

ITEM 50

CURED-IN-PLACE PIPE (CIPP)

1.0 DESCRIPTION. The Contractor shall provide all labor, materials and equipment necessary to install and test cured-in-place resin impregnated flexible tube pipe liner, reinstallation of lateral services complete with “Top Hats”/lateral liners, hydrophilic end seals and pre and post CCTV in accordance with the detail plan sheet, Item Spec 40 and as specified herein. When installed, cured, and complete, the liner shall extend from one manhole to the next 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 in original condition. When no pre-liner is used, hydrophilic end seals are required.

2.0 SUBMITTALS.

A. Reference Standards. All work and materials used shall be in compliance with the following standards that are made part of this specification:

1. American Society for Testing and Materials (ASTM) (latest edition):
 - a. ASTM D543, Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
 - b. ASTM D638, Test Method for Tensile Properties of Plastics.
 - c. ASTM D790, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - d. ASTM D5813, “Standard Specification for Cured-in-Place Thermosetting Resin Pipe”.
 - e. ASTM F1216, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin Impregnated Tube.
 - f. ASTM F1743, 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).
2. National Association of Sewer Service Companies (NASSCO) industry standard procedures and recommendations.

B. Shop Drawings.

1. The Contractor shall submit evidence of qualifications. Installation of the sewer pipelining system shall be performed by an experienced Contractor fully licensed and approved by the lining manufacturer.
2. If the Contractor anticipates utilizing steam or hot water curing, three of the ten regional projects must be a steam or hot water cured application. If the Contractor anticipates utilizing ultraviolet radiation curing, five of the ten regional projects must be a UV cured application.

3. The Contractor shall submit a copy of manufacturer's licensee certificate. Also, the Contractor shall submit a list of ten similar regional jobs within the past three years which include the following information:
 - a. Project owner:
 - i. Point of contact
 - ii. Phone number
 - b. Project description including:
 - i. Location
 - ii. Scope of project
 - iii. Length of pipe
 - iv. Pipe diameter
 - v. Project start and completion dates
 - vi. Project costs
 - vii. Installation and curing methodology
 - viii. In addition, three (3) of the ten (10) regional jobs must indicate the successful use of steam curing if this method is to be utilized by the Contractor
4. Product Data. Furnish manufacturer's general product data concerning the material to be used on his project.
5. Test Results. Prior to the use of any materials, the Contractor shall furnish, at its expense, the results of testing of the proposed materials by an independent laboratory in conformance with these specifications.
 - a. All submitted test data shall have been performed on laboratory samples within the last ten (10) years.
6. 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.
7. Testing Laboratory. The Contractor shall provide a preapproved CIPP testing laboratory to perform structural analysis and thickness testing in accordance with this specification and the following procedures.
 - a. Approved testing facility shall be:
 - i. Smithers MSE Inc., Akron, OH 330-762-7441
 - ii. SCSE Engineering Approved Equal
8. The Contractor shall also submit the following:
 - a. Testing by an independent laboratory to verify that the products to be used meet all minimum strength standards as set forth in ASTM F1216, Table 1.
 - b. Testing by an independent laboratory to verify that the products used meet the Creep Factor specified within. The submittal shall include the long-term Flexural and Tensile Modulus of Elasticity measured in accordance with ASTM D2990.
 - c. Testing by an independent laboratory to verify that any product to be used on the project meets the minimum chemical resistance requirements as established in ASTM F1216, Table 2, where the testing is in accordance with Appendix X2 of ASTM F1216.

- d. Installation Procedures. The Contractor shall submit the CIPP liner manufacturer's detailed installation procedures for the installation method(s) to be utilized on this project for the pre-liner (if required) and the liner.
 - e. Curing Cycle and Cooling Rate. The Contractor shall submit the resin manufacturer's recommended curing cycle as well as the recommended cooling rate. The Contractor shall submit inversion pressure (desired and maximum), curing pressure (desired and maximum) and times (part of the curing cycle) for air inversion/steam curing.
9. The following submittals (a-d) shall be made a minimum of ten (10) working days prior to lining:
 - a. Pre-rehabilitation video recordings and logs. The Contractor shall submit 2 copies of the pre-rehabilitation video recordings and logs to the Engineer that document the existing sewer condition after the Contractor has cleaned the line.
 - b. Notify Engineer at least 24 hours prior to any video recording. Video recording shall be done during normal contract working hours excluding holidays. See SCSE Specification Item 40A.
 - c. Lateral Status Determination Report. The Contractor shall submit a lateral status determination report for each manhole-to-manhole section for approval by the Engineer. The Engineer will provide his record review and determinations of each lateral for use by the Contractor in determining lateral status. Dye testing by the contractor shall be used to determine any unknown or questionable laterals or connections. No CIPP liner installation shall be performed until written approval of this report is issued by the Engineer.
 - d. Bypass Pumping Plan. The Contractor shall submit a bypass pumping plan for each manhole-to-manhole section to be lined for approval by the Engineer. See SCSE Specification Item 51 Bypass Pumping.
 10. The following submittals, a & b, shall be made within one week of lining:
 - a. The Contractor shall submit a copy of the cure logs for each manhole-to-manhole installation. The cure logs shall contain records of the curing cycle and the cooling cycle.
 - b. Each cure log shall clearly indicate the project name, Project Number, the manhole section that was lined, dates and curing/cool down times in a tabular format.
 11. Post-rehabilitation video recordings and logs. The Contractor shall submit two (2) Electronic copies on USB flash drives of the final television inspection that show the rehabilitated sewer along with reinstated service connections.
 12. Notify Engineer at least 24 hours prior to any video recording. Video recording shall be done during normal contract working hours excluding holidays. See Item 40A.
 13. Resident/Commercial Notifications. The Contractor shall submit for engineering approval a copy of the resident and/or commercial notifications for all phases of work, as described herein.

