- (4) U.S. Pipe and Foundry Company
- (5) Mueller Company
- (6) Kennedy Valve Company

**VALVE BOXES:** Cast iron valve boxes will conform to ASTM A48, Class 30B. All boxes will conform to the shape and dimensions shown on the City of Winston-Salem detail drawing for “Cast Iron Valve Box” and will be free from holes, cracks or any other defects. All castings will be thoroughly coated with an asphaltic varnish. The name of the manufacturer shall be permanently cast on each piece. Valve boxes that do not meet specifications shall be rejected.

Cast iron valve boxes furnished under these specifications shall be manufactured by one of the following:

- (1) Sigma Corp.
- (2) SIP Industries
- (3) DSI International
- (4) Star Pipe Products

**VITRIFIED CLAY PIPE AND FITTINGS:** Vitrified clay pipe shall be manufactured in accordance with ANSI/ASTM C700, tested in accordance with ANSI/ASTM C301 and shall be classified as extra strength pipe. The specific type of joint shall be the O-ring compression type
joint. This joint shall conform to ANSI/ASTM C425. All pipe will be unglazed. Pipe shall be manufactured by one of the following:

(1) Logan Clay Products Company
(2) Superior Clay Corporation
(3) Can Clay Corporation

If for any reason the Engineer finds any or all vitrified clay pipe unacceptable, the Contractor shall be responsible for obtaining acceptable pipe. The Engineer's acceptance or rejection of all pipe will be final.
SECTION B - METHODS OF CONSTRUCTION
GENERAL

EASEMENTS: The necessary easements for construction for all pipe lines under this Contract which are not on street right-of-way will be secured by the City of Winston-Salem. The Contractor shall stay within the easements. If the Contractor desires an additional easement for easier access, storage, or any other purpose, it will be his/her responsibility to obtain the easement from the individual property owner. If the Contractor desires such additional easement he shall acquire same from the property owner and present a signed easement agreement satisfactory to the City prior to entering upon such additional easement to perform the work. Such work will begin only after the Contractor receives written approval from the City. Failure to comply with these terms relating to easements by the Contractor shall constitute breach of this Contract. The City will not be responsible for, and the Contractor shall hold the City harmless from, any damages or claims from property owners resulting from the Contractor working outside the easements obtained by the City. The Contractor shall not receive any additional compensation for any delays due to acquisition of easements by the City.

All trees, buildings, etc., within the permanent easement will be removed unless otherwise indicated on the plans or as directed by the Engineer. If necessary for construction of the pipe line, any trees, buildings, etc., within the construction easement may be removed by the Contractor. Any trees, buildings, etc. that are to be saved or removed by others shall be designated on the Engineer's drawings and/or marked by a City survey party.

SAFETY PROVISIONS AND TRAFFIC CONTROL: The Contractor shall provide adequate barricades, construction signs, warning lights, guards and traffic flagmen as required by the Engineer. Such protection shall be maintained during the progress of the construction work and until it is safe for traffic to use the roadway. All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by barricades and shall be protected by proper lights. The rules and regulations of the local authorities and the North Carolina Department of Transportation regarding safety provisions and traffic control shall be observed at all times.

The Contractor shall carry on the work in a manner which will cause the least interruption to traffic and may close a street only with the permission of the Engineer and/or the City Department of Transportation. Should it become necessary to allow only one way traffic, the Contractor shall provide one flagman with a stop-slow paddle for each end of the one way strip for proper direction of traffic.

The standard procedures for construction signing, and devices used for traffic control, shall conform with the latest NCDOT Roadway Standard Drawings and Standard Specifications for Roads and Structures and the Manual on Uniform Traffic Control Devices (MUTCD). One example of these procedures is shown on a City of Winston-Salem detail drawing for “Signing Construction Operations” contained herein. Where this procedure proves impractical, a suitable signing system will be devised prior to construction and may be substituted with the approval of the Engineer.

An executed Right-of-Way Encroachment Contract typically applies to work being performed within NCDOT right-of-way. The Contractor shall comply with all traffic provisions outlined in the Encroachment Contract. One such provision normally included within the Encroachment
Contract requires that traffic along State roads be maintained at all times and not be interfered with during peak hour traffic flow, generally considered to be between 7:00 a.m. and 9:00 a.m. and 4:00 p.m. to 6:00 p.m.

Measurement and Payment:

Unless otherwise stipulated in the Contract, the Contractor will not be directly compensated for any traffic control measures necessary, as this work will be considered incidental to all other work performed.

**PAVEMENT REMOVAL**: All rigid or flexible pavement, sidewalk, driveways, etc., to be removed under this Contract shall be completed as specified herein. The Contractor shall cut the pavement with a saw as indicated on the designated detail drawing. Under no circumstances will the Contractor be allowed to pull up pavement without prior cutting. All cutting will be neat and straight. The width of pavement cuts shall not exceed the width indicated on the designated detail drawing.

Should pavement be damaged by the Contractor outside the area specified above, the Contractor will be required to repair the pavement per the appropriate detail and as directed by the Engineer, at the Contractor’s expense. This shall also apply to pavement that is damaged away from the trench area.

**Measurement and Payment:**

No direct payment will be made for pavement removal, as such work will be incidental to other work performed.

**EXCAVATING AND BACKFILLING TRENCHES FOR ALL PIPE LINES (INCLUDING OPEN CUT ENCASEMENT)**: Screenings shall be placed on all paved roadways prior to beginning any trenching activities. Screenings shall be placed on the affected pavement area as directed by the Inspector. All screenings shall be removed once backfilling has been completed.

All excavation will be of one classification regardless of the nature of the material encountered, except for solid rock formation in trenches. Rock excavation will include the excavation of all solid ledge rock which cannot be removed by ordinary excavating equipment. All boulders greater than one cubic yard in size will also be considered rock excavation. Rock encountered in trenches will be uncovered by the Contractor in sections not less than fifty feet (50') in length and the Engineer immediately notified in order to enable him to obtain a record of it. Rock removed without such record having been made shall not be paid for. Rock excavation shall be carried six inches (6") below the bottom of the pipe. Rock excavation for manholes shall be carried six inches (6") below the bottom of the manhole. The trenches will be brought back to grade by the pipe laying crew with suitable material, properly compacted.

All blasting operations will be conducted in strict conformance with the existing ordinances of the City of Winston-Salem (or any other governing authority) and accepted safe practices relative to the storage and use of explosives. Blasting will be done only by experienced personnel. Extreme care and precaution will be used to prevent injury to workmen and to existing pipe, buildings or other structures either below or above the surface of the ground. Sufficient warning will be given.
to all persons in the area prior to blasting. The Contractor will be responsible for all damage due
to blasting operations.

Trenches shall be carefully excavated to the proper grade so that it will not be necessary to fill-in
under the pipe. Pipe shall be placed on a firm foundation so as to prevent subsequent settlement.
The Contractor shall undercut and replace weak or saturated soils below the pipe trench with
stabilization stone or other approved material, as directed by the Engineer, to provide a firm
foundation. Under no circumstances shall pipe be laid in water and no pipe shall be laid under
unsuitable weather or trench conditions.

Trenches for pressure lines (water or sanitary sewer) will, wherever possible, have continuous
grades between air valves and blow-offs or hydrants so as to avoid air pockets and will be of
sufficient width to give room for properly making the joints. Trenches will be of such depth as to
provide a minimum of 36 inches of cover above the top of all pressure lines unless otherwise
approved by the Engineer.

Backfilling along the sides of the pipe and immediately above the pipe will be done by hand with
extreme care. On large pipe lines (12” and above), backhoes or other equipment may be used upon
approval by the Engineer. In order to insure proper grade and alignment and to insure that backfill
material is distributed under the pipe properly, each joint of pipe shall be backfilled to the center
of the pipe and hand tamped as each joint is laid. From one (1) foot above the top of the pipe to
the subgrade, material containing rocks or stones up to 2 inches in their greatest dimension may
be used. Otherwise, rock shall not be used as backfill. The Contractor shall not have open in
excess of two hundred (200) feet of water and/or sewer main trench at one time. Backfilling shall
be completed at the end of each day's work.

All trench backfill under existing or proposed pavement, curb and gutter, sidewalk, and roadway
shoulders shall be compacted to at least 95% of the maximum dry density as determined by
AASHTO T99 and the NCDOT. The final 12” of subgrade under paved areas and under curb and
gutter shall be compacted to 100% (see pavement repair detail drawings). Cross country water
lines or sanitary sewer outfalls shall have backfill compacted to 90% density unless otherwise
directed by the Engineer. Density tests by an independent testing lab are to be made as directed
by the City Inspector at the City’s expense.

Suitable backfill shall be defined as loam, clay, sand, gravel or other materials satisfactory to the
Engineer.

Measurement and Payment:

No separate measurement or payment will be made for trenching, excavation, undercut, wet
excavation, dewatering of excavation, shoring and sheeting, backfilling, compacting, removal
and disposal of existing pavement, and removal and disposal of unsuitable material unless
otherwise stipulated in the Contract.

Screenings shall be measured and paid as the actual number of tons of this material weighed
in trucks on certified platform scales or other certified weighing devices.

Rock excavation will be measured and paid for in cubic yards at the unit price given. Measurement shall be based upon the nominal diameter of the pipe to be laid plus three feet
(3’) and/or the outside diameter of the manhole to be installed plus three feet (3’) times the depth to the bottom of the pipe to be installed and/or depth to the bottom of the manhole to be installed plus six inches (6”). This will include the cost of furnishing all labor, equipment, and material required for the removal and disposal of the rock.

Unless otherwise approved by the Engineer, the material used to replace undercut excavation will be measured and paid in tons for "Stabilization Stone". Stabilization Stone shall be measured and paid as the actual number of tons of this material weighed in trucks on certified platform scales or other certified weighing devices.

**INSTALLATION OF STEEL ENCASEMENT PIPE:** Encasement pipe shall be installed trenchless, unless otherwise shown on the plans. Trenchless installation of encasement pipe shall be accomplished by dry boring and jacking. The boring auger shall be mounted inside the encasement pipe. The installation of the pipe and the boring of the hole shall be done simultaneously. As the boring operation progresses each new section of encasement pipe shall be butt welded to the previously installed section. Voids are to be filled with a Portland cement grout consisting of one (1) part Portland cement grout to three (3) parts sand at sufficient pressure to insure there will be no settlement of the highway or railroad. In the event that an obstruction is encountered during the dry boring operation, the auger is to be withdrawn, the excess pipe cut off and capped, and the pipe abandoned by completely filling the void with Portland cement grout as described above.

Encasement pipe installed either trenchless or by open-cut shall be installed prior to laying the carrier pipe within 50 feet of either end of the encasement. All encasement pipe shall be sealed at the ends with an approved rubber seal to prevent flowing water or debris from entering the space between the encasement pipe and the carrier pipe. The Contractor is responsible for using the methods and equipment needed to attain the alignment, grade and elevation shown on the Engineer’s drawings. Any deviations shall be corrected at the Contractor’s expense.

Additional attempts may be required at alternate locations as directed by the Engineer. The option to install the encasement by open cutting shall not be permitted unless approved by the Engineer and, when applicable, the North Carolina Department of Transportation. If approved, open-cut encasement shall be installed per “Excavating and Backfilling Trenches for All Pipe Lines”.

**Measurement and Payment:**

*Steel Encasement Pipe* shall be paid per linear foot for the appropriate size and thickness and shall include the furnishing of necessary encasement pipe, grouting, hauling, labor, supervision, equipment and tools necessary for installing the pipe as shown on the Engineer's drawings or as may be directed by the Engineer. The Contractor shall be paid for any portion of encasement, installed per the Engineer’s drawing, which is subsequently abandoned.

**INSTALLATION OF CARRIER PIPE:** Carrier pipe installed through encasement shall be ductile iron flexible restrained joint pipe. Casing spacers are required and shall be placed at 10 foot intervals within the encasement. One spacer shall be placed not more than 2 feet from each end of the encasement. Only the runners of the casing spacer shall be in contact with the encasement. The bell of the carrier pipe will not be allowed to be in contact with the encasement. The Engineer must be present to observe the entire installation of the carrier pipe.
Measurement and Payment:

*Carrier Pipe* shall be paid per linear foot for the appropriate size. Measurement shall be based upon, and equal to, the length of related encasement pipe satisfactorily installed. The unit price bid for carrier pipe shall include the furnishing of pipe, hauling, labor, supervision, equipment and tools necessary for installing the pipe as shown on the Engineer's drawings or as may be directed by the Engineer. No direct payment will be made for furnishing and installing casing spacers, as such work will be incidental to the installation of the carrier pipe.

**INSTALLATION OF FENCE GATES:** Fence gates will be furnished and installed at locations as directed by the Engineer or as indicated on the Engineer's drawings. Gates will be installed as per the City of Winston-Salem detail drawing for “Fence Gate”.

Measurement and Payment:

*Fence Gates* shall be paid per each. The unit price bid for fence gates shall include the furnishing of materials, labor, supervision, equipment and tools necessary for installing the gate as shown on the detail or as may be directed by the Engineer.

**INSTALLATION OF FENCING:** Fencing will be furnished and installed at locations as directed by the Engineer or as indicated on the Engineer's drawings. Fencing will be installed as per the City of Winston-Salem detail drawing for “Fencing”.

Measurement and Payment:

*Fencing* shall be paid per linear foot. The unit price bid for fencing shall include the furnishing of materials, labor, supervision, equipment and tools necessary for installing the fence as shown on the detail or as may be directed by the Engineer.

**SANITARY SEWER**

**INSTALLATION OF SANITARY SEWER PIPE:** All materials for laying and jointing the pipe in the trench will conform to the specifications for such material herein given and will be furnished by the Contractor. Grade lines for aligning and grading the pipe in the trench will be established by the Engineer, and all labor and material required will be furnished by the Contractor. Pipe laying for vitrified clay pipe shall in general conform to ASTM C12. Pipe laying for ductile iron pipe shall be in general accordance with the installation requirements for ductile iron water pipe contained herein. Sewer mains designed at a slope between 18 and 22 percent shall be of ductile iron and constructed as shown the City of Winston-Salem detail drawing for “Sanitary Sewer Mains on 18-22% Slope”. Mains installed at grades in excess of 20% shall be anchored securely with concrete as noted on the plans or as directed by the Engineer. Tie-ins (including connections) to all existing manholes will be made by coring a hole in the manhole wall and installing a flexible sleeve. Pipe tie-ins to manholes shall be constructed to conform to the City of Winston-Salem detail drawing for “Flexible Manhole Connector”.

