SECTION SS-26

CURED-IN-PLACE LATERAL PIPE

PART 1 – GENERAL

1.01 SUMMARY

A. Furnish and install the cured-in-place resin impregnated flexible tube pipe liner in service laterals in accordance with the plans and as specified herein. The lateral liner shall be installed from the sewer main and/or exterior cleanout; there shall be no access to inside house/building. When installed, cured, and complete, the liner shall extend from the sewer main to within 3 feet of the 4”-6” transition but no closer than 4 feet to the house foundation or other permanent structures in a continuous tight-fitting, watertight, pipe-within-a-pipe manner with a uniformly smooth interior providing hydraulic flow equal to or greater than the existing sewer. The system shall be a one- or a two-step process that includes a service connection seal containing a full wrap style seal that extends a minimum of 6” in all directions in the sewer main.

If the Contractor’s means and methods require a cleanout then the Contractor shall install a cleanout no further than 7 feet away from the foundation of the structure, and provide a cost for its installation. If the Contractor’s mean and methods does not require a cleanout then no price is to be included.

B. Related Sections:

1. SS-3, Bypass Pumping
2. SS-4, Sewer Cleaning
3. SS-5, Sewer Video Recording and Inspection

1.02 REFERENCES

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. ASTM D-543, Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
2. ASTM D-638, Test Method for Tensile Properties of Plastics.
3. ASTM D-790, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
4. ASTM D-5813, “Standard Specification for Cured-in-Place Thermosetting Resin Pipe”
5. ASTM F-1216, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin Impregnated Tube.

6. ASTM F-1743, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP) (if given approval on a case-by-case basis).
7. National Association of Sewer Service Companies (NASSCO).

1.03 DEFINITIONS (Not Used)

1.04 SYSTEM DESCRIPTION (Not Used)

1.05 SUBMITTALS

The following submittal (A) shall be made with the Bid:

A. Contractor's Qualifications. Submit copy of manufacturer's licensee certificates. Submit information clearly showing that the minimum contractor qualifications shown in Section 1.06A have been met by providing project information such as length of project, pipe diameter, date complete, project cost, owner contact (name and phone number), and installation/curing method.

The following submittals (B-H) shall be made at the pre-construction meeting:

B. Product Data. Furnish manufacturer's general product data.

C. Material Certifications. Written certification is required from the manufacturer that all materials to be used in the work were manufactured and tested in accordance with the appropriate ASTM specification and is being used or installed in conformance with the manufacturer's recommendations. Materials used on this project shall be approved by the City of Columbus, Division of Sewerage and Drainage Trenchless Technology Committee.

D. Resident Notifications. The Contractor shall submit copies of the resident notifications as described in Section 3.03A.

E. Lateral and Mainline Sewer Cleaning. The Contractor shall submit a narrative describing the proposed methods of cleaning the lateral and cleaning the sewer main at the full wrap connection seal recommended by the manufacturers that are in in general conformance with Section SS-4, Sewer Cleaning.

F. Storage and Delivery Procedures. The Contractor shall provide the liner manufacturer's recommended storage and delivery procedures. This shall include storage and delivery temperatures, maximum time from wet-out to installation, and other pertinent information.

G. Material Safety Data Sheets. The Contractor shall submit Material Safety Data Sheets (MSDS) for each component of the CIPP system.

H. Test Results. Prior to the use of any materials, the Contractor shall furnish, at his expense, the results of testing of the proposed materials by an independent laboratory in conformance with these specifications. All submitted test data shall have been performed on field installed samples within the last twelve (12) months. Any material not meeting the requirements of these specifications shall be completely removed from the project. Materials acceptable to the Engineer shall be substituted for rejected items at the Contractor's expense.

Testing by an independent laboratory shall verify that the products to be used meet all minimum strength standards as set forth in ASTM F-1216, Table 1. Testing shall also verify that any product to be used on the project meets the minimum chemical resistance requirements as established in ASTM F-1743, Table 2, where the testing is in accordance with Section 7.2.1 of ASTM F-1743.

<u>The following submittals (I-M) shall be made a minimum of ten (10) working days prior to lining</u>:

I. Pre-lining video and logs. The Contractor shall submit two (2) copies of the pre-lining video and logs to the Engineer that document existing conditions after the Contractor has cleaned the line.

J. Resident Notifications. The Contractor shall submit a copy of the second and third resident notifications.

K. Liner Thickness Calculations. The Contractor shall perform liner thickness calculations for each lateral length to be lined and furnish them to the Engineer with supporting assumptions. Calculations shall be done after cleaning, televising, and other field inspections have been accomplished. Design parameters given in Section 2.03A shall be used in calculations.

L. Installation Procedures. The Contractor shall submit the liner manufacturer's detailed installation procedures.

M. Curing Cycle and Cooling Rate. The Contractor shall submit the resin manufacturer's recommended curing cycle as well as the recommended cooling rate. If there are separate summer and winter resins then manufacturer recommended cooing rates shall be submitted for both.

<u>The following submittals (N-Q) shall be made immediately after lining</u>:

N. Wet-Out Report. The Contractor shall submit a report of the wet-out process identifying each liner by address and shall contain the wet-out length, diameter, liner thickness, wet-out date, wet-out manager, type of resin, and resin and catalyst volumes or weights with supporting calculations for each liner.

O. Cure Logs. The Contractor shall submit a copy of the cure logs for each lateral installation. Each cure log shall clearly indicate the project name, CIP number, and the address and date of lining.

P. Post-lining tapes and logs. The Contractor shall submit two (2) copies of the final television inspection that show the rehabilitated lateral from mainline to the 4”-6” transition.

Q. Cleanout location. The Contractor shall submit two (2) copies of sketch showing location of cleanout with two measurements from fixed points on the property, property address shall be included.