C. Calculations.

1. CIPP Liner Thickness Calculations. The Contractor shall perform CIPP liner thickness calculations for each manhole-to-manhole section and furnish them to the

- Engineer with supporting assumptions, including the actual pipe condition observed based upon the work performed in SCSE Specification Item 40A Video Inspection.
2. All calculations shall be prepared and stamped by a Professional Engineer registered in the State of Ohio. Submit P.E. Certification for all CIPP liner design data.
 3. Calculations shall be performed after cleaning, televising, and all inspections have been completed.
 4. Design parameters given herein shall be used for bidding purposes. If there is a discrepancy between the thickness calculations as determined by the Contractor's engineer and the bidding thicknesses listed herein, the thicker design thickness shall be utilized.
 5. Design Parameters and Mechanical Properties. The following values are to be used to verify that the liner thickness equals or exceeds that shown in the specifications and, where indicated by an ASTM standard, shall serve as the minimum acceptable strength requirements for the final cured liner.
 - a. Fully deteriorated liner design for all existing sewers to be rehabilitated:
 - i. Flexural Strength (ASTM D790): 4,500 psi
 - ii. Short-term Flexural Modulus of Elasticity (ASTM D790) will be accepted for the following Strengths: 400,000 psi
 - iii. Creep Factor: 50%
 - iv. Factor of Safety: 2.0
 - v. Ovality: 5%*
 - vi. Soil Modulus: 1,000 psi
 - b. The CIPP design thicknesses shall be as listed in the attached, project specific Appendix "A".
 - c. Depending on the short-term modulus of elasticity of the liner supplied, the liner thickness shall be as listed above. Specify on the bid sheet the strength of the material (short-term flexural modulus of elasticity) is proposed.
 - d. 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.
 - e. The CIPP liner thickness has been calculated to withstand the soil loading at the deepest point (the maximum difference between the surface elevation and the pipe elevation) between manholes. Unless noted otherwise on the Contract Drawings or job-specific data is available, assume the water table to be at the surface elevation.

D. Certifications.

1. Written certification is required from the manufacturer that all liner and resin used in the work, are manufactured and tested in accordance with the ASTM Standards specified herein and will be used or installed in conformance with the manufacturer's recommendations.
2. CIPP manufacturer shall be ISO certified.

E. Storage and Delivery Procedures. In addition to the requirement above, the Contractor shall provide the resin and 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.

- F. Safety Data Sheets.** The Contractor shall submit Safety Data Sheets (SDS) for each component of the CIPP system as addressed herein.

3.0 MATERIALS.

A. Material Handling. The Contractor shall store all material and equipment in a neat, organized and safe fashion assuring that all hazards are avoided.

1. Materials shall be stored in the delivery truck to reduce/minimize exposure to sunlight and to maintain the temperature of the product to within the manufacturer's recommendation to avoid premature curing.
2. All material shall be stored on wooden pallets. No material shall be stored in the open or in contact with open ground.
3. All products that arrive on site shall be: New unused item; packaged in original unopened packages.
4. All materials are to be kept dry at all times via temporary tarping or inside storage.
5. All materials which are damaged and/or wet, will be unacceptable and returned for replacement at the contractor or manufacturer's expense.
6. All Manufacturers' recommendations of storage pertaining to heat, cold, sunlight, flammability, etc., are to be utilized.
7. Temperature logs of the liner from time of wet-out to installation, shall be given to the Engineer or his representative on site at the time of installation.
 - a. These logs shall contain the calculated volume of resin required and the actual volume of resin provided.
 - b. The Engineer or his representative shall verify that the volume of resin provided is 5 to 10 percent greater than the calculated volume of resin required per ASTM F1216, 7.2.

B. Delivery.

1. CIPP material 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.
4. Only materials approved by the Stark County Metropolitan Sewer District may be used for this project.

C. Pre-Liner (when project requirement). The pre-liner shall comply with the following requirements:

1. Match existing inside trunk diameter.

2. 3-ply laminate combining two layers of linear low-density polyethylene and a high-strength cord grid.
3. Low permeability to inhibit moisture transmission.
4. UV stabilization to protect against degradation, when exposed to sunlight.
5. Resistant to cracking in cold weather.
6. Flexible and light weight.
7. Giffolyn TX-1200; Manufactured by Reef Industries or engineering approved equal.