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Prior to being lowered into the trench, each pipe will be inspected by the crew foreman. Faulty pipe shall be rejected and removed from the work site. No pipe will be laid within ten (10) feet of excavation operations or within thirty (30) feet of rock which must be blasted for removal. The open end of all pipes will be plugged when pipe laying is not in progress, and all pipe will be protected against injury from falling rock when blasting. Pipe will be laid with the bell ends facing the direction of laying. A bell hole will be dug for each bell, but only of sufficient size to insure that the pipe will bear evenly throughout its length on the bottom of the trench.

Bedding for vitrified clay pipe on stable subgrade shall meet the requirements shown on the City of Winston-Salem’s detail drawing for “Bedding Requirements and Safe Cover for Vitrified Clay Pipe on Stable Subgrade”. When required, stone used for bedding shall be stabilization stone. The limits for stone bedding will normally be shown on the profile of the Engineer’s drawing. Stone bedding shall have a minimum thickness beneath the pipe of four inches (4") or one-eighth of the outside diameter of the pipe, whichever is greater. The required thickness shall be determined by the Engineer.

When changing from vitrified clay to ductile iron, a donut manufactured by Fernco, Inc. or approved equal or a flexible coupling with two stainless steel clamps, manufactured by Fernco, Inc. or approved equal, may be used to make the joint. When changing from ductile iron to vitrified clay, the flexible coupling will be used. Twelve inches of #57 stone will be used around all joints where couplings or donuts are used.

When noted on the plans, or as directed by the Engineer, a concrete anti-seepage collar shall be constructed around the pipe. Construction of anti-seepage collars shall be in conformance with the City of Winston-Salem’s detail drawing for “Concrete Anti-Seepage Collar”.

When warranted, polyethylene encasement shall be installed on the ductile iron pipe at the locations shown on the Engineer’s drawings. Installation of the polyethylene shall conform to Method “B” outlined in Section 4.3.2.2 of ANSI A21.5 (AWWA C105).

The Contractor is solely responsible for meeting all invert, grade, and alignment requirements. In the event the Contractor fails to meet these requirements, the Contractor shall remove any manholes and/or pipe and correct the problem. No additional compensation will be allowed.

Backfilling of trenches will be carefully done with select material thoroughly tamped to a point above the top of the pipe as specified under "Excavating and Backfilling Trenches for All Pipe Lines."

Measurement and Payment:

Pipe shall be paid per linear foot according to the depth for the appropriate size and type measured from the original ground elevation of the centerline of the trench to the invert of the pipe. The unit price bid shall include the furnishing of pipe, hauling, labor, supervision, equipment and tools necessary for installing the pipe as shown on the Engineer's drawings or as may be directed by the Engineer. Pipe laid deeper than proposed (due to Contractor error) shall be paid for at the proposed depth. Pipe laid shallower than proposed shall be paid for at shallower depth. Quantities shall be determined based on the as-built horizontal distance from center of manhole cover to center of manhole cover. Payment for pipe installation will not be
made until the areas disturbed by the pipe installation have been restored to their original grade and satisfactorily seeded and mulched.

Cored tie-ins to manholes shall be measured and paid for at the unit price bid per each for Core Into Manhole for the appropriate size and type of pipe.

All bedding stone will be measured and paid in tons for Stabilization Stone. Stabilization Stone shall be measured and paid as the actual number of tons of this material weighed in trucks on certified platform scales or other certified weighing devices.

No direct payment will be made for furnishing and installing concrete anchors, flexible sleeves, donuts or couplings (including #57 stone), as such work will be incidental to the installation of the pipe.

Anti-Seepage Collars shall be paid per each.

Polyethylene Encasement shall be paid per linear foot.

**SANITARY SEWER MANHOLE**s: All manhole construction shall conform to City of Winston-Salem’s detail drawings. Manholes, rings and covers shall be built at the locations, and of the type specified, on the Engineer's drawings. Manholes shall be constructed of precast reinforced concrete. Manhole shelves and channels shall be constructed of precast concrete unless otherwise approved by the Engineer and shall conform to the City of Winston-Salem’s detail drawing for “Precast Reinforced Concrete Manhole with Precast Invert”. Vent pipes shall be installed as noted on the plan or as directed by the Engineer. Vent pipes shall be constructed of 4” ductile iron pipe and installed as shown on the City of Winston-Salem’s detail drawing for “Type “B” 4’ and 5’ Precast Reinforced Concrete Manhole”. Rim and invert elevations of manholes shall be as shown on the Engineer's drawings.

Channels shall be a depth of three-quarters of the diameter of the pipe and shall conform to the inside diameter of the influent and effluent pipes. The channel shall be constructed from the invert of the influent pipe to the invert of the effluent pipe. The channel shall be smooth in order to avoid any turbulence in the manhole. Manhole shelves shall slope from the manhole wall to the channel. The shelf at the wall shall be a minimum of three inches (3”) higher than the shelf at the channel. A maximum of two inches (2") shall be allowed for the protrusion of the influent and effluent pipes beyond the inside wall of the manhole.

All manhole joints shall be sealed on the outside of the manhole with butyl adhesive tape (minimum 6" wide). The tape shall be EZ-Wrap by Press-Seal Gasket Corp. or approved equal. When unstable subgrade is encountered, manholes shall be bedded on stabilization stone. Manholes on outfalls shall be built 24” above existing ground unless a Type "B” manhole is used or the manhole is in a yard. Precast reinforced concrete manholes used on right-of-way maintained by the North Carolina Department of Transportation must be approved by the North Carolina Department of Transportation before being installed.

The Contractor shall install manhole check valves when noted on the plan, or as directed by the Engineer. Check valves shall be installed as shown on the City of Winston-Salem detail drawing for “Manhole Check Valve”.
The Contractor shall be responsible for adjusting the manhole ring and cover to street grade. All points on the top edge of the ring and cover shall match street grade before the Contractor is relieved of any further adjustments. Final adjustment is generally determined at the time of the street cut repair.

**Measurement and Payment:**

*Manholes* will be measured and paid in units of each for the appropriate size and type. The unit price bid shall include the furnishing of manholes, hauling, labor, supervision, equipment and tools necessary for installing the manhole as shown on the Engineer's drawings or as may be directed by the Engineer. Such price shall also include construction of the manhole shelf and channel, furnishing and installing sealant and furnishing, installing and adjusting the necessary ring and cover as noted on the plan or as directed by the Engineer.

Manholes exceeding a height of six feet (6.0'), measured from the top of the manhole cover to the invert at the center of the manhole, shall be considered extra depth. Payment for the portion of manhole installation in excess of 6.0 feet will be measured and paid at the unit price bid per linear feet for *Extra Depth Manholes* for the appropriate size. Manholes installed deeper than proposed (due to Contractor error) shall be paid for at the proposed depth. Manholes installed shallower than proposed shall be paid at the shallower depth.

*4” D.I. Vent Pipes* shall be paid in linear feet measured from the vent opening to the top of the manhole.

*Manhole Check Valves* shall be paid per each for the appropriate size.

**DROP ASSEMBLIES (INSIDE AND OUTSIDE):** Whenever the vertical distance between the influent and effluent pipes is 30" or more, the Engineer shall require a drop assembly. Drop assemblies shall be installed per the City of Winston-Salem detail drawings for “Drop Assembly (Outside)” or “Drop Assembly (Inside)”. If the distance is less than 30", the influent pipe will come into the manhole on the invert of the channel unless the shelf is noted on the Engineer’s drawings.

**Measurement and Payment:**

Drop assemblies will be paid for at the unit price bid per linear foot for *Outside Drop Assembly* or *Inside Drop Assembly* and shall include furnishing and installing the tee, a vertical drop pipe down the side of the manhole, straps, nipples, 90 degree bend at the bottom of the drop pipe and one joint of D.I. or PVC pipe as shown on the appropriate detail. The distance paid for shall be measured from the invert at the top of the drop pipe to the invert at the bottom of the drop pipe. No separate payment will be made for furnishing and installing stabilization stone, Fernco couplings or concrete collar, as shown on the details drawings, as such work will be incidental to the installation of the drop assembly.

**SEWER CONNECTIONS:** All sewer connections shall be bored under existing pavement unless otherwise noted on the plan or approved by the Engineer. Sewer connections shall be installed as shown on the appropriate City of Winston-Salem detail drawing. Wyes or taps will not be allowed within 5 feet of a manhole. Only one bend will be allowed for connecting the sewer connection to
If more than one bend is needed (Ex: bored sewer connection), the road shall be open cut and the connection installed properly. Sewer connections shall be a maximum of 75 feet from the sewer main to the cleanout. Cleanouts shall be installed between property corners of the lot for which the connection is intended.

Connections into manholes will require a flexible sleeve at the manhole. If approved by the Engineer, four-inch (4") connections will be allowed to spill into deep manholes. For connections which spill, the 4" pipe shall protrude a minimum of 4" and a maximum of 6" beyond the inside wall of the manhole. Connections into manholes must be at least 6" from the nearest manhole step. Six-inch (6") connections must connect into a manhole.

Measurement and Payment:

Sewer Connections will be measured and paid per each for the appropriate size and shall include the wye or approved tapping saddle and all other service piping and fittings shown on the appropriate detail drawing unless otherwise noted. When necessary, sewer connections may be bid as either short side, long side open cut or long side bored. The unit price bid for these connections shall only include the materials, labor and equipment necessary to install the connection.

SEWER FORCE MAINS (PVC): Installation (including pressure testing) shall conform to the installation of PVC water pipe contained hereafter. Disinfection will not be required. PVC pipe will be handled with care and shall not be dumped, dragged, dropped or thrown. Heavy materials must not be top loaded on PVC pipe. PVC pipe shall not be stored uncovered in direct sunlight. Trenches will be carefully graded to insure continuous and equal bearing the full length of all joints. Backfilling of trenches will be carefully done with selected material removing all sharp rocks. Air release valves shall be located at all high points as shown on the Engineer’s drawings.

A solid copper-clad steel tracer wire of #12 gauge (or larger) with a 30 mil green high density polyethylene (HDPE) insulation shall be installed with all buried plastic PVC force mains. The tracer wire shall be installed directly over and on the center of the pipe. Wire nut splices shall not be allowed. After installation, the tracer wire shall be tested for continuity. The tracer wire shall be considered acceptable when a continuous non-interrupted read is obtained for the entire length of the pipe line. A 6” wide identification tape printed with the wording “SEWER” shall be installed 18 inches above the pipe.

Measurement and Payment:

Force Mains shall be paid per linear foot for the appropriate size and type. The unit price bid shall include the furnishing of pipe, hauling, labor, supervision, equipment and tools necessary for installing the pipe as shown on the Engineer's drawings or as may be directed by the Engineer. Payment for force main installation will not be made until the areas disturbed by the pipe installation have been restored to their original grade and satisfactorily seeded and mulched.

No direct payment will be made for furnishing and installing tracer wire and identification tape, as such work will be incidental to the installation of the pipe.
**VACUUM TESTING OF MANHOLES:** Each manhole constructed by the Contractor shall be vacuum tested by the Contractor after assembly of the manhole. Prior to testing, and as directed by the Engineer, the Contractor shall clean out each manhole without foreign material being discharged into the existing sanitary sewer system. The test shall be conducted in accordance with ASTM C-1244. The test shall be performed after all grade rings and rings and covers have been installed. After the testing equipment is in place, a vacuum of 10 inches of mercury shall be drawn on the manhole. The time for the vacuum to drop to 9 inches of mercury must be greater than the minimum time listed below:

<table>
<thead>
<tr>
<th>Manhole Depth</th>
<th>4’</th>
<th>5’</th>
<th>6’</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10’</td>
<td>60 sec.</td>
<td>75 sec.</td>
<td>90 sec.</td>
</tr>
<tr>
<td>10 - 15’</td>
<td>75 sec.</td>
<td>90 sec.</td>
<td>105 sec.</td>
</tr>
<tr>
<td>15 - 25’</td>
<td>90 sec.</td>
<td>105 sec.</td>
<td>120 sec.</td>
</tr>
<tr>
<td>25 - 30’</td>
<td>105 sec.</td>
<td>120 sec.</td>
<td>135 sec.</td>
</tr>
</tbody>
</table>

The Engineer shall be present during the entire testing process. Any subsequent repairs to manholes which fail the vacuum test must be made on the inside and outside of each manhole. The Contractor will be responsible for the complete removal of all plugs.

**Measurement and Payment:**

No direct payment will be made for vacuum testing of manholes, as such work will be incidental to the installation of the manhole.

**AIR TESTING OF SEWER MAINS:** A low-pressure air test shall be performed by the Contractor after the pipeline is completely backfilled and before being placed into service. The Engineer must be present during the entire testing process. Any work done without their supervision will not be accepted.

**Low Pressure Air Testing Requirements:**

The Contractor shall use an approved pressure gauge and perform the test in accordance with ASTM C-828. Each section of pipeline (including connections) between manholes will be tested by plugging the upstream manhole and the downstream manhole. By using mirrors, lights, etc., the Contractor must show the Engineer that the 2 plugs are at the proper location and that the line is clear between the plugs. Air is added to the line until the pressure is between 3.0 psi and 4.0 psi. If the pressure drops more than 1.0 psi during the time shown on the chart below, the line is presumed to have failed the test. An obvious leak in any section will be corrected even if the section passes testing. The Contractor will be responsible for the complete removal of all plugs.
Air test time shall be as follows:

**Minimum Air Test Time**

<table>
<thead>
<tr>
<th>Main Size</th>
<th>Time (minutes per 100 feet of pipe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8”</td>
<td>1.5</td>
</tr>
<tr>
<td>10”</td>
<td>1.8</td>
</tr>
<tr>
<td>12”</td>
<td>2.1</td>
</tr>
<tr>
<td>15”</td>
<td>2.4</td>
</tr>
<tr>
<td>18”</td>
<td>2.7</td>
</tr>
<tr>
<td>21”</td>
<td>3.3</td>
</tr>
<tr>
<td>24”</td>
<td>3.9</td>
</tr>
<tr>
<td>27”</td>
<td>4.5</td>
</tr>
<tr>
<td>30”</td>
<td>5.1</td>
</tr>
<tr>
<td>36”</td>
<td>6.3</td>
</tr>
<tr>
<td>42”</td>
<td>7.6</td>
</tr>
</tbody>
</table>

**Measurement and Payment:**

No direct payment will be made for acceptance testing, as such work will be incidental to the installation of the pipe and/or service connections.

