

STANDARD SPECIFICATIONS

FOR

CITY OF COOKEVILLE

TELEVISION OF SANITARY SEWER LINES,
CURED-IN-PLACE PIPE (MAIN LINE
AND LATERAL) INSTALLATION,
AND
LATERAL REPLACEMENT ON CIPP MAINS

Department of Water Quality Control
City of Cookeville, Tennessee
1860 South Jefferson Ave
Cookeville, Tennessee 38506

Ricky Shelton, Mayor
Mike Davidson, City Manager
Ronnie J. Kelly, Director

SECTION I: TECHNICAL SPECIFICATIONS FOR THE TELEVISION INSPECTION OF SANITARY SEWER MAIN LINES

SUBSECTION	PAGE
1-01 INTENT	CIPP-1
1-02 QUALIFICATIONS	CIPP-1
1-03 EQUIPMENT	CIPP-1
1-04 CLEANING	CIPP-1
1-05 TV INSPECTION.....	CIPP-2
1-06 SAFETY	CIPP-3

SECTION II: TECHNICAL SPECIFICATIONS FOR THE INSTALLATION OF CURED-IN-PLACE PIPE (MAIN LINE CIPP)

2-01 INTENT	CIPP-5
2-02 REFERENCED DOCUMENTS	CIPP-5
2-03 QUALIFICATIONS	CIPP-5
2-04 MATERIALS	CIPP-5
2-05 STRUCTURAL REQUIREMENTS	CIPP-6
2-06 TESTING REQUIREMENTS	CIPP-6
2-07 TV INSPECTION.....	CIPP-7
2-08. EXCAVATION/INSTALLATION	CIPP-7
2-09 INSPECTION	CIPP-7
2-10 SAFETY	CIPP-8
2-11 CLEANUP	CIPP-8

SECTION III: TECHNICAL SPECIFICATIONS FOR THE INSTALLATION OF CURED-IN-PLACE PIPE (LATERAL LINING)

3-01 INTENT	CIPP-9
3-02 GENERAL	CIPP-9
3-03 REFERENCES.....	CIPP-9
3-04 QUALIFICATIONS	CIPP-10
3-05 DESIGN CONSIDERATIONS.....	CIPP-10
3-06 PRODUCT & INSTALLER ACCEPTABILITY	CIPP-10
3-07 MATERIALS	CIPP-10
3-08 INSTALLATION.....	CIPP-12
3-09 RESIN SYSTEM	CIPP-13
3-10 CIPP PROCESSING.....	CIPP-13
3-11 SAFETY	CIPP-14

SECTION IV: TECHNICAL SPECIFICATIONS FOR THE REPLACEMENT OF LATERALS CONNECTED TO CURED-IN-PLACE (CIPP)

4-01 INTENT CIPP-15
4-02 MATERIAL CIPP-15
4-03 EXCAVATION CIPP-16
4-04 PIPE BEDDING CIPP-18
4-05 SEWER MAIN/LATERAL INSTALLATION CIPP-18
4-06 BACKFILLING OF SEWER LINES CIPP-19
4-07 SERVICE LINE & CONNECTIONS/CLEANOUTS CIPP-20
4-08 EROSION CONTROL CIPP-20
4-09 REMOVAL, RESTORATION & MAINTENANCE OF PROPERTY CIPP-21
4-10 STREET & DRIVEWAY REPLACEMENT CIPP-22
4-11 TESTING & INSPECTION CIPP-25
4-12 BYPASSING OF RAW SEWAGE CIPP-25
4-13 CLEANUP CIPP-25

APPENDIX A: CLEAN-OUT DETAIL A-1

CLEAN-OUT DETAIL (PAVEMENT) A-2

SEWER CLEAN-OUT BOX A-3

APPENDIX B: VIDEOS OF LINES TO HAVE CIPP INSTALLED B-1

SECTION I: TECHNICAL SPECIFICATIONS FOR TELEVISION INSPECTION OF SANITARY SEWER MAIN LINES

1-01 INTENT

1. It is the intent of this specification to provide for television inspection of main sewer lines and providing the owner with a video log and digital video file of each section televised. These lines are being televised to find sources of infiltration and inflow (I/I) and to find structural defects and restrictions in the existing sewer line. If the bid form is for televising of the lines in wet weather, the work shall be done in wet conditions as detailed herein or as approved by the engineer.
2. There may be some instances that the Owner's records are incorrect and the contractor may discover that the line indicated on the drawings is either a different diameter or material than indicated. If such lines are discovered the Contractor shall bring it to the attention of the Owner and the Contractor shall correct his drawings and use the correct information of the logs and video.
3. If any blockage and/or defect is discovered, that in the opinion of the Contractor requires immediate attention by the Owner, the Contractor shall immediately notify the Owner of such.

1-02 QUALIFICATIONS

1. The person doing the CCTV work and coding the defects shall be certified through NASSCO's Pipeline Assessment
2. and Certification Program (PACP)©. The submittals shall include a copy of the certification from the employee(s) that will be doing the coding.

1-03 EQUIPMENT

1. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the Owner's Representative; and if unsatisfactory, equipment shall be removed and no payment will be made for an unsatisfactory inspection.
2. The contractor shall have on-site with the camera van an operator who is trained and certified in the use of NASSCO's Pipeline Assessment and Certification Program (PACP)©.

1-04 CLEANING

1. The bidder shall include light cleaning in his bid for all sections. Cleaning for all sections shall require the use of a water jet truck. It is recognized that there are some conditions such as broken pipe and major blockages that prevent cleaning from being accomplished or where additional damage would result if cleaning were attempted or continued. Should such conditions be encountered, the Contractor will not be required to clean those specific manhole sections. If in the course of normal cleaning operations, damage does result from preexisting

and unforeseen conditions such as broken pipe, the Contractor will not be held responsible. The equipment shall have a selection of at least three high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel. The NASSCO Jetter Code of Practice shall be consulted as a guide for the selection of different type nozzles and recommended pressure applications for various cleaning requirements

2. Cleaning Precautions: During sewer cleaning operations, satisfactory precautions shall be taken in the use of cleaning equipment especially with tools which retard the flow in the sewer line are used, precautions shall be taken to insure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer.
3. Root Removal: Roots shall be removed in the designated sections where root intrusion is a problem. Special attention should be used during the cleaning operation to assure almost complete removal of roots from the joints. Any root removal which requires the use of additional equipment such as a root saw to remove is considered heavy cleaning.
4. Light cleaning includes removal of sediment up to 25% of the pipe diameter. Debris greater than that or which requires the use of special equipment such as a root saw is considered heavy cleaning. Where the contractor determines that heavy cleaning is necessary, he shall notify the Owner and document the before and after condition of the pipe and/or blockage. It is understood that the before video may not be complete such as when roots or grease block the camera from continuing. Depending on the way the bid item is worded – heavy cleaning may be part of the television or it may be a separate pay item.
5. Any water necessary for cleaning or installation of the liner shall be furnished by the Owner at a location designated by the owner. The City requires that this water to be metered (meter can be furnished by the City upon request). Water Usage shall be reported to the owner on a monthly basis. If the Owner furnishes the meter, the meter must be returned prior to final payment being made.

1-05 TV INSPECTION

1. Light cleaning is included in all televising bid items.
2. Wet conditions, if used on the bid form, shall mean that it should be raining at the time of the line is televised, be within 48 hours of at least a ½ inch rain, a day that snow is melting, or the ground water table is sufficiently high as determined by the Engineer
3. After cleaning, the manhole sections shall be visually inspected by means of closed-circuit television. The inspection will be done one manhole section at a time and the flow in the section being inspected will be suitably controlled. All CCTV inspections shall be performed in accordance with PACP standards including the specific date and time of inspection.
4. Each lateral must be shown with a view perpendicular to the main, with the camera centered on the lateral, and the camera shall pan the lateral connection looking for cracks and/or leaks.

5. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Nothing shall be used to pull the camera through the line that obstructs the camera view. If, during the inspection operation, the television camera will not pass through the entire manhole section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire manhole section, the inspection shall be considered complete noted as Survey Abandoned and no additional inspection will be required.
6. The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be above ground by means of a meter device and displayed on the video. Accuracy of the distance meter shall be periodically checked by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the Owner's Representative.
7. TV Audio - The tape for each section televised shall have audio stating the upstream and downstream manhole numbers, pipe size description of taps and defects. The pipe size and manhole numbers shall be stated at least every 100' of line televised.
8. TV Log - A written log by the Contractor and will clearly show the length of the section televised, size of pipe televised, the upstream and downstream manhole numbers, the location of major defects, and a description of the defect. In addition, other points of significance such as locations and positions of building sewers, unusual conditions, roots, storm sewer connections, cracks, fractures, broken pipe, presence of scale and corrosion, and other discernible features, as defined in the PACP defect codes, will be recorded on electronic media and a copy of such records will be supplied to the Owner. The location shall be by distance in 1/10 of a foot, from the manhole center. The position shall be clock position with 12 o'clock being the top of the pipe. The log shall also document defects that can be seen around the service connection or in the lateral.
9. Documentation and deliverables shall be as follows:
 - 9.1 Television Inspection Logs shall be delivered to the Owner within two weeks of the line being televised.
 - 9.2 Electronic media recordings: The purpose of electronic media recording shall be to supply a visual and audio record of problem areas of the lines that may be replayed by the Owner. Acceptable formats are CD's, DVD's, or USB flash drives. Within two weeks of the line being televised the electronic media recording of video showing conditions and defects will be delivered to the Owner.

1-06 SAFETY

1. The Contractor is responsible to conduct operations in a safe manner and in accordance with OSHA regulations. Owner or Engineer's on-site representation in no way relieves Contractor of Contractor's Safety Obligations.

2. To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, red lanterns and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the highway. All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor. The rules and regulations of the local authorities respecting safety provisions shall be observed. All traffic control and signage shall be in accordance with the Manual of Uniform Traffic Control Devices (MUTCD).
3. The Contractor shall carry on the work in a manner which will cause the least interruption to traffic, and may close to through travel not more than two (2) consecutive blocks, including the cross street intersected. Emergency Services Personnel shall be notified of all street closures.
4. All sanitary sewer manholes in the City of Cookeville are deemed permit required confined spaces. If the contractor's personnel enters any manhole they shall have a confined space entry program in place and issue a permit for entry.

SECTION II: TECHNICAL SPECIFICATIONS FOR THE INSTALLATION OF CURED-IN-PLACE PIPE (CIPP)

2-01 INTENT

It is the intent of this specification to provide for the reconstruction of pipelines by the installation of a resin-impregnated flexible tube which is inserted into the original conduit. When cured, the finished pipe (CIPP) will be continuous and formed to the original conduit. There may be some instances that the Owner's records are incorrect and the contractor may discover that the line indicated on the drawings is PVC, has already had CIPP installed, or has been sliplined. If such lines are discovered the Contractor shall bring it to the attention of the Owner and the Contractor shall not televise or line those segments. There may also be some sections that the Owners records list the wrong diameter. The Owner's intention is that those sections will be lined, but they should be brought to the Owner's attention and if there is not a bid item for that size pipe, that will be negotiated.

2-02 REFERENCED DOCUMENTS

1. This specification references ASTM F1216 which is made a part hereof by such reference and shall be the latest edition and revision thereof. ASTM F1216 shall govern.

2-03 QUALIFICATIONS

1. Only bids from qualified products or contractors will be accepted. Bids submitted on products or from contractors that do not have sufficient qualifications in the opinion of the Owner will be returned. The proposed method of reconstruction shall be clearly and legibly identified on the bid form and the apparent low bidder shall submit a statement of Qualifications within seven (7) days.
2. Qualified products are Inliner USA, Insituform, Invert-a-pipe, Cureline, and Mooreliner, MSP Liner, SAK CIPP liner, and AIT CIPP liner.
3. Additional products may bid must they must provide with their bid a letter from the State stating that their product is State approved and provide references of jobs completed.

2-04 MATERIALS

1. Tube - The tube material shall meet the requirements of ASTM F1216. Bidder shall state manufacturer of felt to be used on this job.
 - 1.1 The tube shall be fabricated to a size that when installed will form to the internal circumference and length of the original pipe. Allowance shall be made for circumferential stretching during insertion.
 - 1.2 The outside layer of the tube shall be plastic coated with a transparent flexible material that is compatible with the resin system used. The plastic coating shall not be subject to delamination after cure of the CIPP.
 - 1.3 No materials shall be included in the tube that are subject to delamination in the cured CIPP.

2. Resin - The resin system shall meet the requirements of ASTM F1216.
3. The wall color of the interior pipe surface of the CIPP after installation shall not be of a dark or non-reflective nature that could inhibit proper closed circuit television inspection.

2-05 STRUCTURAL REQUIREMENTS

1. The CIPP shall be designed as per ASTM F1216, Appendix XI, with the following additional requirements:
 - 1.1 The CIPP strength design shall assume no bonding to the original pipe wall.
 - 1.2 External Hydrostatic Design - Acceptable third party testing and verification of the enhancement factor, K, (equation 1 - ASTM F1216) shall be submitted by each manufacturer and/or CIPP product.
 - 1.3 External Buckling Design - Where the CIPP is designed as a stand-alone pipe, a fully deteriorated condition, acceptable third party testing and verification of design analysis techniques (ASTM F1216, Section X1.2.2) shall be submitted by each manufacturer and/or CIPP product. This testing requirement can be accomplished with soil box testing.
2. The bond between all CIPP layers shall be strong and uniform. All layers, after cure, must form one homogeneous structural pipe wall with no part of the tube left unsaturated by resin.

2-06 TESTING REQUIREMENTS

1. Chemical Resistance - The CIPP shall meet the chemical resistance requirements of ASTM F1216. CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical testing requirements.
2. Hydraulic Capacity - Calculations must support that the CIPP shall have at least 100% of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the original pipe material. A typical roughness coefficient of the CIPP shall be as verified by third party test data.
3. CIPP Field Samples - To verify past performance, the manufacturer shall submit test results of the same resin system and tube materials as proposed for the actual installation. These test results must verify that the CIPP physical properties specified in section 4.2 of this specification have been achieved in previous field applications. New resin systems can be used by obtaining prior approval.
4. Any water necessary for cleaning or testing shall be furnished by the Owner at a location designated by the Owner. All water usage shall be metered using a water meter. Meter will be furnished by the City upon request.

2-07 CLEANING AND TV INSPECTION

1. Cleaning shall be as detailed in Section I of the specifications. There is no extra payment for heavy cleaning in lines that are to have CIPP installed.
2. TV inspection work necessary for the installation of CIPP shall be done in accordance with the *Specification for Television Inspection of Sanitary Sewers* (Section I of the Specifications).
3. All lines shall be televised before and after the CIPP is installed. The final video shall be after the laterals are replaced.

2-08 EXECUTION/INSTALLATION

1. CIPP installation shall be in accordance with ASTM F1216 with the following additional requirements:
 - 1.1 Resin Impregnation - The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall.
 2. Hydrotite shall be used in each manhole at the mouth of every pipe into the manhole that a liner is installed.
 - 3.1 Service Reconnections – Service reconnections shall be made without excavation. The City will, however, make up to three excavations on this project for this purpose if deemed necessary, without charge to the Contractor. Any costs related to additional excavations will be entirely at the installer's expense. Note that in State Highways, the City may have to obtain a permit prior to any point repairs, which may take up to 30 days. If the lateral is to be replaced (dig and replace) use the specification in Part II for that work.
 - 3.2 Service reconnections shall be cut out to at least 90% of the original tap size. Reconnections shall be brushed smooth where debris will not catch. Irregular or rough reinstatements noticed during work or on the finished video will have to be smoothed.
4. Any water necessary for cleaning or installation of the liner shall be furnished by the Owner at a location designated by the owner. The City requires that this water to be metered (meter can be furnished by the City upon request). Water Usage shall be reported to the owner.

2-09 INSPECTION

1. For every ten insertion lengths designated by the owner in the contract documents, one CIPP sample shall be prepared using one of the following methods.
 - 1.1 The sample shall be cut from a section of the cured CIPP at an intermediate manhole or at the termination point that has been inserted through a like diameter pipe which has been held in place by a suitable heat sink, such as sandbags.
 - 1.2 The sample shall be fabricated from material taken from the tube and the resin/catalyst system used and cured in a clamped mold placed in the downtube.

2. Samples shall be tested in accordance with ASTM F1216.
3. Leakage testing of the CIPP shall be accomplished while under a positive head. CIPP products in which the pipe wall is cured while not in direct contact with the pressurizing fluid must be tested by an acceptable method, such as air testing.
4. Visual inspection of the CIPP shall be in accordance with ASTM F1216.
5. The Contractor shall supply the Owner with before and after videos of each section TV's and/or lined.