1.06 QUALITY ASSURANCE

A. Contractor’s Qualifications. Installation of the sewer lateral lining system shall be performed by an experienced Contractor fully licensed and approved by the lining process manufacturer. The Contractor shall have a minimum of three (3) years of experience in such work and shall have satisfactorily completed fifty (50) lateral CIPP installations having a minimum installed length of forty (40) feet.

If the Contractor uses an approved lateral lining system listed in Section 2.01C, then installation of the full wrap service connection seal shall be performed by an experienced Contractor fully licensed and approved by the full wrap service connection seal manufacturer. The Contractor shall have a minimum of three (3) years of experience in such work and shall have satisfactorily completed fifty (50) installations of the connection.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. CIPP material (not wet-out on site) shall be delivered to the job site in a covered refrigerated truck to minimize exposure to sunlight and to maintain the temperature of the product within manufacturer’s recommendations to avoid premature curing.
2. Delivery of material shall be coordinated with other trades to avoid delays.
3. Pipe preparations and field inspections shall be completed prior to delivery of liner to site.

B. Storage of Materials

1. Material shall be stored in the delivery truck in order to minimize exposure to sunlight and to maintain the temperature of the product to within manufacturer’s recommendation to avoid premature curing.
2. No material shall be stored in the open or in contact with the ground.
3. Temperature logs of liner from time of wet-out to installation shall be given to the City representative on site at the time of installation.

C. Handling

1. Handle all products with care. Only sound, undamaged products shall be accepted.

1.08 PROJECT/SITE CONDITIONS

A. Environmental Requirements

1. Contractor may be required to monitor styrene odors as necessary in businesses and residences to ensure that concentration levels are under recommended limits. Monitoring equipment shall be onsite prior to commencement of the work.
2. Contractor shall use caution when working in combined sewers. During rain events, combined sewers may reach capacity quickly and/or head up.

B. Safety. All work to be completed in conformance with all applicable safety standards, in particular OSHA Standard 29CFR 1910.146, Permit Required Confined Space Entry.

1.09 SEQUENCING (Not Used)
1.10 SCHEDULING (Not Used)

1.11 WARRANTY

A. Provide manufacturer's standard written guarantees and warranties dated from time of Substantial Completion. The Contractor shall guarantee all work as stated in the CMSC Section 109.13.

1.12 SYSTEM STARTUP (Not Used)
1.13 INSTRUCTION OF OWNER'S PERSONNEL (Not Used)
1.14 COMMISSIONING (Not Used)
1.15 MAINTENANCE (Not Used)

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Combined Full Wrap Service Connection Seal and Lateral Lining Products. Subject to compliance with requirements, provide one of the following:

1. LMK Enterprises: T-liner
2. BLD Services: Service Connection + Lateral
3. Liquiforce: Junction Liner

B. Full Wrap Service Connection Seal Products. Subject to compliance with requirements, provide one of the following:

1. LMK Enterprises: T-liner
2. BLD Services: Service Connection + Lateral
3. Liquiforce: Junction Liner
4. Formadrain (Formapox 301 only)
5. Easyliner: Junction Liner

C. Lateral Lining Products*. Subject to compliance with requirements, provide one of the following:

1. Easyliner: Plumb Liner
2. Nuflow
3. Flowliner
4. MaxLiner
5. Formadrain (Formapox 301 only)
6. Perma Liner: Perma-Lateral
7. Hammerhead: Hydraliner (HH Liner only)

*Use of one of these products requires installation of an approved full wrap style service connection seal listed in Section 2.01B above. A letter must be submitted from the lateral lining manufacturer stating the full wrap service connection seal is compatible with its lateral lining product.

2.02 EXISTING EQUIPMENT (Not Used)

2.03 MATERIALS

A. Design Parameters and Mechanical Properties. The following values are to be used in liner thickness calculations and, where indicated by an ASTM standard, shall serve as the minimum acceptable strength requirements for the final cured liner.

Flexural Strength (ASTM D-790)	4,500 psi
Flexural Modulus of Elasticity (ASTM D-790)	250,000 psi
Creep Factor	50%
Factor of Safety	2

Each tube shall be designed to withstand internal and/or external pressures as dictated by site and pipe conditions as well as the installation process used by the Contractor. Minimum liner thickness shall be 4.0 mm. Unless job-specific data is available, assume the water table to be four (4) feet below ground level.

B. Fabric Tube. The flexible fabric tube shall consist of one or more layers of flexible needled felt or an equivalent woven and/or non-woven material capable of carrying resin, withstanding installation pressures and curing temperatures, and compatible with the resin system used. The tube shall be sized to accommodate the forces of

installation, host pipe configuration, and any other pertinent factors to assure a tight fitting final product with a smooth finish.

C. Resin System. The resin system shall be a polyester or vinyl ester resin and catalyst system compatible with the insertion process. The resin system shall contain dye for purposes of ensuring thorough wetout, however the resin shall not contain fillers or additives, except those required for viscosity control, fire retardant, chemical resistance, or life extension. The following additives may not interfere with the visual inspection of the cured-in-place liner pipe or its required properties: thixotropic agents added for viscosity control, the opaqueness of the plastic coating, and resins that may contain pigments, dyes, or colors.

The tube shall be vacuum impregnated with resin (wet-out) under controlled conditions. The volume of resin used shall be sufficient to fill all voids in the tube material at nominal thickness and diameter and an allowance for migration of resin into the cracks and joints in the host pipe. A roller system shall be used to uniformly distribute the resin throughout the tube.

D. Inverting/Curing Medium. Air, potable water, steam or other water source can be used for inversion or curing. In no instance will sewage be used to invert or cure liners or calibration tubes. If a private water source is proposed for use, a written agreement shall be obtained from the owner of the private water source and a copy of said agreement given to the Engineer.