**VIDEO INSPECTION:** As a final measure required for acceptance, the Contractor shall clean and televise all sanitary sewer mains prior to requesting final inspection. The Contractor shall televise the entire sewer main and all service connections using standardized NASSCO (PACP, MACP, & LACP) practices, unless otherwise specified below. The process shall begin at the upstream manhole for each segment, and proceed to the downstream manhole for that same segment. Connections shall be televised from the cleanout to the main. Video inspection may occur only after Record Drawings are accepted and approved by the City of Winston-Salem. Prior to beginning the process, a 24 hour notice must be given by the Contractor to the Engineer. Prior to video inspection in paved areas, structures must be raised to final grade and 2” of asphalt must be in place. The City will not accept video that is more than 180 days old unless approved by the Engineer.

The cameras used for inspection shall be ones specifically designed and constructed for sanitary sewer pipeline inspection. Lighting for the cameras shall be suitable to provide a clear color picture of the entire periphery of the pipe. The cameras used for mains must be able to pan, tilt and zoom in order to allow for 360 degree viewing. The television system shall be equipped to indicate the camera travel distance in feet by display on the video viewing screen. All television equipment (camera, monitor, etc.) must be capable of producing picture quality which is satisfactory to the Engineer.

Within 2 hours of the video inspection, the Contractor shall clean the sewer mains and service connections with a high velocity water jet. All debris shall be collected in the downstream manhole and removed by the Contractor. Debris shall not be released into the existing sewer system. During the entire video process, the distance counter must be set at zero at each upstream manhole for each segment (set the counter at zero at the ground for each service connection). The Contractor will be required to pan and tilt at each manhole and at each service connection. The
interior of each manhole must be marked with the manhole station (or manhole number) with paint or some other legible identifier (6” - 12” high letters or numbers). Each cleanout stack must be marked with the house number or the lot number. For mains, the Contractor will also be required to pan, tilt and zoom at all couplings, at all dates for Protecto 401 lined ductile iron pipe, and when any potential problems or abnormalities are noticed or suspected. Travel speed for the camera will be 15 - 30 feet per minute. The following video screen data will be required:

- Project name and project number
- Date of inspection
- Travel distance and time
- Station of start and end manholes
- Depth of start and end manholes
- Size of main
- Type of pipe

All above data shall be shown at the start and end manholes of each segment. While the camera is moving through the main and service connections, distance shall be the only data shown on the screen (top left or top right of screen).

For mains, a stream of water approximately 1” in width must be flowing during the entire video process. For service connections, a minimum of 5 gallons of water must be introduced into each cleanout stack just prior to the video process. In all cases, the flow must be shown on the bottom of the video screen.

Two copies of the entire video inspection along with a properly formatted PACP standard exchange database shall be submitted to the Engineer on a data disc (DVD or flash drive). A "properly formatted PACP standard exchange database" includes properly PACP coded defects (NASSCO version 6.x), proper media paths to associated video files, and all asset IDs used in the inspection must match what the submitted record drawings indicate for each asset. The video file shall be formatted to MPEG-4 (MP4) with software compatible and readable by the City of Winston-Salem. The City of Winston-Salem shall not be responsible for purchasing additional software necessary to view the video file. Each inspection (manhole to manhole or cleanout to main) shall be separated into its own chapter or file. In the event of a main inspection, the chapter or file shall be named to indicate the upstream manhole station or number and then the downstream manhole station or number (e.g. MH1-MH2). In the event of a service connection inspection, the chapter or file shall be named to indicate the house number or lot number associated with the inspection. All file naming should match the identification numbers (manhole station or number, house number, or lot number) shown on the Record Drawings. The submitted video must have the ability to be viewed using fast forward and rewind.

Any video that does not clearly show the pipe and service connections will be rejected. In the event that repairs are made, the segment receiving the repairs shall be flushed and televised again. The Engineer must oversee the entire cleaning and televising process. Final approval of the video inspection will only be after the Engineer has reviewed the video in the office (videos will not be field approved).
Measurement and Payment:

No direct payment will be made for cleaning and video inspection, as such work will be incidental to the installation of the pipe and/or service connections.

WATER

INSTALLATION OF WATER PIPE:

1. Installation Requirements For All Water Pipe

The Contractor shall furnish and install pipe to a depth as shown on plans at all locations required by the Engineer. Minimum cover will be 36 inches (36”) unless otherwise approved by the Engineer. Pipe laying for ductile iron will generally conform to ANSI/AWWA C600. Pipe laying for PVC will generally conform to ANSI/AWWA C605.

All material for the laying and jointing ductile iron and PVC pipe in the trench will conform to the specifications for such material as hereinbefore given and will be furnished by the Contractor. Pipe, fittings, valves and other pipe line accessories shall be loaded, transported, unloaded, stored, handled and installed by methods that will insure final installation in a sound and undamaged condition. Ductile iron pipe and fittings shall be handled in such a manner that neither the lining nor the coating will be damaged. PVC pipe shall be loaded and unloaded in accordance with the manufacturer’s published recommendations. Recommended hauling devices, such as hooks inserted in the ends of pipe, shall have well-padded surfaces. All PVC water pipe will be shipped and stored at the project in such a manner as to be protected from exposure to direct sunlight and heat sources such as engine exhaust. Ductile iron pipe and fittings in which the linings are broken or loosened in unloading or subsequent handling shall be rejected by the Engineer. Under no circumstances shall water main pipe, fittings or valves be dropped to the ground onto or against hard or solid objects or materials, or otherwise subjected to possible damage from impact or shock. In distributing pipe line materials at the site of the work, each piece shall be unloaded opposite or as close as possible to the installation in order to avoid unnecessary rehandling. All gaskets shall be stored out of direct sunlight.

All pipe will be thoroughly cleaned of all dirt and other debris before being placed in the trench. Pipe will be laid on true lines and grades as directed by the Engineer. Pipe shall normally be laid with the bell ends facing the direction of laying. Bell holes will be dug at each joint to assure the pipe barrel will lie flat on the trench bottom. Every open end of the pipe will be securely plugged when pipe laying is not in progress.

Standard corporation cocks will be installed at any location as directed by the Engineer for filling, flushing or disinfecting the line. They shall be left tightly closed after the line is completed.

All taps shall be made after the water main has pressure. No "dry" taps will be allowed. On dead end mains, taps for permanent water connections shall not be made beyond the last hydrant or blowoff.
Direct tapping of Ductile Iron (without a saddle) will be allowed in accordance with the following:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Maximum Size Tap Without Saddle</th>
</tr>
</thead>
<tbody>
<tr>
<td>4”</td>
<td>½”</td>
</tr>
<tr>
<td>6”</td>
<td>1”</td>
</tr>
<tr>
<td>8”</td>
<td>1”</td>
</tr>
<tr>
<td>12”</td>
<td>1 ½”</td>
</tr>
</tbody>
</table>

All concrete and asphalt driveways less than 30 feet in width shall be bored (no encasement) for installation of all water pipe up to and including 8” pipe. The auger bit shall be just large enough to allow passage of the pipe bell through the bored hole.

2. Installation Requirements for Ductile Iron Pipe

a. General Requirements:

When warranted, polyethylene encasement shall be installed on the ductile iron pipe at the locations shown on the Engineer’s drawings. Installation of the polyethylene shall conform to Method “B” outlined in Section 4.3.2.2 of ANSI A21.5 (AWWA C105).

All valves, hydrants and fittings will be placed in the line as indicated on the Engineer's drawings and in accordance with instructions from the Engineer. On stub outs, the Contractor shall be required to use retainer glands on the valve and on all fittings (see City of Winston-Salem detail drawing for “Stub-Out Installation”). Gate valves shall require cast iron valve boxes. Eight-inch PVC or 8” ductile iron pipe shall be installed vertically centered over the valve nut and the valve box placed over the 8” pipe (see City of Winston-Salem detail drawing for “Valve Box Installation”). All existing valves larger than 12” that must be operated shall be operated by the Utilities Division of the City of Winston-Salem. The Engineer must be present if existing valves are operated by the Contractor.

Tapping sleeves and valves shall be used for "wet" taps into existing water mains as indicated on the Engineer's drawings. The Contractor shall verify the type of material, size, etc., of the existing main prior to ordering the sleeve. For taps on larger mains (24" and above), a saddle may be used in lieu of a sleeve, but only if the tap is less than or equal to half the size of the line to be tapped. All tapping sleeves and valves shall be water tested before the tap is made. Test pressure shall be 200 psi for 15 minutes without any drop in pressure. All tapping sleeves and valves shall be installed level. The Engineer must be present during the entire tapping and testing process.

All manholes installed on State maintained right-of-way must be approved by the North Carolina Department of Transportation. Cast iron manhole rings and covers will be furnished and set in mortar. Covers will have the word "Water" cast thereon.

Sleeves used for tying to existing mains, etc. shall be made of ductile iron (minimum 12" in length). If after all pipe is homed up, the gap between the two plain ends is more than 1", a filler shall be cut to go between the two plain ends. The filler shall be at least...
3" wide but not more than 5" wide, and shall be ½" wider than the depth of the mechanical joint bell for that size of pipe.

Bell joint leak clamps shall be made of ductile iron.

b. Requirements For Ductile Iron Mechanical Joints:

The bell, spigot, gland and gasket shall be wiped clean (and wire brushed if necessary) of all dirt, sand, etc. The bell, spigot and gasket shall then be coated with soapy water or approved pipe lubricant and the gland and gasket slipped over the spigot end of the pipe. The spigot shall then be centered in the bell and the gasket carefully pushed evenly into the bell. The gland shall be pushed up to the gasket with the gland being parallel to the face of the bell. Bolts shall be inserted and the nuts tightened uniformly by hand until snug. At this point the joint may be deflected if so desired. Final tightening of the bolts shall be done with a ratchet torque wrench, unless the Engineer decides that a non-torque wrench is acceptable. It is essential that the gland be brought toward the pipe bell evenly, maintaining approximately the same distance between the gland and the face of the bell at all points. This may be done by partially tightening the bottom bolt; then the top bolt; next, the bolts on either side; and finally the remaining bolts, alternately tightening bolts 180 degrees apart. This cycle is then to be repeated until all bolts are tightened to a torque as listed below:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Bolt Size</th>
<th>Torque (Foot-Pounds)</th>
<th>Length of Non-Torque Wrench</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot;</td>
<td>⅝&quot;</td>
<td>45 - 60</td>
<td>8&quot;</td>
</tr>
<tr>
<td>4&quot;-24&quot;</td>
<td>¾&quot;</td>
<td>75 - 90</td>
<td>10&quot;</td>
</tr>
<tr>
<td>30&quot;-36&quot;</td>
<td>1&quot;</td>
<td>100 - 120</td>
<td>14&quot;</td>
</tr>
</tbody>
</table>

If effective sealing is not obtained at the maximum torque specified for the size of bolt used, the joint shall be disassembled, thoroughly cleaned and reassembled. Overstressing of bolts to compensate for poor installation practice will not be permitted.

c. Requirements For Ductile Iron Push On Joints:

All interior bell and exterior spigot surfaces shall be cleaned, the gasket installed in the bell, and all joint surfaces lubricated with the pipe manufacturer's lubricant. Lubricant shall be applied according to each manufacturer's recommendations. Gaskets from different pipe companies are not interchangeable. The spigot end must be beveled. The spigot shall then be pushed straight into the full depth of the bell. The spigot end of the pipe shall not be allowed to touch the ground or trench wall after lubrication. The joint may be deflected only after the joint is assembled. All instructions and recommendations of the pipe manufacturer relative to gasket installation and jointing operations shall be observed and followed by the Contractor. It is essential that each gasket is in proper position when the pipe is "shoved home." A leaking joint will result from an improperly made joint. Each defective joint, if any, discovered after pipe has been laid, shall be repaired by and at the expense of the Contractor by a method acceptable to and approved by the Engineer.
Joint deflection for mechanical and push-on joints shall in no case be greater than 80 percent of the maximum recommended by the pipe manufacturer and/or ANSI/AWWA C600.

Installation Requirements For 2” PVC Push On Joints:

All instructions and recommendations of the pipe manufacturer relative to gasket installation and jointing operations shall be observed and followed by the Contractor. All interior bell and exterior spigot surfaces, the fitting and the elastomeric gaskets shall be cleaned. Factory installed gaskets should not be removed. The pipe manufacturer’s lubricant shall be applied in accordance with the pipe manufacturer’s published recommendations. The spigot end of the pipe shall not be allowed to touch the ground or trench wall after lubrication. The elastomeric gasket will have been factory installed in most bell joints. If the gasket is not pre-installed, position the gasket in the annular groove of the bell or coupling. To assure compatibility, only gaskets supplied by the particular pipe and fitting manufacturer(s) shall be used. Pipe spigot ends are pre-marked at the factory with a circumferential insertion line. This line references how far the spigot should be inserted into the adjoining PVC pipe bell. Field-cut pipe spigot ends shall be marked and beveled to match the manufacturer’s insertion line. Pipe-to-pipe joints shall be assembled to only to the insertion line. After assembly, the insertion line shall remain visible and be nearly flush with the lip of the adjoining PVC pipe bell. Joints assembled beyond the insertion line shall be considered over-assembled and may result in damaging stresses or leakage. The bell or coupler shall be in straight alignment with the pipe spigot end before and during joint assembly.

