

Technical Specification 024.01

SANITARY PIPELINE REHABILITATION

1.0 General

- a) The intent of this specification is to provide the requirements for the rehabilitation of sanitary sewer mains with the use of a resin-impregnated, flexible, Cured in Place Pipe (CIPP) liner.
- b) The utility contractor shall furnish all labor, tools, and materials, and perform all required operations in connection with the lining of existing sewer with a continuous extruded jointless and seamless polyethylene deformed pipe liner.
- c) The contractor shall be experienced in this type of work and shall comply with a Brunswick County pre-qualification process in order to be considered for the work.
- d) The work shall also include complete maintenance of all wastewater flows, reopening of service wyes or tees, removal of protruding service connections, etc., and other ancillary items associated with work of this nature.
- e) When completed, the formed liner shall extend from end-to-end of the section being lined in a continuous jointless, seamless, tight-fitting pipe-within-a-pipe as specified herein.

2.0 Reference Standards

ASTM D-638:	Standard Test Method of Tensile Properties of Plastics
ASTM D-790:	Test Methods for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM F-1216:	Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin Impregnated Tube
ASTM D-2412:	Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel – Plate Loading
ASTM D-2990:	Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics
ASTM D-5813:	Cured-in-Place Thermosetting Resin Sewer Pipe

When reference is made to one of the above standards the revision in effect at the time of the bid opening shall apply to the project.

3.0 Product Requirements

- a) All materials shall be accompanied by test reports certifying that the material conforms to the applicable ASTM requirement listed herein. Materials shall be shipped, stored, and handled in a manner consistent with the written recommendations of the manufacturer. Storage locations shall be approved by the Engineer and Brunswick County.
- b) Cured-in-place lining (CIPP) shall be of the following products, or approved equal:
 - Invert-A-Pipe by Improved Technologies Group
 - National Liner by National EnviroTech Group, LLC
 - Inliner by Inliner Technologies, Inc.
 - Insituform by Insituform Technologies, Inc.
 - Diamond Lining Systems by Daystar Composites, LLC
 - Premier-Pipe USA by J.W.M. Environmental, Inc.

4.0 Submittals

- a) The following submittals are required from the utility contractor:
 - 1) Letter to the Engineer from the contractor stating that the contractor has performed system cleaning and a camera inspection of the proposed pipeline rehabilitation and the sewer main is clean enough to ensure an effective rehabilitation lining.
 - 2) A copy of the camera inspection of the pipeline shall be submitted to the Engineer and Brunswick County.
 - 3) Contractor's description of all equipment and materials to be used during the CIPP rehabilitation lining process.
 - 4) Contractor's description of his proposed rehabilitation lining methodology.
 - e) Contractor's proposed waste water bypass pumping plan.
- b) Manufacturer's reports shall be submitted for all items to be furnished in accordance with the provisions of the General Conditions as supplemented. Submittals shall include information on the deformed polyethylene liner intended to be utilized for the project.

4.0 Safety

- a) The utility contractor shall conform to all work safety requirements of pertinent regulatory agencies, and shall secure the site for the working conditions in compliance with the same. The utility contractor shall erect such signs and other devices as are necessary for the safety of the work site and personnel.

- b) The utility contractor shall perform all of the work in accordance with applicable OSHA standards. Emphasis shall be placed upon the requirements for entering confined spaces and working with hot steam and / or hot water.