D. CIPP Liner. The liner shall comply with the following:

1. System proposed (materials, methods, workmanship) must be proven and designed to have a 50-year design life.
2. Consist of resin-impregnated flexible felt or fiber tube inverted through the existing pipe to the terminal manhole using either hydrostatic or air pressure.
3. Cured by circulating hot water, steam or ultraviolet radiation curing throughout the tube.
4. Liner shall be resistant to hydrogen sulfide, carbon monoxide, carbon dioxide, methane mercaptans, diluted sulfuric acid and exposure to soil and wastewater bacteria.
5. CIPP lining products shall comply with the latest versions of ASTM F1216 or F1743, including appendices.
6. Stark County Sanitary Engineers Approved Manufacturers shall be:
 - a. Insituform.
 - b. InLiner USA.
 - c. United Liner.
 - d. CIPP Corp.
 - e. National Liner.
 - f. Spiniello Liner.
 - g. Approved equal.

E. Hydrophilic End Seals – shall be used to seal all end runs of the CIPP process. The hydrophilic seals shall comply with the following:

1. Be a seamless molded compression gasket sealing product.
2. Swell in the presence of water.
3. Successfully passed a 10,000-hour hydration/dehydration test proving the hydrophilic rubber will not dry out.
4. Intended for use with but not limited to; Inverted CIPP Liners, Pull-in-place CIPP Liners, Fold and Form Plastic Liners etc.
5. Comply with ASTM F3240 for Installation of Seamless Molded Hydrophilic Gaskets.
6. Seal shall be complete. No leakage shall be permissible after installation.
7. Stark County Metropolitan Sewer District Approved Manufacturer shall be:
 - a. Insignia Hydrophilic End Seal (LMK Technologies).
 - b. BLD.
 - c. Engineering approved equal.

F. Lateral Liners. Lateral liners/top hats shall be utilized at all lateral reinstatement to seal the connection between the CIPP liner and the lateral connection. Lateral liner/Top hats shall comply with the following:

1. Structural standalone homogeneous main to lateral CIPP connection.
2. Extend a minimum of five (5') foot into the lateral.
3. Shall comply with ASTM F3240 and ASTM F2561. No cleanout shall be required for ASTM F2561 installation purposes.
4. Seal shall be complete. No leakage shall be permissible after installation.
5. Stark County Sanitary Engineers approved lateral liners/ "Top Hats" shall be:
 - a. Main lines less than 27" Diameter:
 - i. Insignia Lateral "shorty" by LMK Technologies
 - ii. BLD Services
 - iii. Engineering approved equal
 - b. Main Lines equal to or greater than 27" Diameter:
 - i. Insignia Lapel Liners by LMK Technologies
 - ii. BLD Services
 - iii. Engineering approved equal

G. Chemical Grout. Chemical grouts shall be used to plug and seal active leaks as directed by the engineer. These materials shall be compatible with the approved lining system and approved by the Engineer, prior to usage. The chemical grout shall:

1. Adhere to wet or dry surfaces.
2. Be quick setting.
3. Have zero percent shrinkage per ASTM D2126.
4. Be ASTM, ANSI and NSF approved.
5. Be manufactured by Thoro Seal, Green Mountain Inc., Sika, Avanti International, or approved equal.

4.0 EXECUTION. The Contractor shall be required to verify all quantities indicated above and as necessary to fully perform and complete this project as indicated on all detail plans and as specified herein. The contractor shall manage and coordinate on-site work with all necessary sub-contractors in the execution of this work.

A. General. This work includes, but is not limited to, and may be in conjunction with other pay Items:

1. Pre-cleaning of the pipe section to be lined shall follow Item 40.
2. Bypass for this project to follow Item 51.
3. The Contractor shall provide pre-CCTV of pipe section to be lined prior to any work.
4. Install the CIPP liner system.
5. Cut in/Reinstatement of all lateral service(s).
6. "Top Hat"/T-liner installation for all lateral service(s).
7. Hydrophilic end seal installation.
8. Chemical grouting as directed by the engineer.
9. Post-cleaning for the CIPP liner shall follow Item 52.

10. Post CCTV of the CIPP liner shall follow Item 40.

B. Inversion. Installation shall be by inversion (ASTM F1216). Pulled-in-place installation (ASTM F1743) may be allowed on a case-by-case basis, if approved by the Engineer. 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 Engineer to inspect the materials and the “wet-out” procedure upon request.