Pipe design laying condition shall be Type 2, flat-bottom trench with backfill lightly consolidated to centerline of pipe except when pipe is bent longitudinally within a curve. When installing pipe within a curve the pipe laying condition shall be Type 3, with the pipe bedded in a minimum of 4 inches of loose soil with backfill lightly consolidated to the top of the pipe. When laying 2” PVC in other than a straight line, the trench may be curved to change direction as shown on the plans and shall in no case be curved in less than a 50 foot radius. All curvature should be accomplished by bending the pipe rather than by deflecting the joints. There is no deflection allowed at the joints. To avoid deflecting the joints while achieving curvature, joints shall be sufficiently braced or backfilled and compacted to keep them stationary. It is essential that each gasket is in proper position when the pipe is “shoved home.” A leaking joint will result from an improperly made joint. Each defective joint, if any, discovered after pipe has been laid, shall be repaired by and at the expense of the Contractor by a method acceptable to and approved by the Engineer.

For installation of PVC pipe to PVC couplings or PVC fittings the above procedure shall be followed except the factory-applied insertion line may not provide for proper depth of assembly. The Contractor shall determine the proper insertion depth by measuring the inside depth of the fitting bell or coupler and subtracting no less than 0.5 in. while also ensuring that full engagement of the gasket with the joined pipe spigot will occur. The Contractor shall mark new insertion line(s) on the pipe spigot(s) to be joined. After assembly, the new insertion line shall be nearly flush with the lip of the adjoining coupler or PVC fitting bell. When installing PVC pipe to metallic fittings, the insertion depth is generally less than those of PVC pipe and fittings. Before assembly or insertion, the Contractor shall make sure the pipe spigot end is squarely cut, deburred and given only a slight outer bevel. If the pipe spigot end has the factory bevel, the factory bevel shall be removed or shortened to ensure that when assembled the gasket
will be in full contact with the nonbeveled portion of the pipe outside diameter. The fitting manufacturer’s assembly recommendations shall be followed.

A solid copper-clad steel tracer wire of #12 gauge (or larger) with a 30 mil blue high density polyethylene (HDPE) insulation shall be installed with all buried plastic water mains and connected to blow-off assemblies and services. The tracer wire shall be installed directly over and on the center of the pipe. The tracer wire shall be installed so that electrical continuity is maintained throughout the pipe system. As few connections as possible shall be made in the tracer wire. Connections will be made using a corrosion proof connector recommended for direct burial use. Wire nut splices shall not be allowed. After installation, the tracer wire shall be tested for continuity. The tracer wire shall be considered acceptable when a continuous non-interrupted read is obtained for the entire length of the pipe line. For blow-off assemblies and water services connected to plastic water main pipe, tracer wire shall be spliced to water main tracer wire and extended to the water meter box. A 6” wide identification tape printed with the wording “WATER” shall be installed 18 inches above all PVC water pipe.

Two (2) inch water mains taps to a 6 inch or larger water main must be installed in accordance with the City of Winston-Salem detail drawing for “2” Water Main Tap to 6” or Larger Water Main”. Two (2) inch water mains taps to a 6 inch or larger water main shall be installed where shown on the Engineer’s drawings or as directed by the Engineer.

Measurement and Payment:

*Driveway Bores* shall be paid per linear foot. Measurement shall be based upon the width of each driveway along the centerline of the water main plus five feet.

No payment will be made for corporation cocks installed as directed by the Engineer for filling, flushing or disinfecting the line.

Ductile Iron Pipe

*Ductile Iron Water Mains* shall be paid per linear foot for the appropriate size. Measurement shall be based on the total horizontal centerline distance along the water main plus the length of any hydrant legs installed measured from the center of the main to the center of the hydrant. No deduction will be made for valves, fittings, manholes, etc. The unit price bid shall include the furnishing of pipe, hauling, labor, supervision, equipment and tools necessary for installing the pipe as shown on the Engineer's drawings or as may be directed by the Engineer. Payment for pipe installation will not be made until the areas disturbed by the pipe installation have been restored to their original grade and satisfactorily seeded and mulched.

*Polyethylene Encasement* shall be paid per linear foot.

*Ductile Iron Fittings* shall be paid per pound and shall include the cost of furnishing and installing the fittings and accessories. Payment will be made based on weights for ductile iron fittings as listed in AWWA C110. Weights for fittings up to and including 30" are on file in the Engineering Division. The weights to be used for payment include fitting weight only. No payment will be made for glands, bolts and gaskets. In case of discrepancy, the City chart shall prevail over AWWA C110.
Tapping Sleeves and Valves shall be paid per each for the appropriate size.

Gate Valves (temporary and permanent) shall be paid per each for the appropriate size and shall include furnishing and installing cast iron valve boxes (or manholes if specified).

Air Release Valves shall be paid per each for the appropriate size and shall include furnishing and installing a corporation cock on the main, two bronze ball valve curb stops, brass pipe, brass fittings, air release valve, and manhole as indicated on City of Winston-Salem detail drawings for “Air Release Valve”.

PVC Pipe

PVC Water Mains shall be paid per linear foot. Measurement shall be based on the total horizontal centerline distance along the water main and shall include all fittings, jointing materials, blocking, and other necessary appurtenances. The unit price bid shall include the furnishing of pipe, hauling, labor, supervision, equipment and tools necessary for installing the pipe as shown on the Engineer's drawings or as may be directed by the Engineer. Payment for pipe installation will not be made until the areas disturbed by the pipe installation have been restored to their original grade and satisfactorily seeded and mulched. No direct payment will be made for furnishing and installing tracer wire and identification tape, as such work will be incidental to the installation of the pipe.

Two (2) inch water mains taps to a 6 inch or larger water main shall be paid per each and shall include everything shown on the City of Winston-Salem detail drawing for “2” Water Main Tap to 6” or Larger Water Main”.

WATER CONNECTIONS: All water connections shall be bored under existing pavement unless otherwise noted on the plan or approved by the Engineer. Water connections shall be installed as shown on the appropriate City of Winston-Salem detail drawing. All 5/8” - 2” meters will be installed by the City of Winston-Salem.

Measurement and Payment:

Water Connections will be measured and paid per each for the appropriate size and shall include everything shown on the appropriate City of Winston-Salem detail drawing except for the meter and the expansion connection. When necessary, water connections may be bid as either short side, long side open cut or long side bored. The unit price bid for these connections shall only include the materials and installation cost necessary to install everything shown on City of Winston-Salem detail drawings except for the meter and the expansion connection.

CUTTING OF GRAY IRON, DUCTILE IRON AND PVC PIPE: Gray iron pipe will be cut with one of the following devices: Hydraulic cutters, wheel-type cutters or saw. Ductile iron pipe will be cut with a saw only. PVC pipe will be cut with a circular saw, handsaw or similar equipment. Any variations in the above-described must have prior approval of the Engineer. Pipe ends must be beveled if used for push-on joint.
Measurement and Payment:

No direct payment will be made for cutting pipe, as such work will be incidental to all other work performed.

CONCRETE THRUST BLOCKS: Concrete thrust blocks shall be constructed as directed by the Engineer at all bends, tees, tapping sleeves, tapping saddles, reducers, plugs, etc. to provide restraint against thrust resulting from internal pressure. Any exceptions to this such as restrained joints or mechanical joints with retainer glands will be noted on the Engineer's drawings or otherwise specified. Thrust blocks will not be required for restrained joint pipe (exception - blocking will be required when connecting restrained pipe to existing pipe).

All thrust blocks will be constructed of a minimum of Class A concrete. Thrust blocks for bends, fire hydrants, tees and stub-outs shall be constructed in accordance with the City of Winston-Salem thrust block detail drawings.

Polyethylene shall be placed over all fittings before the concrete is poured. All nuts and bolts shall be clear of concrete so that the joint will be accessible. Plywood shall be used as forms for blocking. Concrete is to be poured only against stable undisturbed soil and should be allowed to set prior to any backfilling. Thrust blocks should be allowed to cure two days prior to pressure testing the water main. Higher strength concrete may be required when it is necessary to pressure test prior to the end of the two day curing time.

Measurement and Payment:

No direct payment will be made for thrust blocks and straps where the size of the pipe is 12 inches in diameter or smaller. For pipe larger than 12 inches, thrust blocks and straps will be paid for at the unit price bid per cubic yard for *Class A Concrete*. The Contractor shall be responsible for presenting concrete delivery tickets to the Engineer at the time of delivery. Payment shall be based upon the quantity of concrete required by the Engineer.

SETTING FIRE HYDRANTS: Hydrants must be installed in accordance with the City of Winston-Salem detail drawing for “Hydrant and Valve Installation” and may not be backfilled until inspected and approved by the Engineer. Hydrants will be set at the location shown on the Engineer's drawings or as directed by the Engineer.

Hydrants will normally be three and one-half feet from the ground to the bottom of the hydrant (42" bury). However, when plans indicate a deeper bury is required, such hydrants will be furnished conforming to the depth of bury as shown on the plans. Hydrant extensions will be installed only if necessary. When installing a hydrant extension, care shall be taken to insure that the breakable safety coupling in the main valve stem is at the same location as the safety flange on the barrel.

A concrete thrust block will be poured behind and under the hydrant shoe. No. 57 stone will be placed around the base of each hydrant from the bottom of the thrust block to within 12 inches of the surface of the ground. The stone will extend at least 6 inches away from the hydrant barrel in all directions. The Contractor shall take particular care to prevent the stone from becoming filled with earth or other improper material which will prevent proper drainage from the hydrant barrel.
Each hydrant shall be painted with at least one coat of yellow paint (See Fire Hydrants, Section A - Materials) after the hydrant has been set and final grade has been established.

Measurement and Payment:

*Hydrants* will be measured and paid as the actual number furnished, installed and accepted. The pay limits for hydrants are as shown on the detail drawing for “Hydrant and Valve Installation”. No direct payment will be made for installation of the concrete thrust block or furnishing and installing No. 57 stone, as such work will be incidental to the installation of the hydrant.

*Hydrant Extensions* will be measured and paid for in linear feet of pipe that has been incorporated into the completed work.

Payment for all other items shown on the detail drawing for “Hydrant and Valve Installation” including 6” D.I. pipe for hydrant leg, 6” gate valve and box, tee and tapping sleeve and valve will be paid for at the unit prices for other pay items included in the contract.

**BLOW-OFF ASSEMBLIES:** Blow-off assemblies shall be placed as indicated on the Engineer’s drawings or as directed by the Engineer.

Measurement and Payment:

*Blow-Off Assemblies* will be measured and paid per each for the appropriate size and shall include installation of everything shown on the City of Winston-Salem detail drawing for “Blow-Off Assembly”.

**FLUSHING:** Prior to pressure testing and disinfection, the Contractor shall flush all water mains with a polyurethane foam pipe pig (minimum 5 pounds per cubic foot density) by Knapp Poly Pig, Inc. or approved equal. The pipe pig shall be propelled hydraulically through the mains at a rate sufficient to remove all foreign matter. Valves shall be operated in a manner which will direct the pipe pig toward the end of the main or a selected discharge point. The pig shall be removed through an open end of the main, a fitting, or through a fire hydrant which has the main valve seat ring removed. Flushing shall continue until the Engineer determines that the mains are free from all foreign matter. The Engineer must be present during the entire flushing process. Any work done without the Engineer’s supervision will not be accepted.

Measurement and Payment:

No direct payment will be made for flushing, as such work will be incidental to the installation of the pipe.

**PRESSURE TESTING:** After flushing of the water main is completed, all ductile iron water mains shall be tested in accordance with AWWA C600 - Section 4 and two (2) inch PVC water mains shall be tested in accordance with AWWA C605 – Section 7. The test shall be performed with all hydrant valves (4 ½” or 5 1/4”) closed, but all hydrant leg valves (6”) open. All corporation cocks shall be open and angle valves inside meter boxes will be closed. The number of sections to be tested at one time shall be determined by the Engineer. Testing shall not be performed within
24 hours after the new main is filled or within two days after the thrust blocks have been poured. Test pressure at the high point in the new main shall be 200 psi, and this pressure shall be maintained for no less than two hours. Test pressures above 200 psi must be approved by the Engineer. If after the two hour period the pressure has dropped more than five psi, a quantity of water must be used to bring the pressure back up to test pressure. This quantity of water must be metered and shall not exceed the following allowable leakage figures:

<table>
<thead>
<tr>
<th>MAIN SIZE</th>
<th>2”</th>
<th>4”</th>
<th>6”</th>
<th>8”</th>
<th>12”</th>
<th>16”</th>
<th>20”</th>
<th>24”</th>
<th>30”</th>
<th>36”</th>
</tr>
</thead>
<tbody>
<tr>
<td>GALLONS</td>
<td>0.38</td>
<td>0.76</td>
<td>1.15</td>
<td>1.53</td>
<td>2.29</td>
<td>3.06</td>
<td>3.82</td>
<td>4.59</td>
<td>5.73</td>
<td>6.88</td>
</tr>
</tbody>
</table>

* This table is figured for 200 psi. Engineer will provide allowable leakages for higher test pressures.

If the allowable leakage is exceeded or if pressure drops more than 15 psi, the test fails. All leaks shall be repaired regardless of whether or not the allowable leakage is exceeded. The Engineer must be present during the entire pressure testing process. Any work done without their supervision will not be accepted.

Measurement and Payment:

No direct payment will be made for pressure testing, as such work will be incidental to the installation of pipe.

**DISINFECTION:** All water mains shall be disinfected by the Contractor in accordance with AWWA C651. The Contractor shall furnish qualified personnel to do the work who are experienced with chlorine and disinfecting agents. Disinfection shall be accomplished by the continuous feed method using liquid chlorine or a hypochlorite solution. If liquid chlorine (100 percent available chlorine) is used, a chlorine-gas water mixture shall be injected into the new main through a solution feed chlorinator and a booster pump. If hypochlorite is used, the hypochlorite solution shall be applied to the new main with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. In addition, a rate setter or meter may be required in order that the flow in gallons per minutes may be determined. Hypochlorite shall either be calcium hypochlorite (65 percent available chlorine in granular or tabular form) or sodium hypochlorite (5 - 15 percent available chlorine in liquid form).