2-10 SAFETY

1. The Contractor is responsible to conduct operations in a safe manner and in accordance with OSHA regulations. Owner or Engineer's on-site representation in no way relieves Contractor of Contractor's Safety Obligations.
2. To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, red lanterns and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the highway. All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor. The rules and regulations of the local authorities respecting safety provisions shall be observed. All traffic control and signage shall be in accordance with the Manual of Uniform Traffic Control Devices (MUTCD).
3. The Contractor shall carry on the work in a manner which will cause the least interruption to traffic, and may close to through travel not more than two (2) consecutive blocks, including the cross street intersected. Emergency Services Personnel shall be notified of all street closures.
4. All sanitary sewer manholes in the City of Cookeville are deemed permit required confined spaces. If the contractor's personnel enters any manhole they shall have a confined space entry program in place and issue a permit for entry.

2-11 CLEAN-UP

1. Upon acceptance of the installation work and testing, the Installer shall reinstate the project area affected by the operations.

SECTION III: TECHNICAL SPECIFICATIONS FOR THE INSTALLATION OF CURED-IN-PLACE PIPE (LATERAL CIPP)

3-01 INTENT

This specification covers material requirements, installation practices, and test methods for the reconstruction of a sewer service lateral pipe and the main connection without excavation. The pipe renovation shall be accomplished by the inversion and inflation of a resin impregnated, single-piece cured-in-place (CIPP) lateral and main connection liner outfitted with engineered, molded hydrophilic gasket seals that are designed specifically for sealing the CIPP/lateral connection interface and lateral termination. When cured, the liner extends over a predetermined length of the service lateral and the full circumference of the main pipe at the lateral connection. The materials and installation practices shall, at a minimum, adhere to the requirements of ASTM F2561-11 "Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One-Piece Main and Lateral Cured-in-Place Liner." This specification takes precedence over any other similar specification that may be found in other sections of the bid documents.

3-02 GENERAL

The reconstruction shall be accomplished using a resin absorbent textile tube of particular length and a thermo-set resin with physical and chemical properties appropriate for the application. The launching device and launching hose is winched through the mainline and positioned at the appropriate service lateral connection. The mainline bladder is inflated seating the hydrophilic molded gaskets and pressing the connection liner against the main pipe at the connection while the lateral tube inverts up into the lateral pipe by the action of the inversion bladder. The resin-saturated liner is cured with the molded gaskets embedded in-place between the host pipe and the new liner, and the inversion bladder and launching device are removed from the pipe.

3-03 REFERENCES

7.1 ASTM F2561 - Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One-Piece Main and Lateral Cured-In-Place Liner.

7.2 ASTM F1216 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.

7.3 ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

7.4 ASTM D792 - Standard Test Methods for Density and Specific Gravity of Plastics by displacement.

7.5 ASTM D2990 - Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics.

7.6 ASTM D5813 - Standard Specification for Cured-in Place Thermosetting Resin Sewer Pipe.
NOTE: ASTM F2561-11 references several complementing standards; one of which is ASTM F1216. The ASTM F1216 standard is referenced for purposes of tube design considerations for a CIPP liner. ASTM F1216 is not an applicable standard for the sealing of lateral connections where the lateral CIPP forms a verifiable non-leaking connection to the mainline CIPP. ASTM F2561 is

the industry standard for renewing lateral pipes and main/lateral connections using full-hoop CIPP liners and pre-molded compression gaskets.

3-04 QUALIFICATIONS

1. The contractor or subcontractor performing the work of this section shall be employees of the company manufacturing the CIPP Lateral Lining system components, or shall be licensed by the system manufacturer. The Manufactured System must have a minimum of a five (5) year history of satisfactory performance. The contractor or subcontractor shall provide evidence of training for installation of the lining lateral system from the system manufacturer.

3-05 DESIGN CONSIDERATIONS

1. The CIPP shall be designed per ASTM F1216, Appendix X1.
2. The CIPP design for the lateral tube and main sheet shall assume no bonding to the original pipe.
3. The resin saturated lateral tube and the main sheet must place the resin in full contact with the host pipe. The cured liner must provide coating on the interior of the lateral piping for an improved flow rate.
4. The liner must be smooth and have an average roughness coefficient “n” factor of 0.013 or lower.

3-06 PRODUCT AND INSTALLER ACCEPTABILITY

1. BLD and LMK’s full circle lateral lining systems are acceptable. Other full circle systems may be approved by the engineer if information is submitted for review and approval. The Manufactured System must have a minimum of a three (3) year history of satisfactory performance with a minimum of 20,000 CIPP lateral installations.
2. The Installer (the licensed company or subcontractor bidding) must provide, prior to beginning the installation, a statement from the Manufactured system, that they are an approved contractor and have met the training requirements to install the product.

3-07 MATERIALS

1. Liner Assembly - The liner assembly shall be continuous in length and consist of one or more layers of absorbent needle punched felt, circular knit or circular braid that meet the requirements of ASTM F1216 and ASTM D5813 Sections 6 and 8. No intermediate or encapsulated elastomeric layers shall be in the textile that may cause delamination in the CIPP. The textile tube and sheet shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe segments, and flexibility to fit irregular pipe sections. The resin saturated textile tube and sheet shall meet ASTM F1216, 7.2 as applicable, and the tube shall have 5% to 10% excess resin distribution (full resin contact with the host pipe) that when compressed and cured will meet or exceed the design thickness.

2. Mainline Liner Tube - The main liner tube shall be formed from a flat sheet of resin absorbent material suitable for CIPP. The forming of the tube is accomplished by one end of the textile sheet overlapping the second end and sized accordingly to create a circular lining equal to the inner diameter of the lined main pipe. The interior of the textile sheet shall be laminated with an impermeable, translucent flexible membrane. The textile sheet before insertion shall be permanently marked on the membrane as a "Lateral Identification" correlating to the address of the building the lateral pipe provides service. The mainline tube shall have compressible ends which provide a tapered transition to the mainline liner or pipe.
3. Lateral Liner Tube - The exterior of the lateral liner tube shall be laminated with an impermeable, translucent flexible membrane. Longitudinal seams in the tube shall be stitched and thermally sealed. The lateral tube will be continuous in length. The lateral tube will be capable of conforming to offset joints, bends, bells and disfigured pipe sections. For pipe configurations that contain pipe diameter transitions, the transition liner tube must be formed by the manufacturer prior to installation to ensure proper wall thickness per ASTM F1216.
4. Mainline Connection - The main tube and lateral tube shall form a one-piece assembly by stitching the lateral tube to the mainsheet aperture. The connecting end of the lateral tube shall be shaped to match the aperture and curvature of the main tube. The lateral tube and main tube shall be sealed by use of a flexible UV cured adhesive/sealant applied in a factory controlled setting. The main/lateral tube assembly shall take the shape of a "TEE" or "WYE" with corresponding dimensions such as a curved circle or a curved elliptical opening in the pipefitting.
5. Hydrophilic Gasket Seals - The mainline tube shall include a seamless molded flange shaped (aka Hydrohat) gasket attached to the main liner tube at the connection or four molded hydrophilic O-rings at the mainline termination ends. The gasket(s) must be a minimum of 2.5mm thick and must retain this consistent thickness under installation pressures. The lateral tube shall include two compression molded O-ring gaskets attached six-inches from the terminating end of the lateral tube. The hydrophilic gasket seals must be manufactured in a controlled factory environment with strict quality control and quality assurance protocols. A liquid sealant, adhesives or other fluid like materials having paste like consistency will not be accepted.
6. Mainline End Seal Test Data - The hydrophilic gasket seals shall include test data that supports substantial expansion properties so to form a watertight compression end seal at the terminating ends of the CIP-lateral liner. The test protocol shall simulate subterranean conditions and hydraulic loading at surface. Gasket seal submittals must include tests data simulating hydration/dehydration conditions for a period of 10,000-hours and the test results must successfully demonstrate and document long-term performance without deterioration, loss of material, flexibility, and expansion of the gasket during repeated cycles of hydration and dehydration.
7. Bladder Assembly - The liner assembly shall be surrounded by a second impermeable, inflatable, invertible, flexible translucent membrane bladder that will form a liner/bladder assembly. The translucent bladder shall facilitate vacuum impregnation while monitoring the resin saturation process.