1. All procedures to prepare the liner for installation will be in strict compliance with the manufacturer’s recommendations. Any material not properly prepared shall be rejected and replaced with acceptable materials at the Contractor’s expense. The contractor shall not proceed with work until satisfactory conditions are present in the sewer and the local environment.
2. Installation. A scaffold, elevated platform, or other means of providing required pressure shall be provided at the access point. 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. Hydrostatic or air pressure shall be used to inflate the tube, molding it against the walls of the host pipe.
3. Tube installation pressures shall be limited so as not to stretch the tube longitudinally by more than five (5) percent of the original length. Mark exterior of manufactured tube along its entire length at regular intervals not to exceed five feet as a gauge to measure elongation during installation. Longitudinal stretch of tube shall be gauged by comparing markers on fully inserted tube to actual length of pipe being rehabilitated.
4. Liner shall not touch the ground or other contaminants prior to inversion in pipe.
5. All installation of the CIPP system to include but not be limited to the following, shall be in accordance with all SCMSD Item Specifications, Detail Drawings and Manufacturer Installation Requirements:
 - a. Flow bypassing for the pipe section to be lined.
 - b. Pre-cleaning and CCTV of the pipe section to be lined prior to any work.
 - c. Removal of any debris or obstructions.
 - d. Installation of the CIPP liner system.
 - e. Cut in/Reinstatement of any service sewer(s).
 - f. Cut any protruding lateral(s).
 - g. Lateral liner installations for lateral service(s).
 - h. Hydrophilic end seal installation.
 - i. Chemical grouting as directed by the engineer.
 - j. Post-cleaning and final CCTV “post-construction inspection”.
6. Curing Using Circulated Heated Water: After the installation is complete, 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.

7. Using Steam: After the installation is complete, the Contractor shall supply suitable heat steam-generating equipment as approved by the Engineer. The equipment shall be capable of delivering steam throughout the section to uniformly raise the temperature within the pipe to a level required to effectively cure the resin.
8. Using Ultraviolet Light: For UV-cured liners, all light trains shall produce infrared sensor readings including pressure and temperature, recorded by computer to document/log the cure along the entire length of the installed liner. The cure procedure shall be in accordance with the liner and resin manufacturer's recommendations.
 - a. The light train unit(s) shall also include and utilize CCTV to determine any defects before curing
9. Equipment shall be muffled to reduce excess noise during the curing process. All night work shall be approved by the Engineer before proceeding with the work.
10. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supply. Two additional gauges/thermocouples (one for backup) 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. Thermometers and wire sensors shall be compatible with and acceptable by the resin and liner manufacturers. Water temperature in the pipe during the cure period shall be as recommended by the resin manufacturer.
11. 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 manufacturer's recommended temperature. The cure period shall be of a duration recommended by the resin manufacturer and requires continuous recirculation of the water to maintain the temperature. Duration of cure shall, at a minimum, be the manufacturer's recommended time. Documentation shall be provided to the Engineer.
12. Cool Down, After Heated Water Cure. The Contractor shall cool the hardened pipe to a temperature below 100 degrees Fahrenheit before relieving the hydrostatic head. Cool-down shall be accomplished by introducing cool water into the inversion standpipe to replace water being drained from a small hole made in the downstream end. The rate of cooling shall not exceed resin manufacturer's recommendations. Documentation shall be provided to the Engineer.
13. Post Steam Cure. The Contractor shall cool the hardened pipe to a temperature below 113 degrees Fahrenheit before relieving the internal pressure within the section. Cool-down may be accomplished by introducing cool water into the section to replace the mixture of air and steam being drained from a small hole made in the downstream end. The rate of cooling shall not exceed resin manufacturer's recommendations. Documentation shall be provided to the Engineer.
14. Finish work. The new pipe shall be cut off in the manhole at a suitable location. Excavation will not be allowed at cleanouts unless approved by the Engineer. The finished product shall be continuous over the length of the pipe 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.

15. Invert through Manholes. The invert shall be continuous and smooth through all manholes. If a liner is installed through a manhole, the bottom portion of the liner shall remain, and the bench of the manhole shall be grouted with a resin mixture compatible with the CIPP and shaped as necessary to support the liner.
16. If the liner terminates on either side of a manhole, the invert shall be built up to remove any flow restrictions and to form a continuous invert through the manhole with water plug hydraulic cement.

C. Sealing in Manholes.

1. Hydrophilic seal will be required between the manhole walls and pipe. The hydrophilic seal shall fill the annular space between the pipe and manhole, in lieu of a pre-liner.
2. The seal shall form a watertight seal between the CIPPL and the manhole wall at the pipe penetration. Do not leave any annular gaps. Seal the annular space with a hydrophilic seal per ASTM F3240 as specified above.
3. The Engineer shall be notified if field conditions warrant other types of sealing materials including, but not limited to, grout, resin, or urethane.
4. As specified in above section the Contractor shall provide CCTV inspection of the hydrophilic end seals at all main and manhole connections to provide documentation proof that the end seals are properly installed and not leaking or blocked with excess resins, at the main connections or manhole connections.
5. If end seals are leaking the contractor shall repair said seals to assure no leaking occurs. All repairs and re-inspection shall be made at the Contractor's expense.
6. No leaking or dripping water is permissible.

D. Service Connections. While not anticipated, the exact location and number of any orphan type service connections shall be verified during the initial television inspection.