5.0 Materials

- a) Deformed/Reformed Polyethylene Pipe shall be made from polyethylene resins and it shall comply with the cell classification ASTM D-3350, 345434C, D or E for High Density Polyethylene (HDPE). The installed pipe liner shall also meet these material cell classifications.
- b) In addition, the product material shall meet the ASTM F1533, Standard Specification for Deformed Polyethylene (PE) Liner and ASTM 1606, Standard Practice for Rehabilitation of Existing Sewers and Conduits with Deformed Polyethylene (PE) Liner.
- c) The minimum length of the pipe liner shall be that deemed necessary by the installer to effectively span the distance from the starting manhole to the terminating manhole or access point, unless otherwise specified. No butt fusion joints are permitted from the starting manhole to the terminating manhole. **The contractor is responsible for informing the Engineer if any excessive sewer reaches are encountered that would prevent a continuous pipe liner installation between manholes.**
- d) The liner shall have an initial Standard Dimension Ratio (SDR) of no more than forty (40). After installation, the Standard Dimension Ratio and liner thickness will vary slightly as determined by the actual inside diameter of the host pipe. The continuous length liner shall have passed an independent ten thousand (10,000) hour long term buckling test to establish a fifty (50) year design life for the liner product utilized.
- e) Material and Equipment Acceptance:
 - 1) At the time of manufacture, each lot of liner shall be inspected for defects and tested in accordance with ASTM D2837 and D-1693. At the time of installation, the liner shall be homogeneous throughout, uniform in color, free of cracks, holes, foreign materials, blisters, or deleterious faults.
 - 2) For testing purposes, a production lot shall consist of all liner having the same marking number. It shall include any and all items produced during any given work shift and must be so identified as opposed to previous or ensuing production.
- f) Liner Marking:
 - 1) Liner shall be marked at five (5) foot intervals or less with a coded number which identifies the manufacturer, SDR, size material, date, and shift on which the liner was extruded.

- 2) At the end of the production shift during which a production lot has been extruded, the marking code on the liner shall be changed to indicate that said time intervals have elapsed and that a new production shift has begun.

g) **Chemical and Physical Testing:**

The Engineer may at any time direct the utility contractor to obtain compound samples and to prepare test specimens in accordance with ASTM D-1928. These specimens shall comply with the minimum property values shown below with the applicable ASTM requirements.

<u>ASTM Property</u>	<u>Test Method</u>	<u>Value</u>
Tensile Strength (break)	D-638	4,500 psi
Tensile Strength (yield)	D-638	3,000-3200 psi
Impact Strength	D-256A	3.0 ft-lb/in
Flexural Modulus	D-790	250,000 psi

- h) The utility contractor shall furnish, prior to use of the lining materials, satisfactory written guarantee of his compliance with the manufacturer's standards for all materials and techniques being used in the deformed lining process. The utility contractor shall provide certified test results for approval by the Engineer, from the manufacturer, that show the material conforms to the applicable requirements. Material not complying with requirements shall be rejected.

6.0 Installation of Liner

a) **General**

- 1) The utility contractor shall insure the cleanliness of the existing sewer prior to insertion of the liner. All debris and obstruction shall be removed. The utility contractor shall submit a letter stating that the sewer is clean enough to ensure an effective lining. Installation of the liner shall not begin until the utility contractor has approval from the Engineer. Approval from the Engineer cannot be given until the utility contractor has established an operational method to bypass the waste water flow. Once the lining process has begun, bypass wastewater flow shall be maintained until the lining is totally formed and all service connections have been reopened.
- 2) The liner shall be constructed of a material which, when installed, shall provide a jointless and continuous structurally sound liner able to withstand all imposed static, dynamic and hydrostatic loads on a long-term basis per the manufacturer's recommendations and published specifications.

b) **Design Requirements**

- 1) The following design requirements must be met by the utility contractor for his method of construction:
 - a) The rehabilitation of the sewer main shall be performed without the need for excavation of the main, demolition of existing structures, and the utility contractor shall be able to re-establish all user lateral services without excavation and minimize the disruptions to neighboring homes and traffic. Excavation for point repairs or emergencies shall be permitted, but only as required and directed by the Engineer, with the necessary approvals from the Engineer and / or Brunswick County.
 - b) The rehabilitated sanitary sewers shall have a significant reduction of infiltration and inflow.
 - c) The submitted pipe lining method shall have sufficient structural strength to support all dead loads, live loads, and ground water load imposed with the assumption that the existing pipe cannot share any loading or contribute to structural integrity of the liner.
 - d) The liner shall provide the least possible thickness or decrease in pipe diameter to meet the strength and other design requirements of this section.
- c) Preparation of Existing Sewer Main for Liner
 - 1) Prior to any lining of a pipe so designated, it shall be the responsibility of the utility contractor to remove internal deposits from the pipeline and to clean each section of pipe of all foreign material to ensure a successful lining operation.
 - 2) Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles, and service connections by closed circuit television. The interior of the pipeline shall be carefully inspected to determine the location and extent of all structural failures. The location of any conditions which may prevent proper installation of lining materials into the pipelines shall be noted so that these conditions can be corrected. The utility contractor shall locate and designate each service connection to be reinstated after lining. A video tape and suitable inspection log shall be kept for later reference by the utility contractor, Engineer, and Brunswick County. Video inspection shall be as directed by the Engineer.
 - 3) The utility contractor shall provide for the transfer of all waste water flows around the section or sections of pipe that are to be lined. A proposed bypass pumping plan shall be submitted by the utility contractor to the Engineer for review and approval prior to commencement of any pipe lining operations. The by-pass shall be made by diversion of the flow from an existing upstream access point and pumping the flow into a downstream access point or adjacent system. The pump and by-pass lines