3-08 INSTALLATION

1. Access Safety - Prior to entering access areas such as manholes, an excavation pit, performing inspection or cleaning operations, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen shall be undertaken in accordance with local, state, or federal safety regulations.
2. Cleaning and Inspection - As per Section I of these specifications.
3. Accessing the Lateral Pipe - A cleanout is strongly recommended and is required to be located on the exterior of the building. The cleanout fitting shall be TEE shaped so to allow upstream and downstream access to the lateral pipe. The cleanout shall be located within two (2) feet of where the finished liner is to terminate. [A cleanout is strongly recommended, to ensure a successful installation and reduce risk of resin slugs, but when installing through a cleanout is not possible, camera access is recommended to ensure proper location and placement of the liner.]
4. Plugging – When steaming out of the cleanout, the upstream side of the cleanout shall be plugged during insertion and curing of the liner assembly to ensure no flow enters the pipe and no air, steam, or odors will enter the building. When required, the main pipe flow will be bypassed. The pumping system shall be sized for peak flow conditions. The upstream manhole shall be monitored at all times and an emergency deflating system will be incorporated so that the plugs may be removed at any time without requiring confined space entry.
5. Inspection of Pipelines - The interior of the pipeline shall be carefully inspected to determine the location of any condition that shall prevent proper installation, such as roots, severe offsets, and collapsed or crushed pipe sections. Experienced personnel trained in locating breaks, obstacles, and service connections by closed circuit television shall perform inspection of pipelines.
6. Line Obstructions - The existing lateral pipe shall be clear of obstructions that prevent the proper insertion and expansion of the lining system. Changes in pipe size shall be accommodated, if the lateral tube is sized according to the pipe diameter and condition. Obstructions may include dropped or offset joints of no more than 20% of inside pipe diameter.
7. Resin Impregnation -The liner assembly is encapsulated within the translucent bladder (liner/bladder assembly), the entire liner including the flat sheet shall be saturated with the resin system (wet-out) under controlled vacuum conditions. The volume of resin used shall be sufficient to fill all voids in the textile lining material at nominal thickness and diameter. The volume shall be adjusted by adding 5% to 10% excess resin for the change in resin volume due to polymerization and to allow for any migration of resin into the cracks and joints in the original pipe. No dry or unsaturated area in the mainline sheet or lateral tube shall be acceptable upon visual inspection.
8. Liner Insertion -The lateral tube and inversion bladder shall be inserted into the launching hose. The main bladder and flat textile sheet (main liner tube) shall be wrapped around a “TLauncher” launching device, formed into a tube and secured by use of rubber bands. A seamless molded flange shaped gasket shall be attached to the main liner tube by use of stainless steel snaps. [Alternatively, when the flange shaped gasket is not used, the four hydrophilic O-rings may be used to secure the main bladder and flat textile sheet to the launching device.] The flanged gasket shall be inserted into the lateral pipe at the main/lateral juncture so that the brim of the

flanged gasket is firmly seated against the mainline pipe liner. Two hydrophilic Orings shall be positioned 6-inches from the terminating end of the lateral liner tube one to two inches apart. The launching device is inserted into the pipe and pulled to the point of repair. The pull is complete when the lateral tube is exactly aligned with the lateral pipe connection. The lateral tube is completely protected during the pull. The mainline liner is supported on a rigid TLauncher device that is elevated above the pipe invert through the use of a rotating skid system. The liner assembly shall not be contaminated or diluted by exposure to dirt or debris during the pull.

9. Bladder -The main bladder shall be inflated causing the main sheet to unwrap and expand; pressing the main tube firmly into contact with the main pipe and embedding the flange shaped gasket [or hydrophilic O-rings] between the main tube and the main pipe at the lateral opening. The lateral tube is inverted through the main tube aperture by the action of the lateral bladder extending into the lateral pipe to a termination point that shall be no less than two (2) feet from the exterior cleanout or predetermined termination point. The bladder assembly shall extend beyond each end of the liner, so the liner remains open-ended and no cutting shall be required.

3-09 RESIN SYSTEM

1. The resin/liner system shall conform to ASTM D5813 Section 8.2.2.
2. The resin shall be a corrosion resistant polyester, vinyl ester or epoxy resin and catalyst system that when properly cured within the composite liner assembly, meets the requirements of ASTM F1216, the physical properties herein, and those which are to be utilized in the design of the CIPP, for this project.
3. The resin shall produce a CIPP, which will comply with the structural and chemical resistance requirements of ASTM F1216.
4. CIPP Initial Structural Properties - Flexural Strength ASTM D790 4,500 psi (31 MPa) Flexural Modulus ASTM D790 250,000 psi (1,724 MPa)

3-10 CIPP PROCESSING

1. Curing - After the liner has been fully deployed into the lateral pipe; pressure is maintained pressing the liner firmly against the inner pipe wall until the liner is cured at ambient temperatures or by steam. The heating equipment shall be capable of delivering a mixture of steam and air throughout the liner bladder assembly to uniformly raise the liner temperature above the temperature required to cure the resin. The curing of the CIPP shall take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of the soil). The heat source temperatures shall be monitored and logged during the cure and cool down cycles. The manufacturer's recommended cure schedule shall be submitted and followed.
2. CIPP Processing - Curing shall be complete without pressure interruption with air or a mixture of air and steam for the proper duration of time per the resin manufacturer's recommendations. The curing process is complete when the temperature of the CIPP falls back to 100 degrees Fahrenheit or less.

3-11 SAFETY

1. The Contractor is responsible to conduct operations in a safe manner and in accordance with OSHA regulations. Owner or Engineer's on-site representation in no way relieves Contractor of Contractor's Safety Obligations.

SECTION IV: TECHNICAL SPECIFICATIONS FOR THE REPLACEMENT OF LATERALS CONNECTED TO CURED-IN-PLACE PIPE (CIPP)

4-01 SCOPE

1. This item shall consist of furnishing all plant, labor, equipment, materials, and appliances and performing all operations in connection with excavation, trenching and backfilling for replacing the sewer tap and lateral on sewer lines that have CIPP installed.
2. Before beginning excavation, the Contractor shall make a videotape (or DVD) showing the status before any construction has begun. The tape will be used for the determination of the condition of property such as mailboxes and driveways prior to the work beginning to help resolve any disputes as to damage caused by the contractor.
3. Record drawing shall be submitted to the owner upon completion of the project. Record drawing shall show the tap location, tap size, length of pipe installed, method/material used to of connect to existing pipe, and the material of the existing pipe, as well as the cleanout location.
4. Caution shall be taken around existing utilities. The contractor is responsible for all costs incurred when utilities are disturbed during construction. All material, labor, and vehicle costs will be charged to the contractor from all departments within the city. It is the contractor's responsibility to contact any utility disturbed. The contractor shall have utilities located in accordance with the Tennessee Utility Damage Prevention Act (Tennessee One Call).
5. The Contractor shall provide a one year maintenance warranty on all sewer lines and related appurtenances.

4-02 MATERIALS

1. GENERAL: Pipe and accessories shall be new and unused materials of the size and type shown on the Drawings and conform to the requirements of the applicable article of this Section of the Specifications.
2. PIPE:
 - A. The interior of all pipe shall be thoroughly cleaned of all foreign matter before lowered into the trench, and shall be kept clean during laying operations. The pipe shall not be laid in water or when trench or weather conditions are unsuitable for work. When the work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other foreign substance can enter the line.
 - B. Any section of pipe, or fitting, or accessory found to be defective, either before or after laying, shall be replaced with new material at no additional expense to the Owner.
 - C. The nominal pipe size, type of plastic, ASTM designation, SDR, and name of manufacturer shall be clearly marked on each joint of pipe.
 - D. Polyvinyl chloride (PVC) pipe and fittings shall meet and/ or exceed all of the requirements

of ASTM Designation D3034. The bell shall consist of an integral wall section with solid cross section rubber ring factory assembly and securely locked in place to prevent displacement or designed for positioning a single rubber gasket ring in an annular recess or socket. All fittings and accessories shall have bell and spigot configuration identification identical to that of the pipe. Minimum "pipe stiffness" (FY) at 5% deflection shall be 115 or higher for all sizes when tested in accordance with ASTM Designation D2412. Pipe shall be SDR-26 PVC.

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

F. Flexible Elastomeric gaskets conforming to ASTM D3212 are required for all pipe.

3. CONNECTIONS TO EXISTING LINES:

A. Taps on Existing CIPP Mains:

Service connections to existing sewer lines with cured in place pipe shall be made with a GPK saddle with straps sealed using carboline kop-coat A-788 Splash Zone Mastic. A minimum of a baseball size of each component of the mastic shall be used and more as needed to provide a uniform watertight seal. The mastic shall be smoothed on the inside of the pipe at the saddle to pipe connection and mastic shall be feathered over the top of the saddle to CIPP interface.

B. Straight Line Connection

New lines may be connected to existing lines other than PVC SDR-35 or SDR-26 by means of a flexible coupling. Coupling materials shall be of an elastomeric PVC secured by bolts and stainless steel bands as manufactured by Fernco or equal. SDR-35 or SDR-26 PVC lines shall be connected using bell and spigot coupling with rubber gasket.