Water from the existing distribution system or other approved source and the chlorine solution must both be made to flow at rates which will guarantee a chlorine concentration of 50-100 parts per million throughout the new main. This high concentration chlorine solution shall not be pumped into copper service connections (this could cause the copper to corrode). Concentrations above 100 parts per million must be approved by the Engineer. The main line valve separating the existing and new water mains shall remain closed during the disinfection process. A bypass line and backflow preventer will be used in order to prevent backflow into the existing system. The backflow preventer must be approved by the City of Winston-Salem Utilities Division. Pumping of the chlorine solution shall be continued until tests conducted at the extremities of the new main indicate a concentration of the required 50-100 parts per million. The chlorinated water shall then be retained in the new main for 24 hours, during which time all valves and hydrants in the new main shall be operated in order to disinfect all parts of the system. After the 24 hour period there
should be at least 10 parts per million concentration of chlorine throughout the main. The chlorinated water shall then be flushed from the main until the chlorine concentration in the water leaving the main is no higher than the concentration in the existing distribution system. The chlorinated water must be flushed into the sanitary sewer system or dechlorinated to 0 parts per million of chlorine prior to discharge. The Utilities Division must be notified prior to flushing. Dechlorination shall be accomplished in accordance with AWWA C655 using equipment by Pollard or approved equal. While the main is being flushed, all service connections shall be thoroughly flushed in order to disinfect each connection.

After final flushing and before the main is placed in service, a sample or samples shall be collected by City personnel from the line and tested for bacteriological quality. The number of samples to be taken and the location of the samples shall be determined by the Engineer. The minimum number of samples shall be one for every 4,000 feet of pipe. No hose or fire hydrant shall be used in collection of samples. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated by the Contractor until satisfactory samples have been obtained. The City, upon 24 hours advance notice, will furnish the personnel and laboratory facilities to conduct the required bacteriological tests. No samples will be taken on Friday, the day before a holiday or on a holiday.

The Engineer must be present during the entire disinfection process. Any work done without the Engineer’s supervision will not be accepted.

Pounds of calcium hypochlorite used for disinfection shall be as follows:

**Pounds of Calcium Hypochlorite Required To Disinfect Water Mains With 100 Parts Per Million of Chlorine**

<table>
<thead>
<tr>
<th>Main Size</th>
<th>Pounds Per 1000 Feet Of Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>2”</td>
<td>0.2</td>
</tr>
<tr>
<td>4”</td>
<td>0.8</td>
</tr>
<tr>
<td>6”</td>
<td>1.8</td>
</tr>
<tr>
<td>8”</td>
<td>3.1</td>
</tr>
<tr>
<td>12”</td>
<td>7.0</td>
</tr>
<tr>
<td>16”</td>
<td>12.4</td>
</tr>
<tr>
<td>20”</td>
<td>19.4</td>
</tr>
<tr>
<td>24”</td>
<td>28.0</td>
</tr>
<tr>
<td>30”</td>
<td>43.9</td>
</tr>
<tr>
<td>36”</td>
<td>63.0</td>
</tr>
</tbody>
</table>

Measurement and Payment:

No direct payment will be made for disinfection, as such work will be incidental to the installation of pipe.
FINAL PREPARATIONS

CONCRETE AROUND STRUCTURES: All manhole rings and covers and valve boxes located within any pavement area (including gravel and dirt streets) shall have placed around them a concrete collar constructed of Class A (3000 psi) concrete, 6" thick, extending a minimum of 12" from the outside circumference of the structure (refer to the City of Winston-Salem detail drawing for “Valve Box Installation” for details). For paved streets, the elevation of the top of the concrete collar shall be at the same elevation as the bottom of the surface course of pavement. For gravel or dirt streets, the elevation of the top of the collar shall be the same as the street elevation.

Measurement and Payment:

No direct payment will be made for the construction of concrete collars, as such work will be incidental to the installation of manhole rings and covers and valve boxes.

SEEDING AND MULCHING: The Contractor shall perform seeding and mulching on all earth areas disturbed by construction. All seeding and mulching will be completed within 14 calendar days following the initial ground disturbing activity or as required by the erosion control permit.

(a) Seedbed Preparation
Grass and weeds, if any, shall first be cut or otherwise disposed of satisfactorily. Areas to be seeded shall be brought to the proper line, grade and cross-section as shown on the plans or as required by the Engineer. Minor shaping and smoothing of uneven and rough areas outside of the graded section shall be done as directed by the Engineer in order to provide for more effective erosion control and for ease of subsequent mowing operations. All rocks shall be removed for Type I seeding and all rocks over 2" in diameter shall be removed for Type II seeding.

The soil shall be scarified or otherwise loosened to a depth of not less than five (5) inches. After initial scarification, dolomitic limestone and fertilizer shall be applied to the soil and worked in throughout the scarified zone. The top two or three inches of soil shall be worked into a satisfactory seedbed, free of clods, by discing, using drags, harrows, or other appropriate means. The preparation of the seedbed shall not be done when the soil is frozen, extremely wet or otherwise in an unfavorable working condition. The Contractor shall get the Engineer’s approval of the finish grading and seedbed preparation prior to seeding. Failure to comply may result in the Contractor reworking the unapproved areas at the Contractor’s expense.

(b) Seed Application
In all cases the seed used must be certified by the North Carolina Department of Agriculture. The date of certification of all seed must be within eight (8) months of the date of sowing. Certification tags from all seed shall be given to the Engineer for inspection and approval prior to seeding.

Seed shall be distributed uniformly over the seedbed at the specified rate of application. The seedbed shall be lightly raked or dragged so as to cover the seed with a layer of soil. The seedbed shall be compacted as directed by the Engineer.
Type I Seeding, Application Rate Per 1000 Square Feet (lawns or other focal areas):

- 100 lbs. of lime
- 20 lbs. of 10-20-20 or 20 lbs. of 10-10-10 in combination with 4 lbs. of 0-46-0
- 5 lbs. of tall fescue, containing a blend of 2 or more tall fescues
- 1 lb. of Kenblue or Kentucky Bluegrass
- 1 lb. of winter annual rye (November 1 to March 1)

Type II Seeding, Application Rate Per 1000 Square Feet (general or low maintenance areas):

- 100 lbs. of lime
- 15 lbs. of 10-20-20 or 15 lbs. of 10-10-10 in combination with 3 lbs. of 0-46-0
- 4 lbs. of tall fescue, containing a blend of 2 or more tall fescues
- 1 lb. of sericea lespedeza (use unscarified seed August 15 to February 1)
- \( \frac{1}{4} \) lb. of German millet (May 1 to August 15)
- 1 lb. of rye grain (prior to May 1 or after August 15)

Seeding mixtures other than those listed above shall be approved by the Engineer prior to seeding.

(c) Applying Mulch

Mulch shall consist of grain straw or other equally satisfactory material approved by the Engineer. Mulch shall be spread uniformly over the area by hand or by mechanical spreader at the rate of 2 bales per 1000 square feet minimum. The mulch shall be applied uniformly to allow some sunlight to penetrate and air to circulate, while serving to partially shade the ground, reduce erosion, and conserve soil moisture. Mulch shall be held in place by means of stakes and twine, spraying of an asphalt emulsion or other means approved by the Engineer.

The rate of application of an asphalt emulsion will be sufficient to bond together the mulch particles without giving a heavy coating of the asphalt material. Adequate precautions shall be taken to prevent spraying asphalt emulsion on cars, fire hydrants, or other structures. The Contractor shall clean any structures that are sprayed.

(d) Seedbed Preparation and Seeding Specifications - Wetland Areas

1. Surface water control measures to be installed according to plan.

2. Areas to be seeded shall be ripped and spread with available topsoil 6" deep. Total seedbed prepared depth shall be 6" to 8" deep.

3. Loose rocks, roots and other obstructions shall be removed from the surface so that they will not interfere with establishment and maintenance of vegetation. Surface for final seedbed preparation, at finish grades shown, shall be reasonably smooth.

4. Provide agricultural lime at rate required to bring soil acidity to slightly acid - ph 6, according to soil test report.

5. Lime and fertilizer shall be applied uniformly and mixed with the soil during seedbed preparation.
6. Apply 0-20-10 commercial fertilizer at the rate of 20 lbs./1000 sf. for warm season mix (see schedule).

7. Apply 10-20-10 commercial fertilizer at the rate of 20 lbs./1000 sf. for cool season mix (see schedule).

8. Apply 10-10-10 commercial fertilizer at the rate of 20 lbs./1000 sf. for temporary cover crops. In addition, provide 15 lbs./1000 sf. of superphosphate.

9. The following is for the warm season mix:
   a. All warm grass seed shall be debearded or conditioned by brushing to create a product nearly the same as debearding. This does not apply to Switchgrass.
   b. Disc two times to break-up crop residue and dirt clods prior to seeding.
   c. Pack soil to create a firm seedbed with a cultipacker or roller.
   d. If a rain shower should fall after the seedbed is prepared but before planting, break up any crust formation.
   e. Seeding shall be installed to a depth of 1/4” utilizing a rangeland drill or conventional grass drills. It is extremely important that seed not be planted deeper than ½“ deep. Do not disc or harrow after seeding. This will put the seed too deep. A Brillion seeder will be acceptable.

10. Seed in accordance with the following schedule and application rates:

<table>
<thead>
<tr>
<th>Dates</th>
<th>Types</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 1 - July 15</td>
<td>Warm Season Mix</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Switchgrass, Cave-in-rock, Alamo</td>
<td>8 bulk #/acre or 4 oz./1000 sf.</td>
</tr>
<tr>
<td></td>
<td>Smartweed</td>
<td>2 bulk #/acre or 1 oz./1000 sf.</td>
</tr>
<tr>
<td></td>
<td>Japanese Millet or Sorghum Sudan Grass Hybrids (mow prior to maturity)</td>
<td>20 lb./acre or ½ lbs./1000 sf.</td>
</tr>
<tr>
<td>July 16 - Sept. 1</td>
<td>Temporary crop of Japanese Millet or Sorghum Sudan Grass Hybrids (to be followed by permanent mixture)</td>
<td>20 lb./acre or ½ lbs./1000 sf.</td>
</tr>
<tr>
<td>Sept. 2 - Nov. 1</td>
<td>Cool Season Mix</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reed Canary Grass</td>
<td>12 bulk #/acre or 6 oz./1000 sf.</td>
</tr>
<tr>
<td></td>
<td>Smartweed</td>
<td>2 bulk #/acre or 1 oz./1000 sf.</td>
</tr>
</tbody>
</table>
Nov. 1 - March 31  Temporary crop of wheat  
(to be followed by permanent  mixture)  40 lbs./acre

11. Contractor shall be required to provide a permanent mixture according to the schedule.
12. Temporary crops must be incorporated prior to seeding of permanent mixtures.
13. Cover crops or temporary crops must be mowed at proper time to prevent seed heads from maturing. Wheat may be harvested.
14. Grass mix and temporary covers shall be mulched with straw applied at the rate of 75 lbs. to 100 lbs./1000 sf. Use clean wheat straw.
15. If hydroseeded, use Virgin Paper Mulch only.

Note: Seed and additional information for the wetland mix, as well as for other grass areas, may be purchased from, but not limited to:

Sharp Brothers Seed Company  
Route 4, Box 237 A  
Clinton, Missouri 64735  
Phone: 1-800-451-3779

16. Yards and golf course lawn areas shall be returned to existing conditions and grass mixtures.
17. Wetlands crossings shall be covered with “Terra Jute” erosion control netting or equal installed per manufacturer directions.

Local Distributor:

Web Tec, Inc.  
P.O. Box 240302  
Charlotte, NC 28224  
800-438-0027 or 704-552-6722

Measurement and Payment:

Unless otherwise stated in the Contract, Seeding and Mulching shall be paid per square yard for the appropriate type and measured based upon the following:

1. Inside street right-of-way: length of main installed times 20 feet.
2. Outside street right-of-way: length of main installed times easement width.

The unit price bid for seeding and mulching shall include: preparing seedbeds; furnishing and thoroughly incorporating into the soil lime and fertilizer; furnishing and covering seed; furnishing, placing and securing a mulch covering and other operations incidental to establishing an acceptable full ground cover.
No deduction will be made for driveways or streets. No payment will be made for areas disturbed for long side connections.

When seeding and mulching has been damaged, and the Contractor has fully complied with the specifications, the Contractor shall be paid at the unit price bid for seeding and mulching to repair the areas of damage. This shall also apply to areas beside driveways or other paved areas needing reseeding once the pavement has been repaired. As an exception to the above, any damage due to the Contractor’s carelessness or neglect shall be repaired by the Contractor at the Contractor’s expense.

Payment for pipe installation will not be made until the areas disturbed by the pipe installation have been restored to their original grade and satisfactorily seeded and mulched.

**CLEANING UP**: All surplus or spoil material and all tools and temporary structures shall be removed from the site by the Contractor. All dirt, rubbish and excess earth from the excavation shall be hauled to a dump provided by the Contractor and the construction site left clean to the satisfaction of the Engineer. In every instance, the Contractor shall be responsible for leaving the site in as good or better shape than before the construction was begun. It shall be up to the Engineer to determine when the cleanup operation is finished and acceptable to the City.

Any excavation from trenches which has been placed on roadway surfaces and driveways will be completely removed from such surfaces as soon as practical, but in no case will excavation material be left on pavement at the end of a work day. Necessary equipment for removal of such material will be available at all times to preclude the development of traffic hazards from dust and/or slick areas caused by rainfall on clay material. The City/County Utility Commission will provide water to the Contractor at no charge for the purpose of flushing streets. To obtain the water at no charge, the Contractor must fill out a Hydrant Use Permit. Tanker trucks used for flushing must be equipped with a backflow preventer or provide a six-inch clear air gap between the filling pipe and the tank. Hydrants opened (and closed afterwards) for filling tanks or flushing must be operated by personnel trained in their operation. Only hydrant wrenches shall be used for opening the hydrants. Any damages associated with the Contractor operating the hydrant shall be repaired by the Contractor at the Contractor’s expense. The Contractor must have the Hydrant Use Permit on site when drawing water from the system. The permit is valid only for the purpose of flushing streets noted on the permit where utility construction has occurred. Failure to follow any of these criteria can result in fines to the Contractor as allowed by the Commission.