shall be of adequate capacity and size to handle the flow. Standby backup bypass pumps shall be a requirement of the proposed bypass pumping plan.

- 4) The approval of the by-passing system in advance by the Engineer shall in no way relieve the utility contractor of his responsibility and/or liability for the bypass pumping system in the event of a bypass pumping spill.
- 5) It shall be the responsibility of the utility contractor to clear the line of obstructions such as solids, protruding branch connections, broken pipe, etc., that will prevent the insertion of the liner. A high speed rotating hydraulic cutter shall be used to cut protruding service laterals, severely offset joints (if possible), roots, concrete or other obstructions in the pipe. The cut shall be made as flush as possible with the wall of the pipe to be restored, and the debris shall be pushed down the pipe to a downstream manhole. If inspection reveals an obstruction that cannot be removed by conventional cleaning equipment, the utility contractor shall notify the Engineer and the cleaning effort shall be abandoned. The utility contractor shall propose an alternate method to remove the obstruction and submit same to Engineer for approval. The cost for this alternate method shall be mutually agreed to by the utility contractor and Brunswick County. The utility contractor shall confirm that the sewer is clean enough to ensure an effective lining. The line segment shall not be lined until approved by the Engineer and Brunswick County after review of the video inspection provided by the utility contractor.

d) Installation of Liner

- 1) The utility contractor shall furnish and install the CIPP lining in the full length of the sewer main to be lined in accordance with the manufacturer's installation recommendations.
- 2) Water shall be used to invert the CIPP liner in accordance with ASTM F-1216.
- 3) End seals shall be installed at all manhole inverts in accordance with the liner manufacturer's recommendations.
- 4) If sewer manhole rehabilitation with the use of a manhole lining product is also being performed along with the CIPP lining operation the CIPP lining shall be sealed to the manhole linings in a manner acceptable to the Engineer.

e) Liner Forming

- 1) Through the use of steam or hot water the deformed pipe shall be reformed to conform to the existing pipe wall in accordance with the manufacturer's recommendations.

- 2) Temperatures and pressures shall be monitored and recorded throughout the installation process to ensure that each phase of the process is achieved at the manufacturer's approved recommended temperature and pressure levels.
- f) Cool-Down
- 1) The utility contractor shall cool the reformed pipe in accordance with the approved manufacturer's recommendations.
- g) Finish
- 1) The finished lining shall be continuous over the entire length of an insertion run and be as free as commercially practicable from visual defects such as foreign inclusions, pinholes, wrinkles, and delamination. The lining shall be impervious and free of any leakage from the pipe to the surrounding ground or from the ground to inside the lined pipe.
 - 2) Any defects which will or could affect the integrity or strength of the lining shall be repaired at the utility contractor's expense in a manner approved by the Engineer and Brunswick County.
 - 3) The beginning and end of the new polyethylene pipe shall be sealed to the rehabilitated pipeline using the lining manufacturer's approved end sealing method. The sealing material shall be compatible with the polyethylene pipe and shall provide a watertight seal between the host pipe and the new liner.
- h) Reports
- 1) Installation reports shall be generated for each line segment of installed liner. The reports shall document installation day/date/time, manhole numbers, street names, sewer location including easements, project number, outdoor temperature, liner curing temperature, curing time, liner thickness, etc.
 - 2) A sample report shall be submitted to the Engineer for review and approval prior to installing any lining.
 - 3) Reports shall be submitted to the Engineer prior to submitting a project pay request.