E. End Seals and Lapped Liners. A leak free seal must be installed to form a sealing bond between the new lateral liner and host pipe, between the full wrap service connection liner and sewer main, and between any lapped sections of liner. A hydrophilic sealing material shall be used at the end of lining tube closest to the structure, and at the full wrap style service connection liner. The cost of this work shall be included in the unit price bid for CIPP.

2.04 MANUFACTURED UNITS (Not Used)

2.05 EQUIPMENT

All equipment required for the installation and curing of the resin impregnated flexible fabric tube, including cables, sleeves, rollers, compressors, generators, pumps, valves, gauges, water heaters, and accessories required for complete installation shall be in accordance with manufacturer's recommendations.

2.06 COMPONENTS (Not Used)
2.07 ACCESSORIES (Not Used)
2.08 MIXES (Not Used)
2.09 FABRICATION (Not Used)
2.10 FINISHES (Not Used)
2.11 SOURCE QUALITY CONTROL (Not Used)

PART 3 – EXECUTION

3.01 ACCEPTABLE INSTALLERS (Not Used)

3.02 EXAMINATION

A. General. Examine areas and conditions within the lateral in which materials and products are to be installed.

B. Material. All lateral liner materials shall be carefully inspected for defects prior to installation. Containers for all materials shall be well marked with product info and shall clearly display storage requirements including date of production and shelf life. The liner shall be homogeneous throughout, uniform in color, free of tears, holes, foreign materials, blisters, or other deleterious faults. Any material found during the progress of the work to have flaws or defects shall be rejected. All defective materials furnished by the Contractor shall be promptly removed by the Contractor from the project site.

C. Responsibility. The Contractor shall be responsible for all materials furnished and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of installed material discovered defective prior to the final acceptance of the work.

3.03 PREPARATION

A. Resident Notification. The Contractor shall be responsible for resident notification, the content and timing of which is described in the table below. Note that the "Responsible Party" column denotes who is responsible for <u>production and distribution</u> of the notices. All notices are required by ordinance. The "Notification of Private Property Work Commencing" shall contain general information about the project and the cured-in-place pipe process using graphics as necessary to illustrate the procedure. Other information to be included shall be project CIP number, project name, description of the work to be performed, time frames for the work, and precautions to take during the course of the project (keeping water in the trap, keeping toilet lids down, etc.) The Contractor shall list the superintendent on the job along with his mobile telephone number as the primary contact. Secondary contact information shall be the company name, address, and telephone number. This initial resident notification shall be submitted at the pre-construction meeting for approval by the Engineer. Immediately following the Notice to Proceed, Contractor shall distribute this information to all residents affected by the work. This information must be received a minimum of one (1) week, two (2) weeks preferred, before the Contactor enters private property.

The "5-Day Notification of LL Work" shall alert residents to any potential utility disruptions necessitated by the work, and that the work will be commencing within one week so that any scheduling accommodations can be coordinated.

The "48-hr Notification of LL Work" is to advise minimal water usage. This notification shall provide the beginning date and time of the disruption, the length of the disruption, and the ending date and time of the disruption. Contact information shall be repeated on this notification. This resident notification shall be distributed by the Contractor no more than two (2) working days prior to commencement of the work.

The "Notice of LL Work" shall be completed 1 hour prior to work commencing. The site inspector shall knock on the door and provide notice to the resident.

The "Notice of Completed LL Work" shall inform residents that work on their lateral is complete and they may resume normal water usage. The Contractor shall distribute this notice immediately upon completion of the work.

Responsible Party	Notification	Timeframe	Method	Template Name
Outreach	Notification of Private Property Work commencing	Immediately after NTP. Must be received at least one week prior to construction.	Mailed to landlords & residences	PP Work Commencing Letter
Contractor	5-day Notification of LL work; 5-day Notification of CO work	Minimum of 5 days, maximum of 10 days prior to work commencing	Door hanger to residences scheduled for work	LL 5-day Notice; CO 5-day Notice
Contractor	48-hr Notification of LL work; 48-hr Notification of CO work	48 hours prior to work commencing	Door hanger to individual residences scheduled for work	LL 48-hour Notice; CO 48-hour Notice
Contractor	Notice of LL work	1 hour prior to work commencing	Contractor Foreman knocks on door	NA
Contractor	Notification of completed LL work	Immediately after work completed	Hand-delivered to residence	LL Completion Notice w/ Lateral Warranty/Maintenance Attachment

Notices shall be produced according to the following specifications:

Size: Refer to attached template for sizing

Finishing: All edges to be professionally cut and smooth; no raggedy edges, with hole and slit: 1" diameter hole and horizontal slit to right edge. Matte varnished on both sides to prevent bleeding in the event of rain.

Printing: Two sides, bleeds on all four sides.

Ink Colors: Navy blue (PMS 288) for text and black screened 10% for gray background color. Ink must be non-petroleum based with low Volatile Organic Compounds of 10% or less.

Paper Stock: White 80 lb. gloss cover, flooded on one side with gray. **Must contain at least 30% post consumer recycled content.** The printer must provide paper manufacturer's sample book or Web link showing recycled content and at least three sample sheets prior to job being awarded. Consistency of paper weight is expected and critical.

B. Cleaning. All sewer laterals and portion of sewer main to be lined shall be cleaned as required prior to lining with CIPP. The term "cleaned" shall mean the removal of all sand, dirt, roots, grease, and all other solids or semisolid materials from the interior face of the sewer lines. Cautions shall be taken during the cleaning process to avoid accidental sewer backups. Refer to specific recommendations SS-4 "Sewer Cleaning".