4. PIPE BEDDING AND BACKFILL

PVC pipe shall be laid in a bed of compacted crushed stone meeting the gradation requirements of the Tennessee Department of Transportation, Size No. 57, to a depth of 6 inches. A crushed stone (Size No. 57) envelope placed up to a point 12 inches above the top of the pipe is required. PVC pipe shall be installed in full compliance with the recommended practice for "Underground Installation of Flexible Thermo-plastic Sewer Pipe," ASTM Designation D2321.

4-03 EXCAVATION

1. GENERAL

A. The excavation shall be carried to the depths required to permit proper bedding of the pipe. The Contractor, at his own expense, shall provide adequate facilities for promptly removing water from all excavations. Trenches shall be of sufficient width to provide free working space on each side of the pipe and to permit proper backfilling around the pipe.

B. All barricades, lanterns, watchmen, and other such signs and signals as necessary to warn the public of the dangers in connection with open trenches, excavations, and other obstructions shall be provided by and at the expense of the Contractor.

- C. The trench shall be straight and uniform so as to permit laying pipe to the proper lines and grades.
 - D. When so required by the Owner where the street cannot be closed, one-half of the street crossings and road crossings shall be excavated, then temporary bridges consisting of 1/2 inch steel plate shall be placed over the side excavated for the convenience of the traveling public; then the remainder of the excavation shall be carried out. All back-filled ditches shall be maintained in such a manner that they offer minimal hazard to the passage of traffic. The convenience of the traveling public and property owners abutting the improvements shall be taken into consideration. All public or private drives shall be promptly backfilled or bridged.
 - E. All excavated material not needed for backfilling purposes shall be disposed of in a manner satisfactory to the Owner.
 - F. All excavated ditches shall be backfilled so that minimal ditch is left open overnight.
 - G. All excavation shall be accomplished in accordance with applicable safety laws and regulations; the Owner does not assume responsibility of any degree or sort for acts of the Contractor. The Contractor shall follow all OSHA regulations on the worksite and follow guidelines as set by the Manual on Uniform Traffic Control Devices (MUTCD) for traffic control procedures and control devices on and around the construction site.
2. UNSTABLE TRENCH BOTTOM MATERIAL OR UNDERCUTTING
- A. If wet, mucky and/or unstable or unsuitable material is encountered in a trench bottom, the Owner may require the unsuitable material to be removed and replaced with sand, gravel or crushed stone to provide a suitable foundation. Undercutting is not a separate pay item. The cost of undercutting shall be merged into the cost of other items.
 - B. In such cases, the trench bottom shall be brought back up to proper grade with bedding material as provided herein and shown on the Plans. TDOT No. 3 (2") stone refill as required for subgrade stabilization, including all excavation, if such excavation and refill is directed by the Owner. In general, where No. 3 stone is required due to unstable pipeline trench conditions, the ditch shall be capped off with No. 57 stone as shown on the Plans. The owner considers the No. 57 Stone bedding material.
3. REMOVAL OF WATER
- A. The Contractor shall at all times during construction provide and maintain means and devices with which to promptly dispose of all water entering the excavations or other parts of the work and shall keep said excavations dry.
 - B. The Contractor shall dispose of water from the work in a suitable manner without damage to adjacent property or sewers. No water shall be drained into work built or under construction.
 - C. During the laying of sewers and until sewer pipe has been bedded in place with at least 1 feet of backfill over the pipe, the Contractor shall keep the groundwater table below the bottom of the trench.

- D. No sewer installation will be permitted except in a dry trench. Running water shall be completely blocked off by dewatering and/or sheathing. The trench must be dry and clean to assure that the hub and spigot of the pipe are perfectly dry before a joint is made.
- E. All removal and handling of water required to maintain dry trenches or other excavations for the construction of sewers or other structures in the trench shall be at the expense of the Contractor.

4. ROCK EXCAVATION

Rock excavation is not a separate pay item on contracts with the City of Cookeville unless there is an item included on the bid form for such. This project includes replacing laterals in their current location so no rock is anticipated. If rock is encountered, the location of the lateral may be relocated.

5. SHEETING, SHORING AND BRACING OF EXCAVATION

Sheeting, shoring and bracing of excavation is not a separate pay item and is the Contractor's sole responsibility to determine when required and to use it in a safe manner.

6. OVER EXCAVATION OR BREAKAGE

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

B. Over-breakage is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the Owner, including slides. All over-breakage shall be removed by the Contractor and disposed of as directed. Payment will not be made for removal and disposal of over-breakage.

4-04 PIPE BEDDING

- 1. All gravity sewers shall be laid on a bed of crushed stone meeting the requirements of the Tennessee Department of Transportation Size No. 57.
- 2. In general, the trench shall be opened below the bottom of the pipe and refilled with bedding material to a depth sufficient to provide a firm bed for the lower quadrant of the pipe at the proper line and grade.
- 3. Where rock is encountered, the trench shall be excavated to a depth of at least 6 inches below the invert of the pipe and refilled with the bedding material to a sufficient depth to provide a firm bed for the bottom quadrant of the pipe. Bedding material for pipe laid in suitable earth or in rock is not a separate pay item.
- 4. Material as specified herein-before for the type of pipe employed shall be brought up evenly along each side of the pipeline and tamped so as to secure the line and grade of the pipeline and to prevent damage thereto.

4-05 SEWER MAIN/LATERAL INSTALLATION

- 1. The trench shall be excavated to the required depth and width and bell holes dug in the bedding in advance of the pipe laying. The laying of gravity sewer pipes in finished trenches shall be

commenced at the lowest point so that the spigot ends point in the direction of the flow. All pipes shall be laid with ends abutting and true to the line and grade indicated on the Plans or directed by the Owner. They shall be fitted and matched so that when laid in the work, they will form a sewer with a smooth and uniform invert. Supporting of pipes shall be as set out above and in no case will the supporting of pipes on blocks or earth mounds be permitted.

4-06 BACKFILLING OF SEWER LINES

1. In the backfilling of the trench, material reasonably free from rock and acceptable to the Owner shall be used. Crushed stone shall be used to bed the pipe as shown on the Gravity Sewer Bedding detail on the plans. This procedure shall be required for all sewers. Crushed stone so used to bed the pipe is not a separate pay item.
2. Except as may be necessary in tamping or backfilling, walking or working on the completed portion of the pipeline shall not be permitted until the trench has been backfilled to a height of at least 12 inches above the top of the pipe as specified herein-before. The filling of the trench shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur. Extra care shall be exercised until the backfill reaches a point 12 inches above the top of the pipe. No backfill material will be used which exceeds 6" in diameter at its greater dimension in the first four feet above the pipe. In the remainder of the ditch, no backfill material that exceeds 18" at its greatest dimension shall be used.
3. In filling the remainder of the trench, the backfill material may be shoveled into the trench without compacting, and heaped over whenever, in the opinion of the Owner, this method of backfilling may be used without inconvenience to the public. Within State Highway rights-of-way or where street paving or shoulders are to be repaired, the contractor will be required to tamp or puddle all backfill as described hereinafter.
4. In backfilling the pipeline trench in areas where the line is laid in the right-of-way of State Highway, backfill shall be of select material of the same type as the existing natural material or fill in which the trench is dug. When so required by the Owner of the roadway, the backfill shall be placed in layers not exceeding six (6") inches and firmly tamped into place by tampers or rammers. The Owner may also require puddling where, in his opinion it is necessary for proper compaction.
5. Crushed stone backfill will be required on lines where street pavement is to be replaced. Puddling may be allowed except where street paving is to be replaced immediately after the backfilling or as noted on the Plans.
6. Backfilling of trenches or excavations on easements shall be performed in such a manner that the private property owner's facilities and grounds shall be restored to as near as possible their original condition immediately after pipe laying. The residue of the stockpiled bedding material shall be cleaned up and placed into the trench, then the previously excavated and stockpiled topsoil suitable for backfill shall be placed in the top of the ditch.
7. On easement areas, the top portion of the trench or excavation shall be filled using the stockpiled topsoil. The ditch should be left high to allow for settling unless this will cause inconvenience to the private property owner. Seeding and sodding shall proceed immediately following backfill.

8. If the backfilling operation is performed during extremely dry weather, the contractor should leave some stockpiled topsoil to use later as additional fill after settlement has occurred.
9. Trench backfill in the vicinity of water service lines shall be properly compacted to prevent settlement and shearing of water service lines.
10. All backfill under existing pavement or sidewalks and 10 feet each side thereof, unless otherwise shown on plans, shall be crushed stone and compacted in six (6) inch lifts.
11. Whenever it is necessary, the Contractor may be required to use a combination of any or all the above outlined methods for proper compaction of the backfill in the trenches.
12. Before final acceptance, the Contractor will be required to level off all trenches where backfill material has been piled up, or to bring the trench up to the level of the surrounding street, roadway, or terrain. The Contractor will be required to remove from the streets, roadways, and private property all excess earth or other materials.