1. It shall be the Contractor's responsibility to accurately field locate all existing active service connections. The Contractor shall reconnect all active and inactive service connections to the liner pipe as indicated in the Lateral Status Determination Report Section 50.03L.
2. All service connections shall be reinstated with the use of a lateral liner as indicated within the above specifications (Materials) and all detail drawings.
3. Lateral/top hat connections at the lateral shall form a smooth, watertight opening following lining of the main and re-establishment of the lateral.
4. All lateral/top hat connections shall form a watertight connection at the main and lateral termination point.
5. As specified above, the Contractor shall provide CCTV inspection of the lateral connection at all main and lateral termination point(s) to provide documentation proof that the top hat is properly installed and not leaking or blocked with excess resins, at the main connections or lateral termination point.
6. If the lateral connection is leaking the contractor shall repair said top hat to ensure no leaking occurs. All repairs and re-inspection shall be made at the Contractor's expense. No leaking or dripping water is permissible.

7. The Contractor shall be responsible for restoring/correcting, without any delay, all missed or faulty reconnections, as well as any damage caused to property owners for not reconnecting the services soon enough or for not giving notice to the owners.
8. All existing active service connections shall be reconnected by a remote-controlled cutting device directed internally by a television camera or by internal manual cutting. Provide a video recording of the remote controlled, robotic lateral cutting procedure for the Engineer. They shall be made by experienced operators so that no blind attempts or holes are made in the liner pipe. Location shall be verified carefully to match earlier video recordings for accurate locations, especially where dimples are not well defined or clearly ascertained.
9. The reestablishment of the service connection with a top hat "shorty" top hat shall be made utilizing trenchless methods at the Contractors Cost at any location.
10. The re-establishment of the service connection with a Lapel Liner top hat shall be made in accordance with the Manufacturer's installation requirements.
11. The Engineer reserves the right to require reestablishment of a service connection by trenchless methods at the Contractor's cost at any location, if the quality or workmanship for the cut is not satisfactory.
12. The cut shall be smooth and circular in nature as seen by a television inspection camera. Lateral cuts shall be brushed as necessary to ensure smooth openings. It shall be properly aligned, invert to invert, to the existing connection with no obstructions to the flow. Resin slugs shall be removed as necessary from reinstated service connections.
13. Any missed cuts, overcuts or undercuts shall be repaired at no cost to the County and to the full satisfaction of the Engineer. All coupons cut from the liner for reopening of lateral connections shall be retrieved from the sewer, accounted for by the Contractor, and turned over to the Engineer.

E. Environmental Requirements.

1. Contractor may be required to monitor styrene odors as necessary in businesses and residences to ensure that styrene concentration levels are under recommended limits.
2. Contractor shall use caution when working in project sewers. During rain events, project sewers may reach capacity quickly and become completely filled.
3. Bypass pump Requirements See Item 51.
4. Install pre-liner and liner through existing or new manholes. Excavation for pre-liner/liner insertion shall not be permitted.
5. All work shall be performed within the easement areas shown on the plan. No staging, access, or any associated work will be permitted outside of easement areas unless prior arrangements with the County are made.

F. 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. This work also pertains to all safety requirements involving work on elevated platforms and working with pressurized equipment.

G. 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.

H. Resin System. The resin system shall be a polyester, epoxy, or vinyl ester resin and catalyst system compatible with the insertion process. The resin system shall not contain fillers or additives, except those required for viscosity control, fire retardant, modulus enhancement, 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. Resin selected shall be reflected in the CIPP liner thickness calculations.

1. 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. A roller system shall be used to uniformly distribute the resin throughout the tube.
 - b. Designate location where uncured resin in original containers and non-impregnated liner tube will be impregnated prior to installation.
2. PET or RECYCLED RESINS WILL NOT BE PERMITTED.
3. CIPP LINERS used on this repair project SHALL BE light-colored or white liner to facilitate closed-circuit TV inspection.

I. Inverting/Curing Medium. The inverting/curing medium shall be heated potable water, steam or UV cured. In no instance will sewage, stream or storm water be used to invert or cure liners or calibration tubes. The Contractor shall be responsible for the procurement, use and disposal of all water used. If a private water source is proposed, a written agreement/permit shall be obtained from the water source owner and a copy of the agreement given to the Engineer.

J. 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.

K. Examination.

1. General. Examine areas and conditions within the sewer system in which materials and products are to be installed.
2. Material. All sewer pipe liner materials shall be carefully inspected for defects prior to installation. 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.