7.0 Independent Testing Laboratory Reports

- a) The contractor shall obtain and submit liner samples to the Engineer for each section of liner installed as directed by the Engineer.
- b) The Engineer will forward the samples to an independent, ASTM certified testing laboratory.

- c) The utility contractor shall select the independent laboratory and shall pay for all laboratory tests. The contractor will be paid for the tests through the Contract at the unit

price bid for each completed test. The contractor shall submit the name and location of the independent testing laboratory to the Engineer for approval, and the contractor shall not be associated with the testing laboratory in any manner.
- d) The Engineer shall copy the utility contractor on all liner test sample submittals to the testing laboratory.
- e) The testing laboratory shall submit all test results directly back to the Engineer with a copy to the utility contractor.
- f) It is the utility contractor's responsibility to ensure the testing laboratory completes the liner sample testing and issues the reports in a timely manner.
- g) The testing shall state whether the liner sample meets all required specifications for strength and thickness in accordance with the Contract requirements.
- h) Any lining that does not meet the specified installed strength and / or thickness shall be corrected by the utility contractor in a manner approved by the Engineer and County, and at no additional cost to the County. The Engineer's decision on how to correct deficient CIPP installations is final.

8.0 Inspection of Liner and Opening of Service Laterals

- a) If, due to broken or misaligned pipe at the access point, the lining fails to make a tight seal, the utility contractor shall apply a seal at that point. A seal shall also be applied at the edge of the liner and a previous manhole insert. This shall be done after the liner has been formed and section through the manhole has been cut open. The seal shall be of a mixture compatible with the pipe.
- b) After the liner has been formed, the utility contractor shall open / reconnect all existing service connections. This shall be done without excavation and in the case of non-man entry into the line, from the interior of the pipeline, by means of a television camera and a cutting device that re-establishes all services to not less than ninety (90) percent capacity. Where holes are cut through the liner they shall be neat and smooth in order to prevent blockage at the service connections.

9.0 Final Acceptance

- a) After installation of the liner and reinstatement of service connections, the utility contractor shall perform a video inspection in the presence of the Engineer and County staff. A radial view video camera shall be used. The finished liner shall be continuous over the entire length of the installation. The liner shall be free of significant visual defects, damage, deflection, holes and the like. Reinstated service connections shall be neat and smooth. All non-conforming issues shall be corrected by the Contractor to the satisfaction and final approval of the Engineer

and Brunswick County.

10.0 Clean-Up

- a) After the liner installation has been completed, inspected, and approved, the utility contractor shall clean up the entire project area and return the ground cover to grade. All excess material and debris not incorporated in the permanent installation shall be disposed of by the contractor in accordance with State and Federal laws and regulations. A final inspection walk through with the Engineer and County staff is required and all punch list items shall be addressed by the utility contractor prior to final payment and release of retainage.

11.0 Warranty

- a) The liner shall be certified by the manufacturer for specified material properties. The manufacturer shall warrant the liner to be free from defects in raw materials for one year from the date of delivery. The utility contractor shall warrant the liner installation for a period of one year from the date of acceptance by Brunswick County. During the warranty period any defects which affect the integrity, strength, or operation of the pipe shall be repaired at the utility contractor's expense to the satisfaction of Brunswick County.
- b) If a liner fails to reform, the utility contractor shall be required to remove the failed liner at no additional cost to the County. This shall include but not be limited to all material, excavation, backfilling, cutting, concrete, pipe, shoring, temporary pavement, permanent pavement, permits and other incidental work required to remove the liner from the existing pipe. If removal is not feasible, or if removal will cause more harm than acceptable to the host pipeline, alternatives may be proposed by the utility contractor to the Engineer for review and approval. The integrity of the existing pipe where the liner was removed shall be rehabilitated by installing another liner or if this procedure is not feasible by installing a new pipe section. There shall be no direct payment for this work.