4-07 SERVICE LINES AND CONNECTIONS / CLEAN-OUTS

1. Service Connection piping shall be SDR-26 PVC pipe of the same size of the existing sewer lateral at the point of connection.
2. Joint shall be rubber gasketed slip-on type.
3. CLEAN-OUTS
 - A. Clean-outs shall be installed on service laterals that do not have a satisfactory clean-out in the opinion of the engineer.
 - B. Clean-outs shall be installed using a wye, and a metal clean-out cap as shown on the detail in Appendix A.
 - C. Where cleanouts are installed in pavement, concrete, or gravel areas, a Sigma MB-344 cleanout box or an approved equal shall be used as shown in Appendix A-2.

4-08 EROSION CONTROL

1. The City of Cookeville is very concerned that the contractor use proper erosion control procedures. The contractor shall explicitly follow any direction from the owner or engineer as well as State regulations as to the placement of erosion control structures. The owner has the authority to stop construction if the proper erosion control procedures are not utilized.
2. Cleanup, grading, seeding, planting, and restoration of the work area shall be carried out as early as practical as the construction proceeds. All areas disturbed during construction shall be seeded to reestablish vegetation within 20 days of disturbance. The owner has the authority to stop work if this protocol is not followed.
3. All temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.
4. All permanent erosion control features shall be incorporated into the project at the earliest

practicable time. Temporary pollution control measures shall be used to correct conditions that develop during construction that require attention prior to installation of permanent pollution control features, or that are needed temporarily to control erosion that develops during normal construction practices.

5. Provisions shall be made to retard the rate of runoff from the construction site and control disposal of runoff, including pump discharges resulting from dewatering operations.
6. The contractor shall be solely and strictly liable for any violations of state or federal water pollution laws, regulations or standards caused during construction by the contractor's forces or subcontractors and shall pay any penalties levied by any agency due to said violations.
7. **Pollution and Erosion Control Methods**
Since this work is for the replacement of laterals and the disturbance is small, it is not anticipated that silt fence will be needed, but the contractor shall use his own judgment depending on the size of the area disturbed. All areas are to be mulched with straw within 7 days of the lateral being replaced. Temporary silt fences and/or erosion control logs shall be placed on the natural ground, at the bottom of fill slopes, in ditches if siltation becomes an issue. Silt fences shall be anchored into the soil.

The Contractor shall be required to maintain the silt fence in a satisfactory condition for the duration of the project or until its removal is requested by the Engineer. The silt accumulation at the fence may be left in place and seeded, removed, etc. as directed by the Engineer. The silt fence becomes the property of the Contractor whenever the fence is removed.

All temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.

4-09 REMOVAL, RESTORATION AND MAINTENANCE OF PROPERTY

1. Where any trees, shrubbery, fences, poles or other property and surface structures have been damaged, removed or disturbed by the Contractor, whether deliberately or through failure to carry out the requirements of the Contract Documents, State Laws, Municipal Ordinances or the specific direction of the Engineer, or through failure to employ usual and reasonable safeguards, such property and surface structures shall be replaced or repaired at the expense of the Contractor. The Contractor shall (unless otherwise stipulated) replace or repair and restore said structures to a condition equal to that before the work began, furnishing all labor and materials incidental thereto.
2. The Contractor shall restore (unless otherwise stipulated) all sidewalks, curbing, gutters, shrubbery, fences, poles, sod or other property and surface structures removed or disturbed as part of the work to a condition equal to that before the work began, furnishing all labor and materials incidental thereto. No permanent pavement shall be restored unless and until, in the opinion of the Engineer, the condition of the backfill is such as to properly support the pavement.
3. All disturbed areas other than lawns (which shall be reseeded in approximately their pre-construction condition) shall be left smooth and thickly sown with a mixture of Blue Grass, Kentucky Fescue #31 and/or such other grasses as are specified by the Owner. When the final

grading has been completed, the entire area to be seeded shall be fertilized with an approved commercial fertilizer such as 19-19-19 at the rate of 5 lbs. per 1000 square feet. After the fertilizer has been distributed, the Contractor shall disc or harrow the ground to thoroughly work the fertilizer into the soil. The seed shall then be sowed in two operations, broadcast either by hand or by approved sowing equipment. The applications shall be 400 lbs. per acre for each operation in yards and 40 lbs per acre in pastures. If the Owner determines to use "hulled" or "unhulled" Bermuda, the application rate shall be 7 lbs. per acre. After the seed has been distributed, the Contractor shall then lightly cover the seed by use of a drag or other approved device. All seed shall be certified not more than three percent weed. The seeded area shall then be covered with straw at the rate of 1 to 1-1/2 tons per acre.

4. Any necessary reseeding or repairing shall be accomplished by the Contractor prior to final acceptance. If the construction work is brought to completion when, in the opinion of the Owner, the season is not favorable for the seeding, the Contractor shall delay this item of work until the proper season for such seeding or temporary seed with a warm season grass as directed by the Owner.
5. All planting and seeding shall be watered thoroughly as soon as completed and shall be watered daily or more often, if necessary until all growth is thoroughly established.
6. Seeding and Landscaping is not a separate pay item. Replacement of sod disturbed by the contractor's operation is not a pay item.
7. Trees that are removed during construction must be disposed of at contractor's expense. Any tree cut shall have the stump removed. Contractor may dig out or grind off stump.
8. Mailboxes shall be placed back in their original location. For any reason the mailbox cannot be placed back into its original location, the inspector shall be notified. The inspector will determine the location of the mailbox. Mailboxes shall be installed 40" from the ground in which the post office vehicle will sit to the bottom of the mailbox. If the shoulder where the post office vehicle sits is disturbed during construction causing the post office to be unable to drive up to the mailbox, the contractor will be responsible for spreading gravel 4" thick (minimum) to provide a large enough radius for the post office vehicle to drive to and from the mailbox.
9. Contractor shall not use private driveways or property to park vehicles or store materials without written permission from the property owner(s).
10. The contractor is responsible for property pins disturbed during construction. Any pins removed during construction must be replaced at the contractor's expense including any survey of the property needed to install the pins in the proper location.

4-10 STREET AND DRIVEWAY REPLACEMENT

1. REPLACING STREETS AND ROADWAYS:

A. General

The Contractor shall replace all streets, alleys and roadways, which may be removed, disturbed, or damaged in connection with his operation under the Contract. The Contractor shall reconstruct same to the original lines and grades and in such a manner as to leave all such surfaces in as good or better condition as that which existed prior to his operations.

The reuse of materials removed in making excavations will be permitted in the manner described, provided said materials are capable of being compacted without settlement.

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

The Contractor shall patch the roadway within 30 days of backfilling the trench. Since asphalt plants regularly shut down during the winter months, the Contractor shall patch roadways with 2.5 inches of Grade B Modified Binder and 1 inch of Grade E topping as specified herein during the time of year which asphalt plants are open. During the time period that the asphalt plants are closed, the Contractor shall replace the roadway with Temporary Pavement Replacement as specified herein. The Contractor shall have 25 days from the date the asphalt plant re-opens to replace all temporary patches placed during times of plant shutdown with Grade B Modified Binder patches as specified herein. Temporary patches shall be replaced by digging out the temporary patch and replacing with 2.5 inches of Grade B Modified Binder and topped with 1" of Grade E topping.

The Contractor shall submit the name and credentials of his paving subcontractor to the Engineer for approval. No pavement shall be replaced without paving subcontractor approval by the Engineer.

B. Temporary Pavement Replacement

If asphalt plants are closed for the season, the Contractor shall replace pavement with a temporary patch comprised of 2 inches of Bituminous Plant Mix Surface Course (Cold Mix) as specified in Section 410 of the TDOT Standard Specifications for Road and Bridge Construction. Temporary patches shall be placed a maximum of forty days from the time of initial construction. The Contractor shall maintain the ditch in the interim with additional cold mix as needed..

C. Traffic-Bound Base Course

Replacement of streets after trenching shall be handled in the following manner:

After the backfill has been compacted to within about 3 inches of finished grade as specified hereinbefore, the Contractor shall place approximately 4 inches of crushed stone, Tennessee Department of Transportation Class "A", Grade "D", as a Traffic-Bound Base Course, at the proper elevation to allow for settlement, but not in such a way as to prevent traffic from using the street.