3. Provide sample and material test data if pre-liner is used.
4. 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.

L. Preparation.

1. Resident & Commercial Notification. The Contractor shall be responsible for business and resident notification. This notification shall contain information about the project and the cured-in-place pipe process using graphics as necessary to illustrate the procedure.
 - a. Other information to be included shall be project number, project name, description of the work to be performed, time frames for the work, equipment utilized on the project, potential odors due to the curing process and any and all precautions to take during the course of the project (keeping water in the trap, keeping toilet lids down, etc.).
 - b. The Contractor shall list the superintendent on the job along with his/her mobile telephone number, as the primary contact. Secondary contact information shall be the company name, address, and telephone number.
 - c. This initial notification shall be submitted to the engineer for approval. Upon approval, the Contractor shall immediately distribute this notification/information to all businesses and/or residents affected by the work. This distribution shall be at a minimum of forty-eight (48) hours in advance of the commencement of any work.
2. Cleaning. All sewers 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, pipe-joint gasket material, and all other solids or semisolid materials from the interior face of the sewer lines. Refer to specific recommendations in SCSE Specification Item 52, Sewer Cleaning.
3. Sewer Video Recording and Inspection. The Contractor shall televise the sewer to provide a detailed record of existing conditions and lateral connections as described in SCSE Specification Item 40.
 - a. Two (2) Electronic copies on USB flash drives of the pre-rehabilitation inspection shall be submitted to the **Engineer**. The Contractor shall be responsible for having a copy of the pre-rehabilitation inspections in the field as well.
 - b. Immediately prior to CIPP liner insertion, the camera shall traverse the sewer to inspect for debris which may have entered the sewer line after the existing condition video recording. **The Engineer must sign off on this reconnaissance television inspection for the CIPP lining work to proceed.**

- c. Notify Engineer a minimum of 24 hours prior to any video recording. Video recording shall be done during normal contract working hours excluding holidays. See SCSE Specification Item 40A.
 - i. No cleaning or CCTV work shall be done without the engineer's present.
 - ii. Any work done without the presence of the engineer shall be rejected and redone at the contractor's expense
- 4. Hydrophilic End Seals. Contractor shall provide CCTV inspection (Specification Item 40) of the hydrophilic end seals at a minimum of 48 hours after installation of all main and manhole seal connections to provide documentation proof that the end seals are properly installed and not leaking at the main connections or manhole connections.
 - a. If the end seals are leaking the Contractor shall wait and re-inspect (CCTV) the seals fourteen (14) days after initial end seal installation. If at this time the end seals are still leaking the Contractor shall repair the seal to assure no leaking occurs and re-inspect the end seal via CCTV. All repairs and re-inspections shall be made at the Contractor's expense.
 - b. No leaking or dripping water is permissible.
 - c. This item shall be included in the unit price bid for CIPP.
- 5. Laterals. Lateral sewer pipes protruding into the main sewer shall be trimmed flush with the interior face 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. Point repairs shall be made as needed around laterals to ensure proper installation of top hats to the lateral.
 - a. The top hat connections shall be provided at all lateral connections and shall form a smooth, watertight opening following lining of the main and re-establishment of the lateral.
 - b. Contractor shall provide CCTV inspection (SCSE Specification Item 40) of all approved lateral liner/top hat connections, at a minimum of forty-eight (48) hours after installation at the main and at the lateral termination point of the top hat to provide documentation proof that the top hat to lateral connect is properly installed and not leaking at the main or termination point of the lateral.
 - c. If the lateral liner seal point(s) are leaking the Contractor shall wait and re-inspect (CCTV) the liner/top hats fourteen (14) days after initial top hat installation. If at this time the top end seal point(s) are still leaking the Contractor shall repair the lateral liner to assure no leaking occurs and re-inspect the top hat via CCTV. All repairs and re-inspections shall be made at the Contractor's expense.
 - d. No leaking or dripping water is permissible.
- 6. Bypassing Sewage. The Contractor shall bypass the sewage around the sections of the sewer that are to be lined as required. The bypass shall be made in accordance with SCSE Specification Item 51, "Bypass Pumping"
- 7. Line Obstruction. It shall be the responsibility of the Contractor to clear the sewer of obstructions, solids, protruding services, or collapsed pipe that will prevent the proper installation of the liner.

- a. If the pre-rehabilitation video recording and inspection reveals an obstruction that cannot be removed by trenchless means from within the sewer, the Contractor shall notify the Engineer. Upon approval of the Engineer, the Contractor shall make a point repair per *Stark County Sanitary Engineering Specifications* to remove the obstruction and repair the sewer.
 - b. If the pre-rehabilitation video recording and inspection reveals a sag/belly in the sewer that has a vertical displacement greater than one-half the pipe diameter, the Contractor shall notify the Engineer. Upon approval of the Engineer, the Contractor shall make a point repair excavation per *Stark County Sanitary Engineering Specifications* to eliminate the sag/belly.
 - c. 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.
8. 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. For steam curing, the Contractor shall take appropriate measures to ensure that non-water residuals/byproducts of steam curing do not enter nearby streams, storm sewers, etc. The Contractor shall comply with all NASSCO Recommendations for Styrene exposure directives.
 9. Manhole Casting Replacement. For CIPP projects where the pipe size does not necessitate the removal of the manhole's casting/cone for the lining process, "SCSE Specification Item 16 – Replace Manhole Frame and Cover" shall be done before the CIPP liner is installed and as directed by the Engineer.
 10. Chemical Pressure Grouting. Chemical pressure grouting shall be used, as directed by the Engineer, to seal large active leaks in the existing sanitary sewer prior to lining. These materials shall be compatible with the approved lining system and approved by the Engineer prior to use.
 11. Existing Pipe Defects. The Contractor shall immediately notify the County of any sanitary sewer pipe defects or problems that prevent him from performing his work as defined by Contract. The Contractor shall allow up to four weeks for the County to correct such defects or problems with no compensation to the Contractor for down time or loss of production.