C. Television Inspection. The Contractor shall televise the sewer main in the vicinity of the lateral and the lateral sewer from the sewer main to the 4"-6" transition to provide a detailed record of existing conditions. Lateral connection shall be observed while the camera is stopped and viewing the connection squarely. Two copies of the pre-lining inspection shall be submitted to the City. The Contractor shall be responsible for having a copy of the pre-lining inspections in the field as well. Immediately prior to liner insertion, the camera shall traverse the sewer to inspect for debris which may have entered the line after the existing condition videotaping. Refer to Supplemental Specification SS-5, Sewer Video Recording and Inspection. A City representative must sign off on this reconnaissance television inspection for the lining work to proceed.

D. Private Source Inflow/Infiltration Investigation. Based on field reconnaissance and contractor obtained lateral CCTV investigations, it may be necessary to perform private source infiltration and inflow (I&I) investigations. Example instances include discovering direct connections beyond the homes' foundation to the existing sanitary lateral service or encountered high rates of active I&I. All suspicious connections or inflows shall be immediately brought to the attention of the City. If the City determines that private source investigations are warranted, the Contractor shall perform the necessary work to try and obtain the I&I source. All such work to identify the sources of said connections or I&I shall only be performed after review and approval of the City.

No City sewer maintenance personnel or equipment will be available to assist in the performance of this work.

Private property owner notification: Since many of the sanitary sewer laterals are located in backyards and investigations may require accessing gutters or downspouts, the Contractor must provide 48 hour written notification, utilizing a door hanger, to all affected owners prior to conducting any investigations. The

door hangers and/or notifications will be provided to the Contractor by the City to be printed. Owner consent must be obtained prior to conducting any investigations.

Field Testing: Once a property has been approved for private source investigations, the Contractor shall assess the property and look for the following:

1. Depressed Driveway
2. Sump Pumps
3. Yard or Area Drain(s)
4. Downspouts not directed to the curb

If any of the above features are encountered, dye testing shall be utilized in order to determine if they are directly connected to the sanitary lateral. Water and dye shall be introduced into each feature while a CCTV camera is within the sanitary service lateral. The Contractor shall be responsible for bringing/providing all water for the testing. For downspouts, if a clean out is not present, the Contractor may need to place the water and dye directly into the gutter(s). All dye tests are to be observed by the City's field representative. If positive tests are found, they shall be properly documented and immediately be reported to the City. All CCTV and/or reports shall be provided to the City.

E. Mainline. Lateral sewer pipes protruding into the main sewer shall be trimmed flush with the inside of the main sewer wall prior to lining. Trimming must be done in a neat, workmanlike manner, causing no damage to the lateral pipe beyond the inside face of the main sewer. This item shall be included in the unit price bid for lateral lining. Sewer mains in project area have been lined with minimum 6mm CIPP. Lateral sewer connections not fully reinstated when sewer main was CIPP lined shall be fully reinstated by the Contractor prior to lateral lining. Cost for this work shall be included in the unit price bid for Item SS-26, Re-cut Sanitary Lateral.

E. Bypassing Sewage. The Contractor shall bypass the sewage around the sections of the sewer that are to be lined as necessary. The bypass shall be made in accordance with SS-3 "Bypass Pumping".

F. Line Obstruction. It shall be the responsibility of the Contractor to clear the sewer of obstructions, solids, or collapsed pipe that will prevent the proper installation of the liner. If inspection reveals an obstruction that cannot be removed by trenchless means from within the sewer, the Contractor shall obtain approval from the Engineer to make a point repair.

In addition, any equipment that is lost, broken, wedged, or stuck in a line section shall be removed by the Contractor at the Contractor's expense.

G. Lateral Point Repair. The Contractor shall make a repair to a lateral if approved by the Engineer, with all work conforming to CMS Item 918 and Standard Construction Drawing AA-S160. The Contractor shall use mud mats to limit rutting/damage to lawns. The Contractor shall place large tarp(s) down where spoils will be placed. The Contractor shall segregate topsoil from spoils for subsequent surface restoration per CMS Item 651. Excavation, repair and backfill shall be completed in the same day; restoration of disturbed areas shall be completed within 48 hours. Place a minimum of 4 inches of topsoil to match existing grade per CMS

Item 652 (or Item 653 if in-situ topsoil is not suitable). Seed per CMS Item 659, Class 1.

1. Tree Protection: No activity shall impact a Public Tree's Critical Root Zone (CRZ) without Forestry's prior approval, per Section 2 of The City of Columbus - Tree Technical Manual. The CRZ equals 1.5 feet of radius per each 1 inch of Diameter Breast Height (DBH). The DBH of a tree is measured 4.5 feet above the ground. For example, the CRZ of a 20-inch tree is a 30-foot radius around the tree.

H. Lateral Point Repair at Wye Connection. The Contractor shall make an open cut point repair on a main line including the replacement of the wye fitting at the lateral connection if approved by the Engineer, with all work conforming to CMS Item 901.15.C and Standard Construction Drawing AA-S170. The Contractor shall use mud mats to limit rutting/damage to lawns. The Contractor shall place large tarp(s) down where spoils will be placed. Excavation, repair and backfill shall be completed in the same day; restoration of disturbed areas shall be completed within 48 hours. For repairs in grass, the Contractor shall segregate topsoil from spoils for subsequent surface restoration per CMS Item 651. Place a minimum of 4 inches of topsoil to match existing grade per CMS Item 652 (or Item 653 if in-situ topsoil is not suitable). Seed per CMS Item 659, Class 1. For repairs in pavement, the Contractor shall backfill the main line in accordance with CMS Item 912. The pavement restoration shall match existing grade and be in accordance with Standard Construction Drawing 1441.

1. Tree Protection: No activity shall impact a Public Tree's Critical Root Zone (CRZ) without Forestry's prior approval, per Section 2 of The City of Columbus - Tree Technical Manual. The CRZ equals 1.5 feet of radius per each 1 inch of Diameter Breast Height (DBH). The DBH of a tree is measured 4.5 feet above the ground. For example, the CRZ of a 20-inch tree is a 30-foot radius around the tree.