Where the entire ditch is to be backfilled with crushed stone, compacted Tennessee Department Size No. 57 may be used up to a point approximately 12 inches below finished grade and then capped with Class "A", Grade "D" Traffic-Bound Base Course placed in 4-inch lifts compacted to 95 percent of its Standard Proctor Density.

Crushed stone added to ditches for maintenance after initial backfill will not be cause for additional payment.

The Contractor may leave replaced roadways in the condition described in this paragraph for a maximum of 30 days before final patch (if asphalt plant is open) or 45 day before

temporary patch (if asphalt plant is closed) is placed.

D. Subgrade for Final Resurfacing

The traffic-bound course described above will comprise of the base course of all types of resurfacing.

When, in the opinion of the Engineer, the trench has reached a condition of settlement satisfactory for final resurfacing the Contractor shall first strip the base course or add backfill with crushed stone - the size specified above to obtain the proper subgrade elevation. The subgrade shall then be rolled with an approved type roller or tamped until thoroughly compacted and 8 inches thick. Any depression shall be filled with crushed stone or gravel as specified above, and the process of rolling or tamping continued until the subgrade has a smooth and uniform surface.

E. Binder Course

Where required Grade "B" modified (B-M) binder as specified in the Tennessee Department of Transportation Specifications Section 307 shall be used as a base prior to application of the asphaltic concrete surface. Placement of binder shall be in 2.5 inches - well compacted with a heavy roller.

Prior to placement of the Binder, the subgrade or base shall be thoroughly cleaned and broomed and a prime coat of Grade RT-2 tar meeting the requirements of TDOT Specifications Subsection 904.04 or Grade AE-P emulsified asphalt meeting the requirements of TDOT Specification Subsection 904.03 shall be uniformly applied at the rate of 0.20 to 0.25 gallons per square yard.

Where the Binder will be left at the finished grade, the existing pavement will be neatly saw cut back approximately one (1) foot outside the trench and the new pavement tied to the existing pavement.

F. Asphaltic Concrete Pavement (Hot Mix)

Where asphaltic concrete pavement is to be replaced, the subgrade shall be prepared as above specified, and this subgrade shall comprise the base course upon which the bituminous pavement shall be laid.

The subgrade shall be thoroughly cleaned and broomed, and a prime coat of medium tar shall be uniformly applied at the rate of 0.20 to 0.25 gallon per square yard. The prime coat shall be applied by a pressure distributor or other approved pressure spray method. When the prime coat has become tacky but not dry and hard, a bituminous surfacing consisting of asphaltic concrete shall be placed, spread, finished and compacted in accordance with the current standard Specifications of the Tennessee Department of Transportation, Section 104. Compacted thickness of asphaltic concrete pavement replacement shall be 1".

G. Untreated Surface

Where the existing surface is untreated crushed stone, the Contractor shall replace the surfacing that is disturbed or removed with crushed stone as above specified to at least the thickness of the existing surface.

2. REMOVING AND REPLACING CONCRETE DRIVEWAYS, SIDEWALKS AND PAVED DITCHES

- A. Whenever it appears that a concrete driveway must be excavated, the Contractor shall notify the Owner prior to excavating to try to figure a way to avoid disturbing the driveway. Whenever driveways are removed or disturbed in connection with the construction work, they shall be replaced to the original condition and grades in fully as good or better condition than which existed prior to the Contractor's operation.
- B. After the sub-base has been brought to a satisfactory grade, a 3-inch layer of cinders or crushed stone shall be spread over it and thoroughly tamped. Immediately prior to pouring the concrete, the cinders or stone shall be thoroughly wetted, or the concrete shall be poured on a layer of heavy building paper.
- C. The driveways shall be the greater of the thickness of the existing concrete or 4" thick. The concrete shall be 4000 psi concrete – air entrained - with reinforcing fibers (1.5 pounds per cubic yard), struck off to accurately placed screeds and worked with a float until the mortar appears on top. After the surface has been thoroughly floated, it shall be brushed to leave marking of a uniform type similar to the existing driveway. All joints and edges shall be finished with an edging tool.
- D. Other types of driveways, such as brick, stone, asphaltic concrete, etc., shall be replaced with materials removed during the progress of the work, or new matching materials, in equally as good condition as that found before the work began.

4-11 TESTING & INSPECTION

1. INSPECTION OF SEWER LINES FOR QUALITY AND LINE AND GRADE

- A. The Contractor shall notify the Owner when pipe will be received on the Job so that arrangements may be made for inspecting the pipes' properties and examining for the manufacturer's identification. Pipe shall be unloaded and stored in accordance with the manufacturer's recommendations. No pipe, materials or equipment shall be stored on private property without the permission of the property owner.
- B. BEFORE THE CONTRACTOR BACKFILLS ANY OF THE LINES, THEY SHALL FIRST BE INSPECTED BY THE OWNER, UNLESS OTHERWISE DIRECTED BY THE OWNER. If any joints, pipes, or other workmanship or materials are found to be defective, they shall be removed and replaced by the Contractor without any extra compensation.

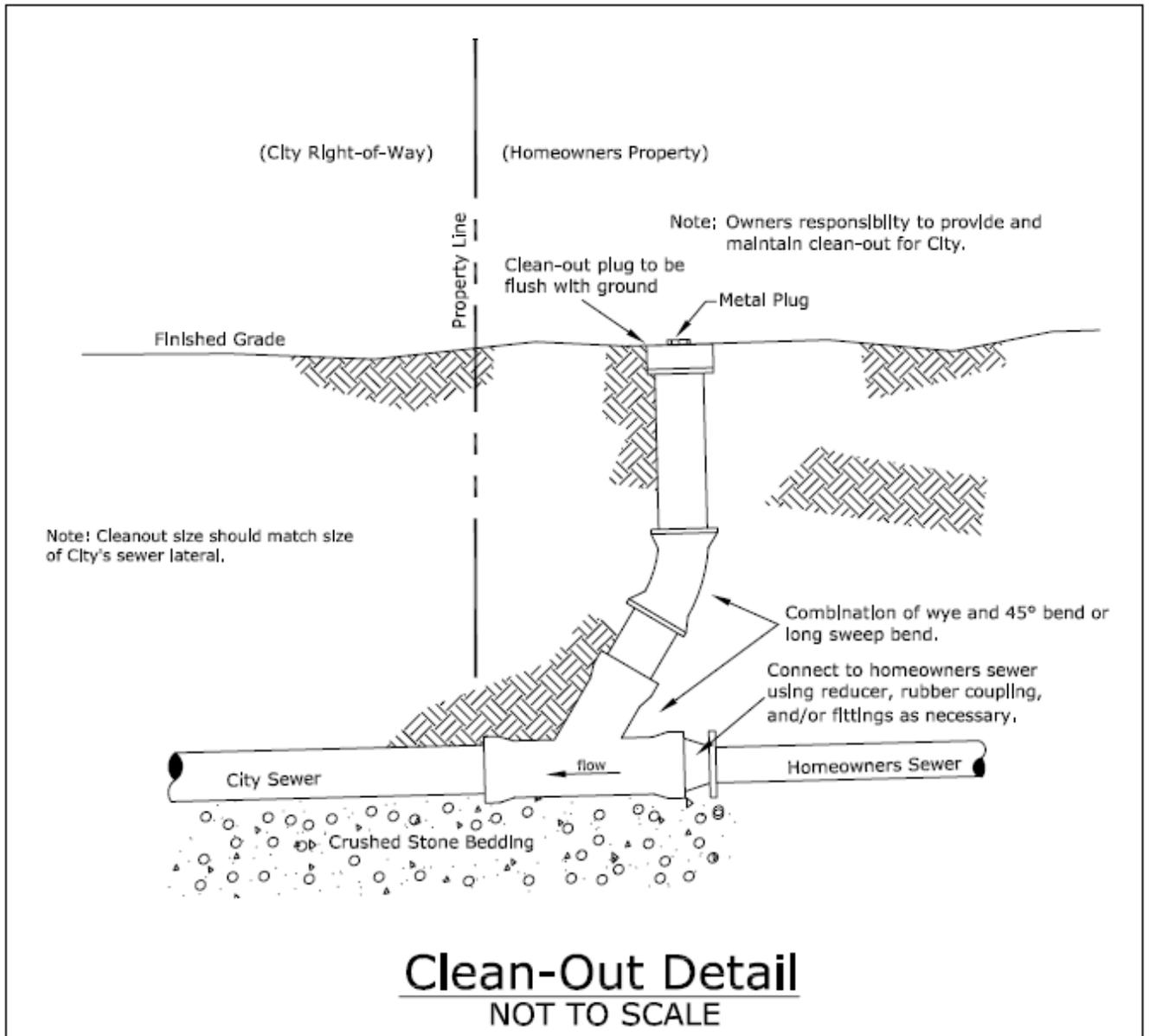
4-12 BYPASSING OF RAW SEWAGE

Under no circumstances will the dumping of raw sewage on private property or into lakes, streams, storm sewers, or in City streets be allowed. Bypass pumping shall be the responsibility of the Contractor and separate payment shall not be made unless there is a separate item on the Bid Form.