All salvageable materials from the City's water or sewer system belong to the City of Winston-Salem and must be turned over to the Construction and Maintenance Section of the Utilities Division.

**FINAL INSPECTION**: The Contractor is instructed to request a final inspection only after the work has been checked by the Contractor. All defects observed by the Engineer during the final inspection shall be repaired by the Contractor at the expense of the Contractor. After the Contractor satisfactorily corrects all defects and the project is deemed acceptable by the Engineer, a final inspection memorandum will be issued by the Engineer. All defects in materials and workmanship discovered during the one (1) year warranty will be corrected by the Contractor at the expense of the Contractor.
SECTION C - WATER AND SANITARY SEWER DETAIL DRAWINGS
ALL WARNING SIGNS TO BE A MINIMUM OF 36" X 36" AND TO BE LUMINOUS WHEN USED AT NIGHT.

FLAGMAN WITH STOP–SLOW PADDLE

100’ TO 200’

VARIES

TRAFFIC CONES

FLAGMAN WITH STOP–SLOW PADDLE

END CONSTRUCTION

500’

VARIES

100’ MILE MAX.

100’

400’

ROAD CONSTRUCTION AHEAD

ONE LANE ROAD AHEAD

FLAGMAN

WARNING SIGNS INDICATING DAILY CONDITIONS (EX: ONE LANE ROAD AHEAD, FLAGMAN) SHALL BE BAGGED OR REMOVED AT THE END OF EACH DAY AND REINSTALLED AT THE BEGINNING OF THE NEXT WORK DAY.

STANDARD LAYOUT FOR SIGNING CONSTRUCTION AND MAINTENANCE OPERATIONS ON TWO LANE HIGHWAYS WHERE ONE LANE IS CLOSED.

WARNING SIGN SEQUENCE IN OPPOSITE DIRECTION SAME AS SHOWN ABOVE.

CITY OF WINSTON–SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17
The suitable backfill shall be made in 6" layers and shall be compacted to at least 95% of standard density (AASHTO Method T-99). Each layer must be thoroughly tamped by a mechanical tamp before the next layer is placed. All asphalt pavement replaced shall be in accordance with the most current N.C.D.O.T. standard specifications. Subgrade density shall be 100%.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17
R:\Data\Utility\Utility Spec Drawings\C-2 asphalt pavement repair.dwg
The suitable backfill shall be made in 6” layers and shall be compacted to at least 95% of standard density (AASHTO Method T-99). Each layer must be thoroughly tamped by a mechanical tamp before the next layer is placed. All asphalt pavement replaced shall be in accordance with the most current N.C.D.O.T. standard specifications. Stone base density and subgrade density shall be 100%.

City of Winston-Salem
Department of Public Works
Engineering Division

N.T.S. Revised 3-1-17
Concrete Pavement and Driveway Repair

WHERE THE EDGE OF THE PATCH OR SECTION OF REMOVED PAVEMENT IS LESS THAN 10' FROM A TRANSVERSE EXPANSION OR CONTRACTION JOINT OR CRACK, THE ENTIRE SECTION OF PAVEMENT SHALL BE REMOVED UP TO THE JOINT OR CRACK AND REPLACED WITH NEW CONCRETE AND ABC STONE IN ACCORDANCE WITH THE MOST CURRENT N.C.D.O.T. STANDARD SPECIFICATIONS.

THE SUITABLE BACKFILL SHALL BE MADE IN 6" LAYERS AND SHALL BE COMPACTED TO AT LEAST 95% OF STANDARD DENSITY (AASHTO METHOD T-99). EACH LAYER MUST BE THOROUGHLY TAMPERED BY A MECHANICAL TAMPER BEFORE THE NEXT LAYER IS PLACED. STONE BASE AND SUBGRADE DENSITY SHALL BE 100%.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-4 concrete pavement & dw repair.dwg
Mill and Patch Method - Option A
(For State Maintained Roads)

CENTER OF PATCH

EXTENT OF THE MILL AND ASPHALT INLAY TO BE DETERMINED BY THE ENGINEER

SAW CUT PRIOR TO MILLING

SAW CUT FOR TRENCH BOX

TOTAL WIDTH OF PAVEMENT CUT = WIDTH OF TRENCH BOX

SAW CUT FOR TRENCH BOX

SAW CUT PRIOR TO MILLING

EXISTING PAVEMENT

MILL 2" AND REPLACE WITH 59.5B

4" I19.0B *

5 1/2" B25.0B

EXISTING PAVEMENT STRUCTURE

* MAY USE 4" B25.0B IN LIEU OF 4" I19.0B IF APPROVED BY THE ENGINEER.

THE PAVEMENT STRUCTURE SHOWN IS THE MINIMUM PAVEMENT STRUCTURE FOR SURFACE, INTERMEDIATE & BASE LAYERS TO BE USED UNLESS OTHERWISE DIRECTED BY THE ENGINEER. SAW CUTS TO BE PERPENDICULAR TO SURFACE. FACE OF CUTS TO BE NEAT, CLEAN AND STRAIGHT. TACK COAT TO BE APPLIED TO ALL EXISTING ASPHALT SURFACES PRIOR TO PLACING NEW ASPHALT.

FLOWABLE FILL (CONCRETE) HAVING A 100–200 PSI MAXIMUM COMPRESSIVE STRENGTH AT 28 DAYS OR OTHER MATERIAL AS APPROVED BY THE ENGINEER. FLOWABLE FILL MUST NOT CONTACT PIPE.

(TRAFFIC BEARING ROAD PLATE OR STEEL PLATE TO BE USED FOR 24 HOURS DURING CURING OF CONCRETE)

MIN. 1’ MIN. 1’

PROPOSED UTILITY

STABILIZATION STONE TO TOP OF PIPE

UNDISTURBED SOIL

"PROFILE VIEW"

NOTE: THE SUITABLE BACKFILL SHALL BE MADE IN 6" LAYERS AND SHALL BE COMPACTED TO AT LEAST 95% OF STANDARD DENSITY (AASHTO METHOD T-99). EACH LAYER MUST BE THOROUGHLY TAMPELED BY A MECHANICAL TAMPER BEFORE THE NEXT LAYER IS PLACED. ALL ASPHALT PAVEMENT REPLACED SHALL BE IN ACCORDANCE WITH THE MOST CURRENT N.C.D.O.T. STANDARD SPECIFICATIONS.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R: \Data\Utility\Utility Spec Drawings\C-5 mill & patch.dwg

C-5
Overlay and Patch Method - Option B
(For State Maintained Roads)

CENTER OF PATCH

EXISTING PAVEMENT

OVERLAY WITH 2'' S9.5B

EXISTING PAVEMENT STRUCTURE

* MAY USE 4'' B25.0B IN LIEU OF 4'' I19.0B IF APPROVED BY THE ENGINEER.

5 1/2'' B25.0B

TRENCH BOX

5' MAXIMUM WIDTH

FLOWABLE FILL (CONCRETE)
HAVING A 100-200 PSI MAXIMUM COMPRESSIVE STRENGTH AT 28 DAYS OR OTHER MATERIAL AS APPROVED BY THE ENGINEER. FLOWABLE FILL MUST NOT CONTACT PIPE.

(TRAFFIC BEARING ROAD PLATE OR STEEL PLATE TO BE USED FOR 24 HOURS DURING CURING OF CONCRETE)

UNDISTURBED SOIL

MIN. 1'

PROPOSED UTILITY

MIN. 1'

STABILIZATION STONE TO TOP OF PIPE

PROFILE VIEW

NOTE: THE SUITABLE BACKFILL SHALL BE MADE IN 6'' LAYERS AND SHALL BE COMPACTED TO AT LEAST 95% OF STANDARD DENSITY (AASHTO METHOD T-99). EACH LAYER MUST BE THOROUGHLY TAMPERED BY A MECHANICAL TAMPER BEFORE THE NEXT LAYER IS PLACED. ALL ASPHALT PAVEMENT REPLACED SHALL BE IN ACCORDANCE WITH THE MOST CURRENT N.C.D.O.T. STANDARD SPECIFICATIONS.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-6 overlay patch.dwg
Saw Cut and Patch Method - Option C
(For State Maintained Roads)

CENTER OF PATCH

TOTAL WIDTH OF PAVEMENT CUT = WIDTH OF TRENCH BOX + 4

SAW CUT FOR TRENCH BOX

SAW CUT FOR PATCH

EXISTING PAVEMENT

SAW CUT FOR PATCH

EXISTING PAVEMENT STRUCTURE

4" H19.08+

5 1/2" B25.09

TRENCH BOX
5' MAXIMUM WIDTH

FLOWABLE FILL (CONCRETE)
HAVING A 100-200 PSI MAXIMUM COMPRESSIVE STRENGTH AT 28 DAYS OR OTHER MATERIAL AS APPROVED BY THE ENGINEER. FLOWABLE FILL MUST NOT CONTACT PIPE.

TRAFFIC BEARING ROAD PLATE OR STEEL PLATE TO BE USED FOR 24 HOURS DURING CURING OF CONCRETE

PROPOSED UTILITY

MIN. 1'

UNDISTURBED SOIL

MIN.

STABILIZATION STONE TO TOP OF PIPE

"PROFILE VIEW"

NOTE: THE SUITABLE BACKFILL SHALL BE MADE IN 6" LAYERS AND SHALL BE COMPACTED TO AT LEAST 95% OF STANDARD DENSITY (AASHTO METHOD T-99). EACH LAYER MUST BE THOROUGHLY TAMMED BY A MECHANICAL TAMPER BEFORE THE NEXT LAYER IS PLACED. ALL ASPHALT PAVEMENT REPLACED SHALL BE IN ACCORDANCE WITH THE MOST CURRENT N.C.D.O.T. STANDARD SPECIFICATIONS.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-7 saw cut & patch.dwg

C-7
<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>SAFE COVER</th>
</tr>
</thead>
<tbody>
<tr>
<td>8''</td>
<td>CLASS &quot;D&quot;</td>
</tr>
<tr>
<td>10''</td>
<td>CLASS &quot;D&quot;</td>
</tr>
<tr>
<td>12''</td>
<td>CLASS &quot;D&quot;</td>
</tr>
<tr>
<td>15''</td>
<td>CLASS &quot;D&quot;</td>
</tr>
<tr>
<td>18''</td>
<td>CLASS &quot;D&quot;</td>
</tr>
<tr>
<td>21''</td>
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<td>CLASS &quot;D&quot;</td>
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<tr>
<td>36''</td>
<td>CLASS &quot;D&quot;</td>
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</table>

**NOTE:**

See technical specifications for bedding requirements for unstable subgrade and rock formations.

\[ Bc = \text{Outside Diameter of Pipe} \]

**CITY OF WINSTON-SALEM**

DEPARTMENT OF PUBLIC WORKS

ENGINEERING DIVISION

N.T.S. REVISED 3-1-17
4' Precast Reinforced Concrete Manhole

Flat top sections used shall be designed to support an H-20 wheel load. Use of a flat top must be approved by the engineer.

See detail drawing for "Manhole Ring and Cover Type 1" and "Manhole Ring and Cover Type 2".

Type 2 to be bolted to cone w/ 4-type 304 stainless steel expansion anchors (3/4" Hilti Kwik bolt II or approved equal).

Max. 3 courses of brick (8 in.) or 2-5" grade rings may be added vertically.

(Not allowed with Type 2 ring & cover)

See detail drawing for "Polypropylene Manhole Step".

Max 24" from top of ring & cover to top step. Top step must be in cone section.

Eccentric cone section

Steps not to be placed over influent or effluent pipes. Steps to be along vertical wall surface from shelf to top of cone.

Note: Do not bolt ring to cone if dirt or concrete surrounds the ring (ex: yard, shoulder, etc.)

City of Winston-Salem
Department of Public Works
Engineering Division

N.T.S. Revised 3-1-17

C-9
5' Precast Reinforced Concrete Manhole

**Flat Top Sections Used**
Shall be designed to support an H-20 wheel load. Use of a flat top must be approved by the engineer.

**Detail Drawing for**
"Manhole Ring and Cover Type 1" and "Manhole Ring and Cover Type 2" — Type 2 to be bolted to cone w/ 4-type 304 stainless steel expansion anchors (3/4" Hilti Kwik Bolt II or approved equal).

**Max. 3 Courses**
Of brick (8 in.) or 2-5" grade rings may be added vertically. (Not allowed w/Type 2 ring & cover)

**See Detail Drawing**
For "Polypropylene Manhole Step" max 24" from top of ring & cover to top step — top step must be in cone section

**Eccentric Cone Section**
Steps not to be placed over influent or efluent pipes. Steps to be along vertical wall surface from shelf to top of cone.

**City of Winston-Salem**
Department of Public Works
Engineering Division

N.T.S. REVISED 3-1-17

FIVE FOOT MANHOLE TO BE USED FOR PIPE WITH A DIAMETER OF 18" OR GREATER SPECIFIED BY THE ENGINEER.

PRECAST CONCRETE MANHOLES SHALL CONFORM TO ASTM C-478. MANHOLES MUST BE ALLOWED TO CURE A MINIMUM OF 3 DAYS PRIOR TO SHIPMENT. THE DATE OF MANUFACTURE AND NAME OF MANUFACTURER SHALL BE ON ALL MANHOLE SECTIONS. CONCRETE SHALL BE 4,000 PSI CIRCUMFERENTIAL REINFORCEMENT WILL BE PLACED AT A MINIMUM OF 0.15 SQ. INS. PER LINEAL FOOT.

**Butyl Rubber Gasket Under Ring and All Grade Rings**

**O-Ring or Butyl Rubber Gasket in All Joints. Joints on Outside of Manhole to Be Wrapped with 6" Wide Butyl Adhesive Tape. All Lift Holes Shall Be Completely Filled With Non-Shrink Grout After Manhole is Set.**

**Riser Section — Min. 6' From Shelf to 5' x 4' Transition Cone.**

**Base Section**

**See Detail Drawing for**
"Flexible Manhole Connector"
Type "B" 4' and 5' Precast Reinforced Concrete Manhole

SEE DETAIL DRAWING FOR "MANHOLE RING & COVER, TYPE 3" TO BE CAST IN MH TOP AT CONCRETE PLANT.