I. Wye Connection or Lateral Grouting. The Contractor shall schedule the work to take place during dry periods when groundwater infiltration will not potentially create issues to the proper installation and curing of the liner, or cause water in basement backups. When high groundwater conditions cannot be avoided, the Contractor shall grout the wye connection or the lateral to stop excessive infiltration/inflow if it inhibits installation and/or curing of liner. The cost of this work shall be distributed amongst the various bid items.

J. Protective Measures. To prevent burnt grass, the Contractor shall provide protective measures (e.g. felt, blocks of wood) to create a barrier between the boiler hoses and the grass for each installation. The Contractor shall be cognizant when parking vehicles and where steam or exhaust outlets are located to not cause damage to trees.

K. Fence Removed For Reuse. If a fence needs to be temporarily removed for installation of the lateral liner, all material shall be designated for reuse per CMS

202 and shall be reinstalled to match existing condition upon completion of the later lining installation.

3.04 ERECTION (Not Used)

3.05 INSTALLATION

A. General. The Contractor shall deliver the liner to the site and provide all equipment required to insert the liner into the sewer and cure it in place. The Contractor shall designate the location where the tube will be vacuum impregnated prior to installation. The Contractor shall allow the Owner to inspect the materials and the "wet-out" procedure upon request. All procedures to prepare the liner for installation will be in strict compliance with the manufacturer's recommendation. Any material not properly prepared shall be rejected and replaced with acceptable materials at the Contractor's expense. Contractor shall not proceed with work until satisfactory conditions are present in the sewer. If the Contractor's means and methods require a cleanout then the Contractor shall install a cleanout near the location shown on plans and provide a cost for its installation.

B. Cleanout. Cleanouts shall be installed in accordance with CMS Item 915 and Standard Construction Drawing AA-S161. The Contractor shall place large tarp(s) down where spoils will be placed. The Contractor shall segregate topsoil from spoils for subsequent surface restoration per CMS Item 651. The Contractor shall use mud mats to limit rutting/damage to lawns. Excavation, installation and backfill of cleanout shall be completed on the same day; restoration of disturbed areas shall be completed within 48 hours. Place a minimum of 12 inches of topsoil to match existing grade per CMS Item 652 (or Item 653 if in-situ topsoil is not suitable). Seed per CMS Item 659, Class 1.

C. Installation. The resin impregnated tube shall be pulled and/or inverted into the host pipe by methods approved by the manufacturer and proven through previous successful installations. The insertion method used shall not cause abrasion or scuffing of the tube. Pressure shall be sufficient to inflate the tube, molding it against the walls of the host pipe. Tube installation pressures shall be limited so as not to stretch the tube longitudinally by more than five (5) percent of the original length.

D. Curing. After the insertion is complete, the Contractor shall cure the liner in accordance with liner manufacturer's recommendation. For heat cured liner the Contractor shall supply a suitable heat source, water recirculation equipment, and a curing medium as approved by the Engineer. The equipment shall be capable of uniformly raising the water temperature to a level required to effectively cure the resin. The equipment shall be muffled to reduce excess noise during the curing process.

The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supply. Another such gauge shall be placed between the tube and the host pipe in the downstream manhole at or near the bottom to determine the temperatures during cure. Water temperature in the pipe during the cure period shall be as recommended by the resin manufacturer.

Initial cure shall be deemed complete when the exposed portions of the tube appear to be hard and sound and the temperature sensor indicates the recommended temperature of the manufacturer. The cure period shall be as recommended by the resin manufacturer and may require continuous recirculation of the water to maintain the temperature.

Steam curing may be used in lieu of water; it shall be performed in accordance with ASTM F-1216.

Curing water or steam shall be discharged to a sanitary sewer. Discharge to a storm sewer, ditch, stream, curb, ground, etc. is prohibited. Steam condensate must be contained and captured and properly disposed of.

E. Cool Down. The Contractor shall cool the hardened pipe to a temperature below 100 degrees Fahrenheit before relieving the hydrostatic head. Rate of cooling shall not exceed resin manufacturer's recommendations.

F. Finish. The finished product shall be continuous over the length of the lateral reconstructed and be free from dry spots, delamination, lifts, and debris under the liner. If any unsatisfactory condition is present in the lined pipe, the Engineer reserves the right to require a suitable repair.

G. Full Wrap Service Connection Seal. The Contractor shall install the full wrap service connection seal per the manufacture's instruction. The unit shall extend a minimum of four (4) inches upstream and downstream of the lateral within the main and shall extend up the lateral overlapping the lateral liner a minimum of three (3) pipe diameters or per the manufacturer's recommendation, whichever is longer.

H. Sealing Lateral at Manhole. The cured-in-place liner shall make a tight seal at the manhole opening with no annular gaps. All liners shall utilize a hydrophilic sealing material or epoxy-sealing component compatible with the CIPP material whenever a liner enters a manhole. The contractor shall submit all pertinent data for the proposed hydrophilic material prior to lining. The cost of this work shall be included in the unit price bid for CIPP.

I. CIPP Spot / Partial Liner. This work includes capping inactive lateral connections and will be performed as authorized by the City. Video must be provided to the City to illustrate completion and quality of lining work.

J. Final Television Inspection. The Contractor shall televise the sewer main at and through the full wrap service connection seal and televise the lateral from the main through the cleanout (if one was installed) to the 4"-6" transition to provide a detailed record of finished conditions. Lateral connection shall be observed while the camera is stopped and viewing the connection squarely. When complete, the Contractor shall submit two (2) copies of the rehabilitated lateral inspection, along with the accompanying logs, which shall be printed clearly or typed as requested in Supplemental Specification SS-5. Post rehabilitation videos shall be submitted within 10 business days of liner installation.