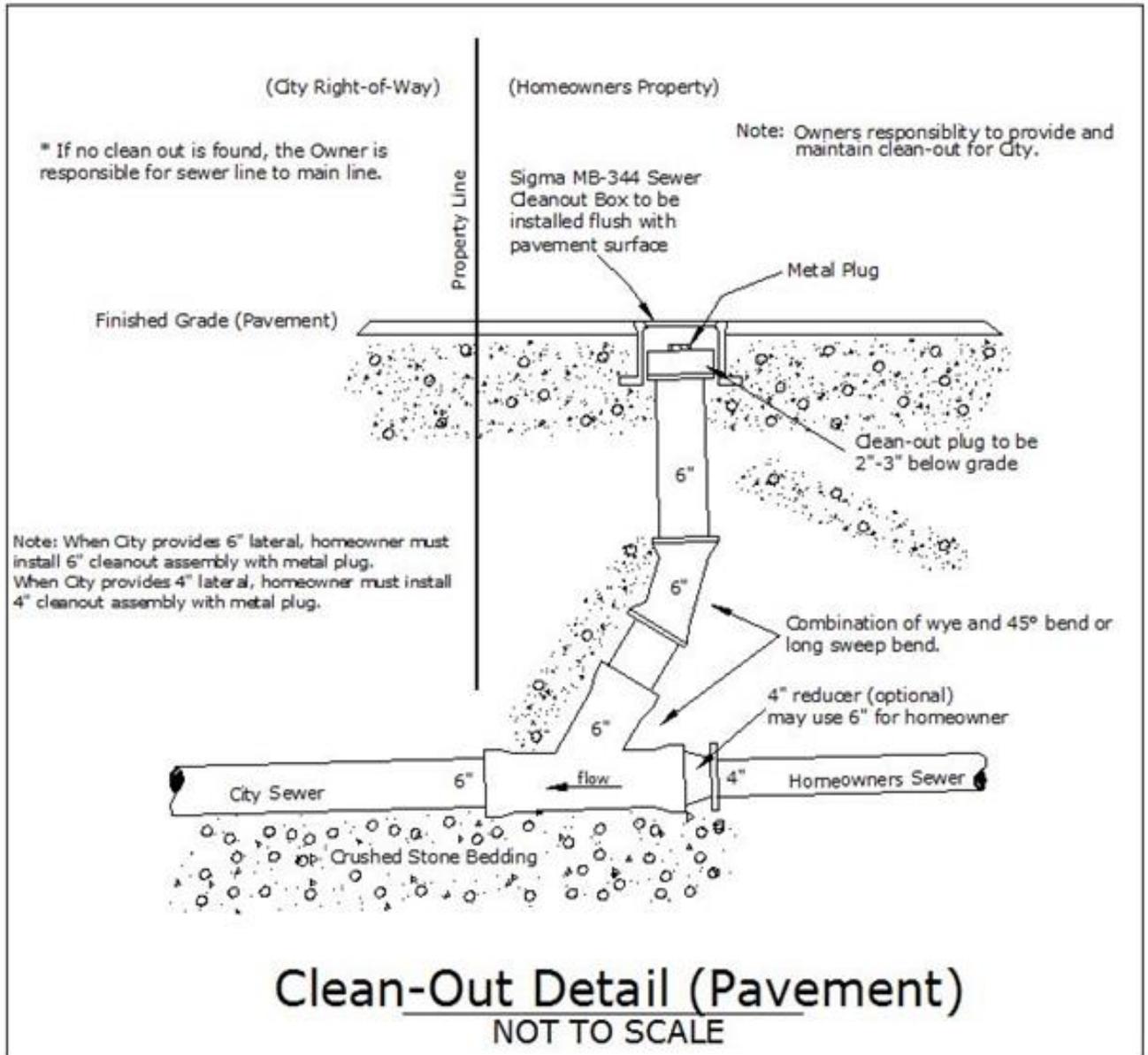
4-13 CLEAN UP

In areas where the sewer line has been backfilled, the Contractor shall clear the right-of-way and surrounding ground, and shall dispose of all waste materials and debris resulting from his operations. He shall fill and smooth over holes and ruts and shall repair all miscellaneous and unclassified ground damage done by him, and shall restore the ground to such stable and usable conditions as may reasonably be required, consistent with the condition of the ground prior to building of the pipeline.

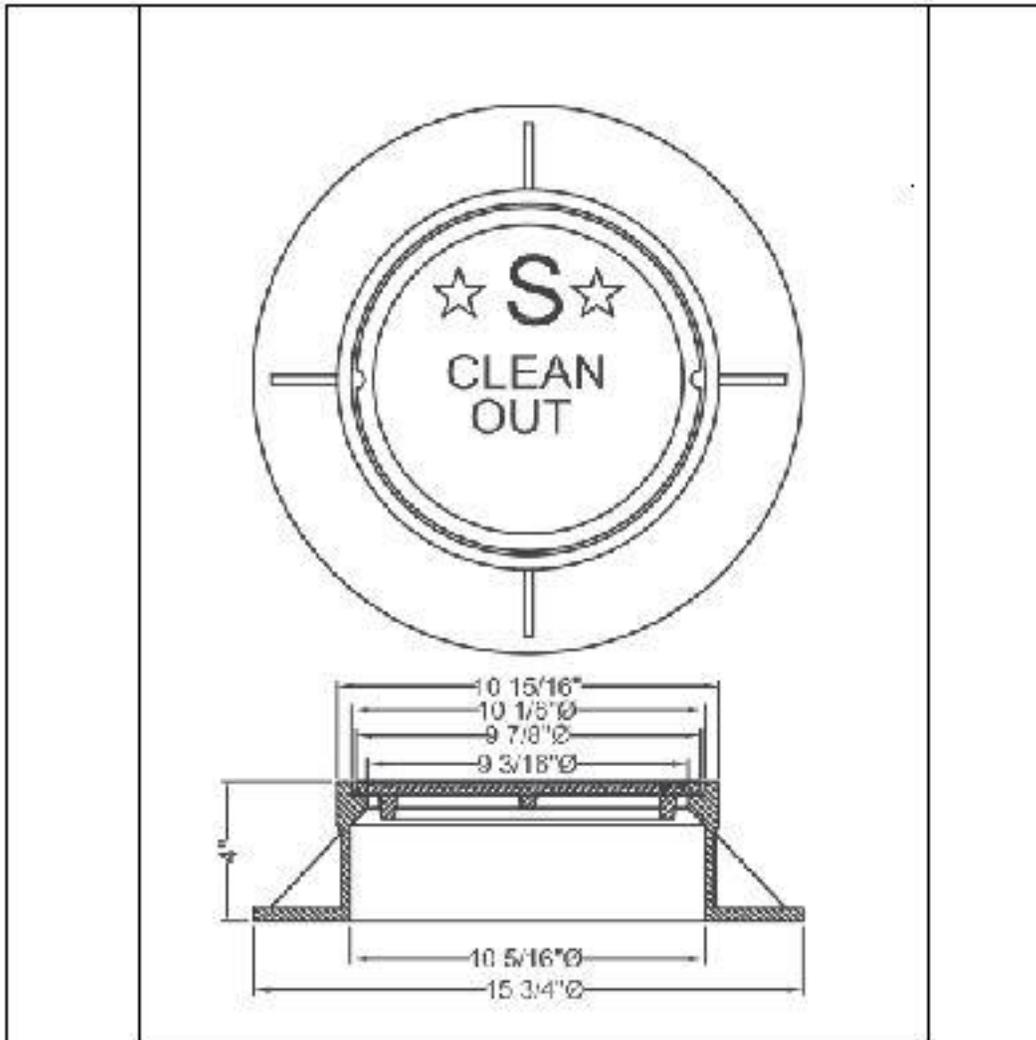
Appendix A-1



Appendix A-2



Appendix A-3



Sewer Clean-Out Box
NOT TO SCALE

* APPROVED EQUAL MAY BE USED WITH
APPROVAL FROM ENGINEER

<p>ITEM NO.</p> <p>MB-344 *</p>	<p>MATERIAL</p> <p>CAST IRON ASTM A48 CLASS 30B</p>
<p>BRAND</p> <p>SIGMA CORPORATION *</p>	<p>WEIGHT</p> <p>31 LBS</p>