M. Restoration.

1. Where portions of the site, either inside or outside the contract limits, not designated for change or new work become damaged during the course of construction by the Contractor's operations, the Contractor shall repair or replace at no additional cost to the County 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.
2. Manhole reconstruction by Contractor to accommodate CIPP liner installation shall be included in the lining costs. If the County elects to have:
 - a. New manhole frame and cover installed on a CIPP access manhole, then frame and cover replacement shall be paid for separately under Item 16.
 - b. The manhole rehabilitated by lining, then the lining costs shall be paid separately under Item 16X.

5.0 ELECTRICAL. This section is not applicable.

6.0 QUALITY ASSURANCE.

A. Testing.

1. Final Television Inspection. The Contractor shall televise the rehabilitated sewer to provide a detailed record of finished conditions and lateral connections. Lateral connections shall be observed while the camera is stopped and viewing the connection squarely.
2. Inspection of all end seals and top hat lateral connections shall be in accordance with the requirements as indicated above.
3. Notify Engineer a minimum of 24 hours prior to any video recording. Video recording shall be done during normal contract working hours excluding holidays. When complete, the Contractor shall submit two (2) copies of the rehabilitated sewer inspection, along with the accompanying logs, which shall be printed clearly or typed as required in Item 40A.
4. CIPP Testing Analysis. The following tests shall be performed for each inversion length of CIPP installed per ASTM F1216 and/or F1743 (when approved):
 - a. Short-term Flexural (Bending) Properties – The initial tangent flexural modulus of elasticity and flexural yield strength shall be measured in accordance with ASTM D790.
 - b. Total wall thickness for cured CIPP liner.
5. The Contractor is to provide test samples to the Engineer in accordance with ASTM F1216, Item 8.1. Note, this item requires two CIPP samples, one from each of the following two methods:
 - a. A restrained sample should be cut from a section of cured CIPP at an intermediate manhole or at the termination point that has been inverted through a like diameter pipe which has been held in place by a suitable heat sink, such as sandbags.
 - b. The plate sample should be fabricated from material taken from the tube and the resin/catalyst system used and cured in a clamped mold placed in:
 - i. The downtube when circulating heated water is used for curing
 - ii. The silencer when steam is used as the curing medium
 - iii. Offsite curing at the contractor's shop or any other location other than on site shall only be permissible by pre-approval of the SCSE engineer
6. Test Sample configuration and size shall be rectangular section(s) measuring approximately 10" – 12" wide x 20" – 24" long.
7. Sample Labeling. Each sample shall be labeled as follows:
 - a. Utilizing a black permanent marker.
 - b. Each sample shall indicate:
 - i. Project Number
 - ii. MH to MH reach for each sample
 - iii. Date sample was obtained
8. CIPP testing standards shall comply with this specification and:

- a. Three-point flexural stress-strain analysis at 400,000 psi in accordance with Appendix "A" and ASTM D2122.
 - b. Measurement of the total wall thickness for CIPP Liner as indicated by Item 50 – Appendix "A" Cured-In Place Pipe (CIPP) – Project Specific Criteria.
 - c. Provide Final Analysis Report.
- 9. The Contractor shall pay for all testing and transportation costs for all sampling as indicated in Section 8.0 "Payment" below.
 - a. The Engineer retains the right to determine how many of the coupons shall be tested as indicated by the bid line items.
 - b. If the Contractor requires additional and/or independent testing for their own testing purposes, the Contractor shall be responsible for the additional sample materials and all testing costs.
- 10. Final Installed Liner Thickness. The final installed liner thickness shall not be less than the thickness specified in the Contract Documents or approved shop drawings.
 - a. The final installed liner thickness shall not be more than 10% greater than the specified or approved thickness. The final installed liner thickness measurement shall be determined from pipe samples, coupons retrieved from the sewer, or as deemed necessary by the Engineer.
 - b. It shall be the Contractor's responsibility to consider site conditions and their installation process to determine the liner thickness to install.
- 11. Non-Compliance. In the event the flat plate samples do not meet the required thickness or Flexural Strength and Flexural Modulus of Elasticity as outlined, actual installed samples must be taken. The installed samples shall be taken as directed by the Engineer and in accordance with all applicable ASTM requirements. From these samples, the Installed.
 - a. 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 these specifications.
 - b. In the event that any liner installation, end seals and/or top hats do not meet the specified strengths, thicknesses, or any required specification standards the liner and all appendages shall be completely removed and reinstalled in accordance with these specifications or as determined by the SCSE Engineer.

B. Observation.

- 1. SCMSD designated representative will visually observe the work performed. The representative will notify the Engineer of any discrepancies with the contract documents in the course of the contractor performing the work. The progress observations by the SCMSD do not waive any rights or remedies, nor divest the Contractor of any responsibility for contract compliance or liability for damage.