K. Warranty Period Television Inspection (NEW). The contractor shall televise 10% of the completed laterals liners as described in 3.05.J above no sooner than 10 months after the warranty period has begun, but prior to the expiration of the

warranty. The laterals to be televised will be chosen at random by the City, however the City will minimize the number of CCTV deployments required, with the total number of CCTV deployments being no more than 10. The cost for this work shall be distributed amongst the various items of the contract per CMS Item 104.01. An appropriate amount of retainage to ensure completion of this work will be withheld in accordance with Item 109.09 of the City of Columbus CMS.

Any defects observed as defined in 3.10.A below, shall be corrected as noted in 3.10.A below, and the warranty for those liners will also be extended as noted in 3.10.A below.

If greater than 20% of the above initial warranty period CCTV inspections contain defects, the contractor shall at his own expense televise an additional 10% of the total number of liners installed on the project. Any corrective measures necessary to repair any defects identified as part of this secondary round of televising shall be performed at the Contractor's expense, along with the cost to perform an additional televising to confirm the success of the repair.

If greater than 20% of the secondary round of lateral televising at the contractor's expense contain defects, then the contractor shall televise at his own expense an additional 33% of the total number of liners installed on the project. Any corrective measures necessary to repair any defects identified as part of this tertiary round of televising shall be performed at the Contractor's expense, along with the cost to perform an additional televising to confirm the success of the repair.

If greater than 20% of the tertiary round of lateral televising at the contractor's expense contain defects, then the contractor shall televise at his own expense all remaining liners installed on the project. Any corrective measures necessary to repair any defects identified as part of this final round of televising shall be performed at the Contractor's expense, along with the cost to perform an additional televising to confirm the success of the repair.

3.06 PREPARATION (Not Used)

3.07 CONSTRUCTION (Not Used)

3.08 RESTORATION

A. General Where portions of the site become damaged during the course of construction by the Contractor's operations, the Contractor shall repair or replace at no additional cost to the City such damage to original or better condition in conformance with the Contract Documents. This shall include, but not be limited to, reseeding, replacing shrubbery in kind, replacing damaged fence, etc.

3.09 PREPARATION (Not Used)

3.10 FIELD QUALITY CONTROL

A. General. The reconstructed lateral shall be continuous (without joints) over the entire length of an insertion run between the mainline and clean-out. The liner shall be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. The liner surface shall be free of leaks, cracks, and crazing with a smooth finish. Some minor waviness that, in the

Owner's opinion, will not appreciably decrease the flow cross section or affect the flow characteristics shall be permissible. City may perform CCTV during wet weather conditions to identify liner leakage and defects.

Any defects in the product shall be repaired at the Contractor's expense in a manner mutually agreed upon by the Owner and Contractor. The Contractor shall reinspect these repairs before the one (1) year guarantee period expires. During the one (1) year guarantee period, any defects that are discovered that will affect the integrity or strength of the product shall be repaired at the Contractor's expense in a manner mutually agreed upon by the Owner and the Contractor. These repairs shall be granted a three (3) year extended guarantee period by the Contractor from the date of repair. The Contractor shall reinspect these repairs prior to the expiration of the three (3) year extended guarantee period.

B. Testing Requirements

1. Sampling and testing for each installed CIPP length shall be in accordance with ASTM F-1216 and/or F-1743. The Contractor is to provide test samples to the City; the City will retain a laboratory to perform these tests. Two plate samples provided to the City by the Contractor for testing shall be fabricated from the tube and the resin/catalyst system used. Production of plate samples for testing shall be obtained from the actual liner during installation, and shall be witnessed by a representative of the City. All laboratories utilized for the testing of CIPP samples shall be located within 100 miles of the City of Columbus to facilitate ease of inspection for all parties involved. All samples shall be labeled before shipment for testing. If the Contractor performs independent tests for their purposes, additional samples shall be provided by the Contractor for that use.

2. Air Test. Lateral air testing shall be performed at the discretion of the Engineer on a random basis, and the Contractor shall complete the test within 10 business days of being notified by the Engineer, but no sooner than 30 days after the liner has been installed. The air test shall be performed on laterals with a minimum cleanout diameter of six-inches. The Contractor shall furnish all equipment and materials to perform the test, the pressure gauge shall be graduated to a tenth of a psi. Testing locations will be provided by the Engineer incrementally at the completion of every 100 laterals.

   The Contractor shall install a set of test plugs in the sewer main adjacent to the full wrap service connection seal, but not so wide as to include any sewer joints. The intent is to provide verification that the junction between the lateral liner and the mainline liner has an air-tight connection. An air test plug shall be inserted into the lateral pipe through the clean-out and positioned adjacent to the upstream end of the liner.

   The lateral being tested shall be pressurized to 4 psi if groundwater is not present [5 psi if groundwater present]. This pressure shall be maintained for at least 2 minutes for air temperature to stabilize, only adding enough air during this time to maintain the pressure. Once stabilized no more air is to be added. The lateral passes the air test if the pressure drop over the next 3 minutes is 0.5 psi or less.

A successful air test shall be paid at a unit price for each lateral; no payment shall be made for a failed test. Any corrective measures necessary to repair any liners failing an air test shall be performed at the Contractor's expense, along with the cost to perform an additional air test to confirm the success of the repair.

If greater than 20% of the air test quantities included in the base bid fail, the contractor shall perform at his own expense, the installation of cleanouts and conducting of air tests on an additional 10% of the total number of liners installed on the project. Any corrective measures necessary to repair any liners failing an air test shall be performed at the Contractor's expense, along with the cost to perform an additional air test to confirm the success of the repair.

If greater than 20% of the air tests performed at the contractor's expense fail, then the contractor shall perform at his own expense, the installation of cleanouts and conducting of air tests on an additional 33% of the total number of liners installed on the project. Any corrective measures necessary to repair any liners failing an air test shall be performed at the Contractor's expense, along with the cost to perform an additional air test to confirm the success of the repair.