WALL PIPE TO BE CAST IN MH TOP AT CONCRETE PLANT.

2 FEET ABOVE THE 100 YEAR FLOOD ELEVATION

2-FLANGED 90° D.I. BENDS (SHORT RADIUS) OR FLANGED D.I. RETURN BEND.

TYPE 304 STAINLESS STEEL SCREEN (18 x 18 MESH)

FLANGED JOINTS

MIN.6"

FLAT TOP

4" I.D. D.I. WALLPIPE CAST IN MH TOP

1'-0"

4'-0" OR 5'-0"

O-RING JOINT OR BUTYL RUBBER.

COMPANION FLANGE WITH 4" OPENING.

3"

4" D.I. PIPE.

MANHOLE TO CONFORM TO CITY STANDARD DETAIL DRAWINGS FOR 4' AND/OR 5' PRECAST CONCRETE MANHOLES.

NOTE: ALL MANHOLES SHALL HAVE WALL PIPE INSTALLED. IF NO VENT IS SHOWN ON ENGINEERS DRAWING, WALL PIPE SHALL BE CAPPED WITH 4" D.I. BLIND FLANGE.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-11 type B precast mh.dwg C-11
Manhole Built Over Existing Line

1. Place horseshoe MH base in wet concrete (4000 PSI).
2. After concrete sets core hole & set new sewer line.
3. Cut out top half of existing pipe, finish inverts & waterproof all cold joints & around all pipe.
4. Pour concrete collars.

SECTION

CITY OF WINSTON—SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-12 mh over existing line.dwg
MANHOLE TO BE BUILT IN ACCORDANCE WITH CITY STANDARD DETAILS FOR 4' AND/OR 5' MANHOLES.

D.I.M.J. TEE
1 JOINT OF D.I. PIPE (MAX. 8% SLOPE)

STABILIZATION STONE
FERNCO COUPLING (OR APPROVED EQUAL)

V.C. PIPE (MAX. 8% SLOPE)

MIN. 30"

D.I. NIPPLE (18" LONG) INSIDE FLEXIBLE MANHOLE CONNECTOR.

D.I. PIPE (1 PIECE OR FLANGED PIECES).

CONCRETE COLLAR

D.I.M.J. 90° BEND

D.I. NIPPLE (18" LONG) INSIDE FLEXIBLE MANHOLE CONNECTOR.

MONOLITHIC BASE SECTION

CITY OF WINSTON—SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3–1–17

R:\Data\Utility\Utility Spec Drawings\C–13 drop assembly (outside).dwg
NOTES:
1. MANHOLE TO BE BUILT IN ACCORDANCE WITH CITY STANDARD DETAIL FOR 5' MANHOLE.
2. SPECIAL APPROVAL BY ENGINEER IS REQUIRED PRIOR TO INSTALLATION OF INSIDE DROP ASSEMBLY.
3. PVC PIPE SHALL CONFORM TO ASTM D1785, SCHEDULE 40. PVC FITTINGS SHALL CONFORM TO ASTM D2665.

FLEXIBLE MANHOLE CONNECTOR

1 JOINT OF PVC PIPE (MAX. 8% SLOPE)

STABILIZATION STONE

12"

V.C. PIPE (MAX. 8% SLOPE)

(OR APPROVED EQUAL)

STABILIZATION STONE

TYPE 316 STAINLESS STEEL PIPE STRAP (2" x 1/4"), ANCHORS AND ANCHOR BOLTS. STRAPS SPACED MAX. 6' APART. MIN. 2 STRAPS.

PVC 90° BEND TO FOLLOW THE FLOW OF SEWER.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-14 drop assembly (inside).dwg  C-14
NOTES:

1) MANHOLE SHALL BE MANUFACTURED AS PER THE REQUIREMENTS OF ASTM C-47B.

2) STANDARD FALL THROUGH MANHOLE IS 1" (.08") (INCLUDING 6" CONNECTIONS INTO MANHOLE).

3) 4" CONNECTIONS INTO MANHOLE MUST HAVE 4" OF FALL FROM CONNECTION INVERT TO 6" INVERT OF MANHOLE OR 4" CONNECTION MAY COME INTO MANHOLE ON TOP OF THE SHELF. EXCEPTIONS WILL BE NOTED ON ENGINEER’S DRAWING.

35° MIN. ANGLE

RISER SECTIONS AND CONE TO BE ADDED AS PER DETAIL DRAWINGS FOR 4 FOOT AND 5 FOOT PRECAST REINFORCED CONCRETE MANHOLES.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17
NOTE: FLEXIBLE MANHOLE CONNECTORS TO BE FURNISHED AS SPECIFIED IN THE TECHNICAL SPECIFICATIONS. MAXIMUM DEFLECTION FOR CONNECTOR IS 7° (12%). SLOPES GREATER THAN 12% MUST HAVE CONNECTORS DESIGNED FOR HIGHER DEFLECTION.
Manhole Ring and Cover (Type 1)

NOTE: TWO HOLES TO BE SPACED OPPOSITE TO EACH OTHER IN THE OUTER RING AS SHOWN. (HOLES TO BE 1" DIAMETER)

NOTE: RING AND COVER WILL HAVE MACHINED SEAT AND WILL CONFORM TO ASTM A48, CLASS 35B. RING AND COVER WILL BE DESIGNED TO SUPPORT AN H-20 WHEEL LOAD.

MINIMUM AVERAGE WEIGHTS
RING 190 LBS.
COVER 120 LBS.
310 LBS.

SECTION

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-17 mh ring & cover type 1.dwg
Manhole Ring and Cover (Type 2)

2 - 1 1/2" x 1 3/4" HEXHEAD, STAINLESS STEEL BOLTS AT 180° COUNTERSUNK. BOLTS TO BE TYPE 316 STAINLESS STEEL.

NOTE: TWO HOLES TO BE SPACED OPPOSITE TO EACH OTHER IN THE OUTER RING AS SHOWN. (HOLES TO BE 1" DIAMETER).

NOTE:
RING AND COVER WILL HAVE MACHINED SEAT AND WILL CONFORM TO ASTM A48, CLASS 3SB. RING AND COVER WILL BE DESIGNED TO SUPPORT AN H-20 WHEEL LOAD.

MINIMUM AVERAGE WEIGHTS
RING 190 LBS.
COVER 120 LBS.
310 LBS.

SECTION
CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-18 mh ring & cover type 2.dwg
C-18
Manhole Ring and Cover (Type 3)

NOTE:
RING AND COVER WILL HAVE
MACHINED SEAT AND WILL CONFORM
TO ASTM A48, CLASS 35B.

DETAIL "C C"

MATCH GROOVES

TOP OF COVER

BOTTOM OF COVER

2 – NON-PENETRATING PICK HOLES

4-1/2"x 1 3/4" HEXHEAD,
STAINLESS STEEL BOLTS
AT 90° COUNTERSUNK.
BOLTS TO BE TYPE 316
STAINLESS STEEL.

PLAN

CONTINUOUS RUBBER
GASKET (1/8" THICK)
GLUED TO RING SEAT.

SECTION

MINIMUM AVERAGE WEIGHTS
RING 136 LBS.
COVER 120 LBS.
256 LBS.

CITY OF WINSTON–SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-19 mh ring & cover type 3.dwg
NOTES:

1. CLEANOUT SHALL BE LOCATED WITHIN THE GRASS STRIP WHEN APPLICABLE. IF THERE IS NO GRASS STRIP
THEN THE CLEANOUT SHALL BE PLACED AS CLOSE TO R/W AS POSSIBLE. IN NO CASE SHALL CLEANOUT
BE PLACED WITHIN SIDEWALK, DRIVEWAY, OR INSIDE A FENCE.

2. CAST IRON SOIL PIPE AND FITTINGS SHALL CONFORM TO THE TECHNICAL SPECIFICATION FOR
"CAST IRON SOIL PIPE AND FITTINGS".

NOTE:

IN LIEU OF WYE'S THE LATERAL MAY BE
CONNECTED TO THE MAIN
USING A TAPPING
MACHINE AND SADDLE
APPROVED BY THE
ENGINEER, OR THE
CONNECTION MAY BE
MADE INTO A MANHOLE.

CONCRETE BLOCK TO BE POURED
180° FROM WHERE CONNECTION
ENTERS THE MAIN (NOT REQUIRED IF
WYE IS USED). BLOCK WILL PROTECT
MAIN WHEN RODDING.

NOTE:

CONTRACTOR MAY BE REQUIRED TO LAY
CONNECTION AS SHOWN BY DASHED LINES IF
ELEVATION IS CRITICAL.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17
NOTES:
1. INSTALLATION TO BE THE SAME AS FOR 4" SEWER CONNECTION (SEE DETAIL DRAWING).
2. CONTRACTOR MAY BE REQUIRED TO LAY CONNECTIONS AT 1% (REGARDLESS OF DEPTH) IN ORDER TO SERVE CUSTOMER. IN THIS CASE, 1/8 BEND WILL NOT BE USED.
CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S.  REVISED 3-1-17
NOTE:
CLEANOUT SHALL BE LOCATED WITHIN THE GRASS STRIP WHEN APPLICABLE. IF THERE IS NO GRASS STRIP THEN THE CLEANOUT SHALL BE PLACED AS CLOSE TO R/W AS POSSIBLE. IN NO CASE SHALL CLEANOUT BE PLACED WITHIN SIDEWALK, DRIVEWAY, OR INSIDE A FENCE.

NOTE:
IN LIEU OF WYE'S THE LATERAL MAY BE CONNECTED TO THE MAIN USING A TAPPING MACHINE AND SADDLE APPROVED BY THE ENGINEER, OR THE CONNECTION MAY BE MADE INTO A MANHOLE.

CONCRETE BLOCK TO BE POURED 180° FROM WHERE CONNECTION ENTERS THE MAIN (NOT REQUIRED IF WYE IS USED). BLOCK WILL PROTECT MAIN WHEN RODDING.

NOTE:
CONTRACTOR MAY BE REQUIRED TO LAY CONNECTION AS SHOWN BY DASHED LINES IF ELEVATION IS CRITICAL.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17
NOTES:
1. INSTALLATION TO BE THE SAME AS FOR 4" RESTAURANT SEWER CONNECTION (SEE DETAIL DRAWING).
2. CONTRACTOR MAY BE REQUIRED TO LAY CONNECTIONS AT 1% (REGARDLESS OF DEPTH) IN ORDER TO SERVE CUSTOMER. IN THIS CASE, 1/8 BEND WILL NOT BE USED.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17
6" Restaurant Sewer Connection

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17
Concrete Anti-Seepage Collar

TRENCH WALL

12"  6" MIN. INTO UNDISTURBED EARTH (TYP.)

DUCTILE IRON SEWER MAIN

STABILIZATION STONE (TYP.)

CONCRETE ANTI-SEEPAGE COLLAR (CLASS "A" CONCRETE)

PLAN

SECTION A - A

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVIS 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-28 concrete anti seepage collar.dwg
Steel Pile Detail

PIPE CRADLE ASSEMBLY

NOTES:

1. DRIVE PILES TO BEARING CAPACITY OF 20 TONS WITH PILE HAMMER APPROVED BY ENGINEER. (MIN. 10’ BELOW GROUND OR AS DIRECTED BY ENGINEER).

2. ENTIRE SURFACE OF PILES SHALL BE DOUBLE COATED WITH COAL TAR EPOXY (KOP—COAT BITUMASTIC 300 M OR APPROVED EQUAL) PRIOR TO INSTALLATION.

3. ENTIRE CRADLE ASSEMBLY SHALL BE DOUBLE COATED WITH COAL TAR EPOXY (KOP—COAT BITUMASTIC 300 M OR APPROVED EQUAL) AFTER ASSEMBLY.

4. PILES TO BE DRIVEN ONLY WHEN ENGINEER IS PRESENT.

5. PILES SHALL HAVE POINT REINFORCEMENT TO PREVENT TWISTING OR BENDING OF PILES WHILE DRIVING.

6. SHOP DRAWINGS OF CRADLE ASSEMBLY SHALL BE SUBMITTED TO ENGINEER PRIOR TO MANUFACTURE.

7. CONTRACTOR TO SUBMIT PILE HAMMER SPECIFICATIONS AND PILE RESISTANCE VALUES TO ENGINEER PRIOR TO INSTALLATION.

8. PILES TO BE CENTERED ON EACH PIECE OF PIPE—JOINTS TO BE CENTERED BETWEEN CREEK BANKS.

CITY OF WINSTON—SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISDA 3-1-17
R:\Data\Utility\Utility Spec Drawings\C-29 steel pile.dwg C-29
Concrete Pier Detail for 12”–16” DI Pipe

2-TYPE 3/4" STAINLESS STEEL EXPANSION ANCHORS (3/4" HILTI Kwik Bolt Approved Equal)

NO. 3 TIES
12" O.C.

NO. 4 BARS
6" O.C.

3" 6" 6" 6" 3" 2" 6"

1'-0"

VARIABLE

3" WIDE X 1/2" THICK STAINLESS STEEL STRAP

12"–16" DI PIPE

NO. 3 TIES
12" O.C.

MINIMUM 2" COVER ON ALL REINFORCEMENT

NO. 4 BARS
9" O.C.

1'-3"

VARIABLE

NOTE: DO NOT USE CONCRETE PIERS IN A STREAM CHANNEL.

CITY OF WINSTON–SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C–31 concrete pier detail for 12”–16” di pipe.dwg

C–31
Concrete Pier Detail for 18"-24" DI Pipe

NOTE: 2" MINIMUM COVER ON ALL REINFORCEMENT.

3" WIDE X 1/2" THICK STAINLESS STEEL STRAP

18"-24" D.I. PIPE

NO.4 BARS 4" O.C.

NO.3 TIES 12" O.C.

NO.4 BARS 18" O.C.

NO.4 BARS 8" O.C.

3"-0" 6" 6" 6" 6" 6" 3"

NO.3 TIES 12" O.C.

NO.4 BARS 6" O.C.

NO.4 BARS 11" O.C.