C. Warranty.

- 1. The Contractor shall guarantee all work for a minimum period of ten (10) years from the acceptance date of the last segment of sanitary sewer repaired with CIPP under the current project.

2. After the completion of the project and up to a period of ten (10) years, the County may inspect all, or portions of, the lined sewers.
3. In the event of failures, the ten (10) year pro-rated warranty shall be enforced as follows:
 - a. Installation through Year 5: Contractor is responsible for all repair/replacement costs. **No** costs shall be bore by the County.
 - b. Year 6; Pro-rated such that, the Contractor shall be responsible for 75% of the repair/replacement costs. The County will accept responsibility for 25% of the repair/replacement cost.
 - c. Year 7 & 8; Pro-rated such that, the Contractor is responsible for 50% of the repair/replacement costs. The County shall accept responsibility for 50% of the repair/replacement cost.
 - d. Year 9 & 10; Pro-rated such that, the Contractor is responsible for 25% of the replacement/repair costs. The County shall accept responsibility for 75% of the repair/replacement costs.
4. The County defines CIPP liner failure under the ten (10) year pro-rated warranty period in accordance with the industries' standard clear signs of failure as:
 - a. Cracking.
 - b. Wrinkles.
 - c. Fins.
 - d. Bulging.
 - e. Lifting.
5. Warranty Clarification: The County does not require a bond, check, letter and/or line of credit, no up-front costs, or dollars, concerning the required 10-year pro-rated warranty. The County requires a written warranty from CIPP contractor and/or liner manufacturer awarded the project, to warranty and cover the costs for the CIPP repairs, as indicated by our requirements above.
 - a. In addition to the ten (10) year warranty as specified above, the Contractor shall provide a two (2) year maintenance bond on the entire system equal to the amount of the Contract.
 - b. Defects or failures shall be reported to the Contractor who will communicate with the Engineer within one week of the notification to prepare a repair schedule.
 - c. In the event of a liner or plate sample failure where any liner installation, end seals and/or lateral liner fails or does not meet the specified strengths, thicknesses, or any required specification standards the liner and all appendages shall be completely removed and reinstalled, or repaired, at the discretion of the SCSE *Engineer*.
 - d. All repairs or replacement of the CIPP system shall be in accordance with these specifications and as determined by the SCSE *Engineer*

D. Field Quality Control.

1. General. This section includes but is not limited to; CIPP Liner, End Seals Top Hats "shorty" and Lapel Liner top hats etc.

2. The rehabilitated pipe shall be continuous (without joints) over the entire length of an insertion run between two manholes.
3. 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 as should be expected from CIPP installed in a workmanlike manner.
4. Some minor waviness, fold or fins that, in the Engineer's opinion, will not appreciably decrease the flow cross section or affect the flow characteristics shall be permissible.
5. Any defects in the product shall be repaired at the Contractor's expense in a manner mutually agreed upon by the Engineer and Contractor.
6. During the ten (10) year pro-rated 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 Engineer and the Contractor. These repairs shall be granted a three (3) year extended guarantee period by the Contractor from the date of repair beyond the actual warranty period.

7.0 MEASUREMENT

A. CIPP Liner Installation. This item of work shall include all necessary television observation, protruding lateral removal and repair, sewer cleaning, pipe preparations, pre-liner insertion, liner resins, water, equipment, labor, testing, lateral liners/top hats, clean up, manhole reconstruction including asphalt repairs required by construction means and methods of CIPP installation, and all other expenses whether specifically mentioned or not to install the cured-in-place pipe.

1. Payment will be made at the unit price bid per lineal foot installed as measured from manhole to manhole along the horizontal centerline of the rehabilitated sewer, complete, tested, and ready for service for:
 - a. Pre-clean.
 - b. Pre-Video.
 - c. Pre-Liner (If required).
 - d. CIPP work as specified above.
 - e. Hydrophilic end seal installation.
 - f. Obstruction Removal.
 - g. Lateral reestablishment, to include but not be limited to; protruding lateral removal and lateral liner/top hat installation.
 - h. Post Video.
 - i. Restoration.

B. CIPP Testing. This item of work shall include all necessary materials, equipment and labor necessary to provide an approved testing facility and test all CIPP samples in accordance with the above specifications, prior to acceptance of said work.

1. Samples shall be determined/measured as a cured sample reach between each independent MH to MH run, unless otherwise agreed upon by the engineer.

2. Samples and number of samples, selected to be tested, shall be determined at the discretion of the Engineer.
3. Payment for sample testing shall be in accordance with the unit bid item below.
4. Samples not selected for testing shall be non-performed from the original contract.

C. Chemical Pressure Grouting. This item of work shall include all necessary equipment, materials, and labor to seal active leaks in the existing sanitary sewer prior to lining.

8.0 PAYMENT. The cost for all labor, equipment, tools and all other necessary items incidental to Item 50 shall be included in the unit prices bid for:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
50	LF.	__" CIPP
50	EA.	Service Reinstatement
50	EA.	Lateral Liner/Top Hat Installation
50	EA.	Sample Testing
50	GAL.	Grouting CIPP Work

END OF SECTION