If greater than 20% of the second iteration of air tests performed at the contractor's expense fail, then the contractor shall perform at his own expense, the installation of cleanouts and conducting of air tests on all remaining liners installed on the project. Any corrective measures necessary to repair any liners failing an air test shall be performed at the Contractor's expense, along with the cost to perform an additional air test to confirm the success of the repair.

C. Final Installed Liner Thickness. The final installed liner thickness shall not be less than the specified thickness, or more than ten (10) percent greater than, the required thickness specified in the Contract Documents. The final installed liner thickness measurement shall be determined from pipe samples, or as deemed necessary by the Engineer.

D. Non-Compliance. In the event the flat plate samples do not meet the required thickness or Flexural Strength of 4,500 psi and Flexural Modulus of Elasticity of 250,000 psi as outlined in Section 2.03A, actual installed samples must be taken. The installed samples shall be taken as directed by the City and in accordance with all applicable ASTM requirements. From these samples, the Installed Thickness shall be determined by taking an average of at least 10 thickness measurements. Installed samples shall then be prepared for re-testing in accordance with Section A above.

Any liner installation not meeting one or all of the specified strength and thickness requirements shall be subject to the calculation of the liner's Value Factor, calculated as follows:

Value Factor, VF = (%thickness)x(%flexural strength)x(%modulus of elasticity)

Where,

* %thickness = actual thickness / specified thickness
* %flexural strength = actual flexural strength / specified flexural strength
* %modulus of elasticity = actual modulus of elasticity / specified modulus of elasticity

* - (100% Maximum for all percentage factors)

Any liner installation having a Value Factor less than 50% shall have the defective sections of liner removed and replaced with a product acceptable to the City at the total expense of the contractor. The re-inspection requirements as listed above shall apply to this re-installed section of line. Payment for any liner installation having a Value Factor in the range of 50% to 99.9% shall be the following:

Payment = Value Factor, VF x Dollar Amount

3.11	ADJUSTING	(Not Used)
3.12	CLEANING	(Not Used)
3.13	DEMONSTRATION	(Not Used)
3.14	PROTECTION	(Not Used)

3.15 SCHEDULES

A. 8"–10" Diameter Mainline/Lateral Connection: The unit price bid for this item includes all work necessary to install full wrap service connection seal and first 25 feet of lateral CIPP liner in laterals located on 8"-10" sewer mains.

B. 12"–15" Diameter Mainline/Lateral Connection: The unit price bid for this item includes all work necessary to install full wrap service connection seal and first 25 feet of lateral CIPP liner in laterals located on 12"-10" sewer mains.

C. 18"-21" Diameter Mainline/Lateral Connection: The unit price bid for this item includes all work necessary to install full wrap service connection seal and first 25 feet of lateral CIPP liner in laterals located on 18"-21" sewer mains.

D. 24" Diameter Mainline/Lateral Connection: The unit price bid for this item includes all work necessary to install full wrap service connection seal and first 25 feet of lateral CIPP liner in laterals located on 24" sewer mains.

E. 6" Lateral CIPP, 4.0 mm Min Thickness (From Mainline): The linear foot price bid for this item of work includes all work necessary to install lateral CIPP liner exceeding 25 feet.

F. 6" Lateral CIPP, 4.0 mm Min Thickness (Manhole Connections): The linear foot price bid for this item of work includes all work necessary to install lateral CIPP liner from 15 manhole connections.

G. 6" Lateral CIPP, (Cleanout Inversion): The unit price bid for this item includes all work necessary to install additional lateral CIPP liner through a cleanout and the first 25 feet of lateral CIPP.

H. 6" Lateral CIPP, 4.0 mm Min Thickness (From Cleanout): The linear foot price bid for this item of work includes all work necessary to install lateral CIPP liner when

the total linear foot of the lateral exceeds 85 feet and a second inversion is necessary from the cleanout. This item excludes the first 25 feet of liner from the cleanout, as this footage is to be included in the cleanout inversion item above.

I. CIPP Spot / Partial Liner: The unit price bid for this item includes all work necessary to cap inactive lateral connections and will be performed as authorized by the City. Video must be provided to the City to illustrate completion and quality of lining work.

J. Re-Cut Sanitary Lateral: The unit price bid for this item includes all work necessary to fully reinstate those lateral connections that were not reinstated when sewer main was previously lined with 6mm CIPP. Video must be provided to the City to document completion and quality of finished brushing and cutting.

K. Sanitary Lateral Air Test. This item of work shall include all necessary equipment, materials, and labor to air test the cured liner, with the exception of the cleanout, which shall be included with SS-26, Cleanout, 2.5-14.5' Deep (For Air Test).

L. Cleanout, 2.5'-14.5' Deep (For Air Test): The unit price bid for this item includes all work necessary to install a cleanout on laterals between 2.5' and 14.5' deep for use during air testing.

M. Cleanout, 2.5'-14.5' Deep (For Cleanout Inversion): The unit price bid for this item includes all work necessary to install a cleanout on laterals between 2.5' and 14.5' deep for completing a cleanout inversion.

N. Cleanout, 2.5'-14.5' Deep (Lateral Liner Installation As Needed): The unit price bid for this item includes all work necessary to install a cleanout on laterals between 2.5' and 14.5' deep for as necessary for installation of lateral liner and at contractor's own volition.

O. Lateral Point Repair (In Grass): The unit price bid for this item shall include all labor, materials, equipment, and incidental work required to perform an open cut point repair on a lateral necessary for installation of the lateral liner, including surface restoration. This item applies only to repairs 8 feet or less in length and 12 feet or less in depth, and only within grass areas. Repairs exceeding these limits will be evaluated and considered for additional payment.