NOTE: DO NOT USE CONCRETE PIERS IN A STREAM CHANNEL.
Concrete Pier Detail for 30" Pipe

4" WIDE X 1/2" THICK STAINLESS STEEL STRAP w/
2-TYPE 304 STAINLESS STEEL EXPANSION ANCHORS.
(3/4" HILTI KWIK BOLT II OR APPROVED EQUAL).

NOTE:
2" MINIMUM CONC. COVERING ON ALL
REIN. BARS. ALL REINFORCEMENT
BARS NO.4 UNLESS OTHERWISE NOTED.

CHAMFER STRIPS ON ALL EXPOSED EDGES.

NO.4 BARS 8" O.C.
NO.4 BARS 15" O.C.

"A"    "B"

HEIGHT  FOOTING WIDTH  REINFORCEMENT
0'-2'   5'-6"       6 BARS @ 12" O.C.
2'-5'   6'-0"       7 BARS @ 11" O.C.
5'-7'   6'-6"       7 BARS @ 12" O.C.
7'-10'  7'-0"       8 BARS @ 11" O.C.

SEE CHART FOR SPACING

NOTE: DO NOT USE CONCRETE PIERS IN A STREAM CHANNEL.
Sanitary Sewer Mains on 18-22% Slope

NOTES:
1. ALL PIPE AND BENDS SHALL BE DUCTILE IRON IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17
R:\Data\Utility\Utility Spec Drawings\C-34 sewer mains on 18%-22% slope.dwg  C-34
Manhole Check Valve

1 JOINT OF D.I. PIPE WITH UNI–FLANGE. UNI–FLANGE MUST HAVE TYPE 316 STAINLESS STEEL SET SCREWS.

FLEXIBLE MANHOLE CONNECTOR

6” MIN

D.I. PIPE

12”

V.C. PIPE

CLAY TO D.I. FERNCO COUPLING (OR APPROVED EQUAL) WITH 12” OF STABILIZATION STONE

FLEXIBLE MANHOLE CONNECTOR

4”

SHELF

MANHOLE WALL

NOTE: BOLTS FOR FLANGES TO BE TYPE 316 STAINLESS STEEL

CITY OF WINSTON–SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3–1–17

R:\Data\Utility\Utility Spec Drawings\C–35 mh check valve.dwg
Fence Gate

6" MIN. PRESSURE TREATED TIMBER POST

ATTACH EXISTING FENCE

14'-0"

ATTACH CHAIN TO POST

5/16" STEEL CHAIN

PADLOCK KEYED TO CITY OF WINSTON-SALEM MASTER

CLASS "A" CONCRETE

3'-0" (TOP)

6" MIN (TYP)

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

R:\Data\Utility\Utility Spec Drawings\C-36 fence gate.dwg

C-36

N.T.S. REVISED 3-1-17
CAST IRON VALVE BOX

1. VALVE BOX WILL CONFORM TO ASTM A48, CLASS 30 B

2. MINIMUM WEIGHTS:
   COVER........................ 29 LBS.
   TOP SECTION........ 60 LBS.
   BOTTOM SECTION.... 49 LBS.
   TOTAL..... 138 LBS.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-38 cast iron valve box.dwg

C-38
Valve Box Installation

PAVEMENT
(INCLUDING GRAVEL AND DIRT STREETS)

CONCRETE PAD

TOP SECTION

BOTTOM SECTION (OPTIONAL)

NOTES:
1. WHEN VALVE IS IN PAVEMENT, TOP OF CONCRETE PAD TO BE AT ELEVATION OF BOTTOM OF SURFACE COURSE.

2. WHEN VALVE IS ON GRAVEL OR DIRT STREET, TOP OF CONCRETE PAD TO BE AT FINISH GRADE.

3. CAST IRON VALVE BOX WILL CONFORM TO ASTM A48, CLASS 30B AND DETAIL DRAWING.

4. TWO (2) BRICKS ARE TO BE PLACED AS SHOWN UNDER PIPE @ 180°. BRICKS SHALL NOT REST ON VALVE BONNET. (PLACE BRICKS ON FLAT SIDE OF BONNET).

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-39 valve box installation.dwg

C-39
Hydrant and Valve Installation

NOTES:

1. HYDRANTS, VALVES AND THEIR ACCESSORIES ARE TO BE FURNISHED AS SPECIFIED IN THE TECHNICAL SPECIFICATIONS OF THE ENGINEERING DIVISION OF THE CITY OF WINSTON-SALEM, N.C.

2. ANY JOINTS BETWEEN THE VALVE AND HYDRANT MUST HAVE RETAINER GLANDS.

= PAY LIMITS FOR "HYDRANT".

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17
R:\Data\Utility\Utility Spec Drawings\C-40 hyd & valve installation.dwg
C-40
2 1/2" Hose Nozzle for Hydrants

THREAD DATA

7 1/2 THREADS PER INCH
0.1333 PITCH
RIGHT HAND
NATIONAL FORM

MAX 2.940" O.D. OF THREADS
MIN 2.910" O.D. OF THREADS

MAX 2.854" PITCH DIAMETER
MIN 2.838" PITCH DIAMETER

2.767" ROOT DIAMETER

2.468" BORE DIAMETER

1.25"

0.875"

2.625"

3.375"

CITY OF WINSTON—SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-41 2.5inch hose nozzle for hydrants.dwg
THREAD DATA

4 THREADS PER INCH
.250 PITCH
RIGHT HAND
V FORM

5.078" O.D. OF THREADS

4.688" ROOT DIAMETER

4.250" BORE DIAMETER

2.875"

5.563"

125"

1"

4 1/4" Steamer Nozzle for Hydrants

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-42 4.25inch steamer nozzle for hydrants.dwg C-42
CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings/C-43 stub out installation.dwg
Concrete Thrust Blocks for Horizontal Bends

**MINIMUM "A" DIMENSION (FEET)**

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<td>2.5</td>
<td>3.0</td>
<td>4.5</td>
<td>5.5</td>
<td>7.0</td>
<td>8.0</td>
<td>10.0</td>
<td>12.0</td>
</tr>
</tbody>
</table>

NOTE: ABOVE DIMENSIONS BASED ON THE FOLLOWING: 250 PSI WATER PRESSURE AND 2000 LB/SQ FT SOIL BEARING CAPACITY (SOFT CLAY)

CITY OF WINSTON—SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3–1–17

R:\Data\Utility\Utility Spec Drawings\C–44 concrete thrust block horizontal.dwg
Concrete Thrust Blocks w/ Anchors for Top Vertical Bends

<table>
<thead>
<tr>
<th>STRAP REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIPE SIZE (INCHES)</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>16</td>
</tr>
</tbody>
</table>

* 45° AND 90° BENDS ONLY

<table>
<thead>
<tr>
<th>MINIMUM REQUIRED CUBIC YARDS OF CONCRETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FITTING</td>
</tr>
<tr>
<td>--------------------</td>
</tr>
<tr>
<td>90° BEND</td>
</tr>
<tr>
<td>45° BEND</td>
</tr>
<tr>
<td>22 1/2° BEND</td>
</tr>
<tr>
<td>11 1/4° BEND</td>
</tr>
</tbody>
</table>

NOTE: ABOVE QUANTITIES BASED ON 250 PSI WATER PRESSURE WITH NO SOIL BEARING PRESSURE.

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ENGINEERING DIVISION

N.T.S. 3–1–17

R:\Data\Utility\Utility Spec Drawings\C–45 concrete thrust block vertical.dwg

C–45
* SEE DETAIL DRAWING FOR "CAST IRON METER BOX FOR 3/4" AND 1" METERS".

NOTES:
1. METER BOX SHALL BE LOCATED WITHIN THE GRASS STRIP WHEN APPLICABLE. IF THERE IS NO GRASS STRIP THEN THE METER BOX SHALL BE PLACED AS CLOSE TO THE R/W AS POSSIBLE. IN NO CASE SHALL METER BOX BE PLACED WITHIN SIDEWALK, DRIVEWAY OR INSIDE A FENCE.

2. ANGLE VALVES AND YOKE TO BE 3/4" OR 1" - SIZE TO BE DETERMINED BY THE ENGINEER.

3. COPPER PIPE SHALL CONFORM TO THE TECHNICAL SPECIFICATIONS FOR "COPPER PIPE".

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DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17
* SEE DETAIL DRAWING FOR "CAST IRON METER BOX FOR 3/4" AND 1" METERS".

* STANDARD METER BOX (SEE NOTE 1 FOR LOCATION)

INSTALL BOX AS CLOSE TO R/W AS POSSIBLE, EXTEND TAILPIECE TO ROW

NOTES:
1. DO NOT INSTALL METER BOX INSIDE A FENCE OR WITHIN SIDEWALK OR DRIVEWAY.
2. ANGLE VALVES AND YOKE TO BE 3/4" OR 1" - SIZE TO BE DETERMINED BY THE ENGINEER.
3. COPPER PIPE SHALL CONFORM TO THE TECHNICAL SPECIFICATIONS FOR "COPPER PIPE".

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17
and 1" Water Connection (Non-Single Family)

* STANDARD METER BOX

* THE METER BOX AND CRIMP SHALL BE INSTALLED AT THE LOCATION NOTED ON THE DETAIL DRAWINGS FOR SINGLE FAMILY CONNECTIONS OR AS DIRECTED BY THE ENGINEER OR AS SHOWN ON THE ENGINEER'S DRAWINGS.

SEE DETAIL DRAWING FOR "CAST IRON METER BOX FOR 3/4" AND 1" METERS."

BRASS CORPORATION COCK (MAX. 30° FROM HORIZONTAL)

NOTE THAT FITTINGS ARE NOT REQUIRED FOR NON-SINGLE FAMILY DWELLINGS.

CITY OF WINSTON-SALEM
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ENGINEERING DIVISION

N.T.S. REVID 3-1-17
NOTES:

1. MINIMUM WEIGHTS:
   A— 5/8" BOX w/COVER....103 LBS.
   B— 1" BOX w/COVER....120 LBS.

2. METER BOX WILL CONFORM TO
   ASTM A48, CLASS 30B.

3. 5/8" BOX DIMENSIONS ARE SHOWN

4. 1" METER BOX IS 6" LONGER THAN
   5/8" BOX. ALL OTHER DIMENSIONS
   ARE SAME AS SHOWN.
Polymer Concrete Meter Box for 1 1/2" and 2" Meters

Cover

Skid Resistant Surface

Pull Slots

Water Meter Lid

Mouse Holes (2) 4" x 4"
Opening with 4" x 4"
Knockout Above Opening

Dimensions (inches)

A 18
B 29 5/8

City of Winston-Salem
Department of Public Works
Engineering Division

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-51 concrete meter box.dwg
TEMPORARY CONSTRUCTION SPool
shall be installed by the
contractor. Spool to be installed
with gaskets and bolts, and tested
to the inlet valve, city to provide
spool, gaskets and bolts.

BY-PASS VALVE AND OUTLET VALVE
shall be padlocked by the
inspector. Spool and padlocks shall
remain intact until a permanent
meter is installed. City to provide
padlocks.

INLET VALVE

13" FOR 1 1/2" CONNECTION
17" FOR 2" CONNECTION

TURBINE METER

METER FLANGE

PADLOCK WINGS

OUTLET VALVE

12" FROM TOP OF METER
BOX TO TOP OF ANGLE VALVE

12" LONG MALE TO TO
MALE BRASS NIPPLE

COMPRESSION TO
MALE IRON PIPE
THREADED COUPLING

BY-PASS BALL
VALVE W/ PADLOCK
WINGS

NOTE: INLET AND OUTLET VALVES SHALL
HAVE METER SUPPORT BRACKETS.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-52 w conn.dwg

C-52
Air Release Valve (Section View)

NOTE:
MANHOLE SHALL CONFORM TO ASTM C-478 SPECIFICATION. JOINTS SHALL BE THE SAME AS FOR 4" & 5" PRECAST REINFORCED CONCRETE MANHOLES. TOP SLAB TO BE DESIGNED TO SUPPORT AN H-20 WHEEL LOAD.

NOTE:
MANHOLE COVER SHALL BE CAST WITH THE WORD "WATER" OR "SANITARY SEWER" ACROSS THE TOP AND SHALL HAVE TWO HOLES SPACED OPPOSITE TO EACH OTHER IN THE OUTER RING OF THE COVER.

NOTE:
ROTATE TOP SLAB TO CENTER 2'-0" OPENING OVER BOTH CURB STOPS.

BRASS PIPE AND BRASS FITTINGS
CORP. COCK
W/FEMALE IRON PIPE
THREAD OUTLET
(FB1600-NL BY FORD)

PRESSURE AIR VALVE
BRONZE BALL VALVE CURB STOPS
(B111-NL BY FORD)

BRASS PIPE & BRASS FITTINGS
CLASS "A" CONCRETE FOOTING

BOTTOM OF FOOTING AT C/L OF PIPE
STABILIZATION STONE

SECTION

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. REVISED 3-1-17
Air Release Valve (Profile View)

NOTE:
MANHOLE SHALL CONFORM TO ASTM C-478 SPECIFICATION. JOINTS SHALL BE THE SAME AS FOR 4’ & 5’ PRECAST REINFORCED CONCRETE MANHOLES. TOP SLAB TO BE DESIGNED TO SUPPORT AN H-20 WHEEL LOAD.

NOTE:
ROTATE TOP SLAB TO CENTER 2'-0" OPENING OVER BOTH CURB STOPS.

NOTE:
MANHOLE COVER SHALL BE CAST WITH THE WORD “WATER” OR “SANITARY SEWER” ACROSS THE TOP AND SHALL HAVE TWO HOLES SPACED OPPOSITE TO EACH OTHER IN THE OUTER RING OF THE COVER.

CITY OF WINSTON-SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S.
REVISED 3-1-17

R:\Data\Utility\Utility Spec Drawings\C-54 air release valve profile view.dwg C-54
2" Water Main Tap to 6" or Larger Water Main

NOTES:
1. TWO (2) BRICKS ARE TO BE PLACED AS SHOWN UNDER PIPE © 180.

CITY OF WINSTON—SALEM
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

N.T.S. DATE: 3–1–17