P. Lateral Point Repair (In Pavement – 12-feet or Less in Depth): The unit price bid for this item shall include all labor, materials, equipment, and incidental work required to perform an open cut point repair on a lateral necessary for installation of the lateral liner, including pavement restoration. This item applies only to repairs 8 feet or less in length and 12 feet or less in depth, and only within paved areas. All pavement restoration shall be performed in accordance with CMS Item 912 and Standard Construction Drawing 1441. Repairs exceeding the length or depth limits defined above will be evaluated and considered for additional payment.

Q. Lateral Point Repair (In Pavement – Greater than 12-feet in Depth): The unit price bid for this item shall include all labor, materials, equipment, and incidental work required to perform an open cut point repair on a lateral necessary for installation of the lateral liner, including pavement restoration. This item applies only to repairs 8 feet or less in length and greater than 12 feet in depth up to the full depth of the main, and only within paved areas. All pavement restoration shall be performed in accordance with CMS Item 912 and Standard Construction Drawing 1441. Repairs exceeding the length or depth limits defined above will be evaluated and considered for additional payment.

R. Lateral Point Repair at the Riser (12-feet or Less in Depth): The unit price bid for this item shall include all labor, materials, equipment, and incidental work required to perform an open cut repair on the riser, as necessary for the installation of the lateral liner, including surface or pavement restoration. This item applies only to repairs 8 feet or less in length and 12 feet or less in depth in either paved or grass areas. Any pavement restoration required shall be performed in accordance with Standard Construction Drawing 1441and shall include the costs of any replacement concrete encasement or saddles. This item shall include payment for replacement of riser sections that do not require the replacement of the wye and shall be measured along the centerline of the pipe.

S. Lateral Point Repair at the Riser (Greater than 12-feet in Depth): The unit price bid for this item shall include all labor, materials, equipment, and incidental work required to perform an open cut repair on the riser, as necessary for the installation of the lateral liner, including surface or pavement restoration. This item applies only to repairs 8 feet or less in length and greater than 12 feet in depth in either paved or grass areas. Any pavement restoration required shall be performed in accordance with Standard Construction Drawing 1441 and shall include the costs of any replacement concrete encasement or saddles. This item shall include payment for replacement of riser sections that do not require the replacement of the wye and shall be measured along the centerline of the pipe.

T. Lateral Point Repair at Wye Connection (12-feet or Less in Depth): The unit price bid for this item shall include all labor, materials, equipment, and incidental work required to perform an open cut point repair on the main line, and to replace the wye fitting and/or riser at the lateral connection, as necessary for installation of the lateral liner, including surface or pavement restoration. This item applies only to repairs 8 feet or less in length and 12 feet or less in depth, on main lines 8 inches to 24 inches in diameter. Work may occur in either paved or grass areas. Any pavement restoration required shall be performed in accordance with Standard Construction Drawing 1441. Repairs exceeding the length or depth limits defined above will be evaluated and considered for additional payment. No separate payment shall be made for sections of riser replaced.

U. Lateral Point Repair at Wye Connection (Greater than 12-feet in Depth): The unit price bid for this item shall include all labor, materials, equipment, and incidental work required to perform an open cut point repair on the main line and to replace the wye fitting and/or riser at the lateral connection as necessary to permit installation of the lateral liner, including surface or pavement restoration. This item applies only to repairs 8 feet or less in length and greater than 12 feet in depth up to the full depth of the main, on main lines 8 inches to 24 inches in diameter. Work may occur in either paved or grass areas. Any pavement restoration required shall be performed in accordance with Standard Construction Drawing 1441. Repairs exceeding the length or depth limits defined above will be evaluated and considered for additional payment. No separate payment shall be made for sections of riser replaced.

V. Private Source Inflow/Infiltration Investigation: The unit price bid for this item shall include all labor, materials, equipment, and incidental work required to perform dye testing for all potential private sources on each individual property identified.

ITEM	UNIT	DESCRIPTION
SS-26	EA	8”–10” Diameter Mainline/Lateral Connection
SS-26	EA	12”–15” Diameter Mainline/Lateral Connection
SS-26	EA	18”–21” Diameter Mainline/Lateral Connection
SS-26	EA	24” Diameter Mainline/Lateral Connection
SS-26	LF	6” Lateral CIPP, 4.0 mm min thickness (From Mainline)
SS-26	LF	6” Lateral CIPP, 4.0 mm min thickness (Manhole Connections)
SS-26	EA	6” Lateral CIPP, (Cleanout Inversion)
SS-26	LF	6” Lateral CIPP, 4.0 mm Min Thickness (From Cleanout)
SS-26	EA	CIPP Spot / Partial Liner As Directed by Engineer
SS-26	EA	Re-cut Sanitary Lateral, As Directed by Engineer
SS-26	EA	Sanitary Lateral Air Test
SS-26	EA	Cleanout, 2.5’-14.5’ Deep (Lateral Liner Installation As Needed)
SS-26	EA	Cleanout, 2.5’-14.5’ Deep (For Cleanout Inversion)
SS-26	EA	Cleanout, 2.5’-14.5’ Deep (For Air Test)
SS-26	EA	Lateral Point Repair (In Grass), As Directed by Engineer

SS-26	EA	Lateral Point Repair (In Pavement – 12-feet or Less in Depth), As Directed by Engineer
SS-26	EA	Lateral Point Repair (In Pavement – Greater than 12-feet in Depth), As Directed by Engineer
SS-26	EA	Lateral Point Repair at the Riser (12-feet or Less in Depth), As Directed by Engineer
SS-26	EA	Lateral Point Repair at the Riser (Greater than 12-feet in Depth), As Directed by Engineer
SS-26	EA	Lateral Point Repair at Wye Connection (12-feet or Less in Depth), As Directed by Engineer
SS-26	EA	Lateral Point Repair at Wye Connection (Greater than 12-feet in Depth), As Directed by Engineer
SS-26	EA	Private Source Inflow/Infiltration Investigation

END OF SECTION