

SECTION 02541

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide for the rehabilitation of sewer pipes using trenchless, Cured-In-Place Pipe (CIPP) installed via a resin-impregnated, flexible tube inverted in the existing sewer pipe by hydrostatic head or air pressure. When cured, the finished product shall be tight fitting and continuous from end to end.
- B. All work shall conform to ASTM F1216 and MDOT Standards and Specifications as modified by the Holland BPW. All non-itemized work shall be considered incidental.

1.2 SUBMITTALS

- A. Product Data: Include technical sheets and manufacturer's installation instructions.
- B. The Contractor shall supply design calculations for each sewer segment. Each sewer segment description shall include manhole numbers, a design summary showing key design parameters, assumptions, calculations, proposed design thickness, and shall be sealed by a professional engineer, licensed in the State of Michigan. Contractor shall obtain the Engineer's acceptance of the minimum design thickness for each sewer segment prior to installation.
- C. Certifications:
 - 1. Contractor shall be licensed directly by the manufacturer as an installer.
 - 2. Product shall meet or exceed the requirements of ASTM F1216.
 - 3. Manufacturer shall maintain a well established and ongoing QA/QC program at the production facility.
 - 4. The Contractor shall certify through third party testing that the CIPP shall have a full-flow capacity equal to or greater than that of the original pipe prior to lining. The capacity of the existing host pipe will be calculated using commonly accepted roughness coefficients, which take into consideration age and condition.
- D. Phasing Plan: Include staging area, construction order (including reconnection of all laterals, restoration of the work area, inspection and testing), bypass pumping procedure and traffic control plan.
- E. Safety: Submit a confined space entry program per OSHA/MIOSHA requirements.

PART 2 - PRODUCTS

2.1 SEWER PIPE MATERIALS

- A. Tube and resin materials shall meet the requirements of ASTM F1216.
- B. The CIPP shall be fabricated from materials which when cured will be chemically resistant in accordance with ASTM F1216.
- C. A minimum CIPP thickness of 6.0 mm shall be used. The actual thickness shall be derived from equations provided in ASTM F1216.
- D. Minimum structural requirements and calculation assumptions shall be:
 - 1. Initial flexural modulus 250,000 psi
 - 2. Initial flexural strength 4,500 psi
 - 3. Long term flexural modulus (EL) 125,000 psi
 - 4. Creep retention factor 50%
 - 5. Ovality Reduction Factor (C) 0.64
 - 6. Enhancement factor (K) 7
 - 7. Safety factor (N) 2
 - 8. Poisson's ratio (ν) 0.30
 - 9. Soil modulus (E's) 700 psi
 - 10. Deterioration rating As Indicated
 - 11. Depth of sewer (H) As Indicated
 - 12. Height of water above pipe (Hw) $0.5 * H$
- E. If following installation it is found that any portion of the CIPP does not meet the minimum design thickness as calculated by the Engineer, the Owner has the right to reject the entire segment. If the entire segment is rejected, the Contractor shall install a second CIPP of sufficient thickness to obtain the minimum design thickness at no cost to the Owner.

PART 3 - EXECUTION

3.1 MOBILIZATION

- A. Mobilization shall be considered incidental. Mobilization shall consist of, but not be limited to costs associated with the movement of personnel, equipment, supplies, and incidentals to the project site. The Owner will not be responsible for any costs associated with travel expenses and hotel/motel rental.

3.2 LIGHT CLEANING

- A. Light cleaning shall be considered incidental.
- B. The Contractor shall provide all equipment necessary for the proper rodding, bucketing, brushing, flushing, cutting service leads, and dewatering of the sewers prior to the lining operation.

- C. The equipment shall be capable of rodding up to 600 feet from one manhole. The rodding unit shall be able to pull brushes, swabs and other cleaning equipment and shall have a footage meter attached so that the location of the cleaning tools will be known at all times.
- D. Where it has been determined through a visual inspection that only small deposits of debris exist within the sewer line, then light-cleaning methods can be used to remove these deposits. Equipment such as balls, scooters and/or high-pressure water jetting equipment will be permitted.
- E. Necessary pulleys and supports shall be installed in manholes so as not to restrict the cleaning operation or damage existing manholes.
- F. All dirt, debris, roots and other material removed from the sewers shall be loaded and hauled away by the Contractor. The Contractor shall dispose of all debris removed from the sewer pipe at the Holland Area Waste Water Treatment Plant.
- G. Dewatering shall include necessary pumping equipment, plugs and temporary piping between manhole sections.
- H. Cleaning of the sewer shall be carried out to the extent that the sewer section can be accurately inspected to evaluate and prepare the section for lining.
- I. Due to the fragile nature of some areas of the pipe sections that have begun to collapse, extreme care and caution shall be exercised while cleaning these areas. If, after proper caution and care has been provided, the sewer should collapse, the Contractor will not be responsible.
- J. In no case shall high pressure water jetting exceed 1,200 psi.

3.3 HEAVY CLEANING/ROOT REMOVAL

- A. Heavy cleaning for removing deposits/roots or other solid materials which requires the utilization of power tools or mechanical equipment such as buckets, root cutters, porcupines, polly pigs, wire brushes, etc. shall be paid for at the unit price as bid, per lineal foot of sewer cleaned.
- B. Roots shall be removed in the designated sections where root intrusion is a problem. Special attention should be used during the cleaning operation to assure removal of roots from the joints. Chemical root treatment may be used at the option of the Contractor.
- C. The cleaning operation shall result in a smooth and reasonably regular section of the sewer pipe having at least 90% of its original cross section area, or other degree of tolerance acceptable to the Engineer. The Engineer shall approve all heavy cleaning before proceeding. The Contractor shall dispose of all debris removed from the sewer pipe at the Holland Area Waste Water Treatment Plant.

- D. During all sewer-cleaning operations, satisfactory precautions shall be taken in the use of cleaning equipment. When hydraulically propelled cleaning tools (which depend upon water pressure to provide their cleaning force) or tools which retard the flow in the sewer line are used, precautions shall be taken to insure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. When possible, the flow of sewage in the sewer shall be utilized to provide the necessary pressure for hydraulic cleaning devices. When additional water from fire hydrants is necessary to avoid delay in normal work procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.
- E. Hydrants shall not be connected to without the use of an approved backflow prevention device. All hydrant usage must be documented by the Engineer. The Contractor must use only those hydrants as identified by the owner. If operations take place between November 1 and April 1, the Contractor shall fill with water from the Holland Board of Public Works Service Center.

3.4 REMOVAL AND DISPOSAL OF DEBRIS

- A. Removal and disposal of debris shall be considered incidental.
- B. The Contractor shall remove all debris between designated manholes by the use of a Vactor truck. In no instance shall debris be flushed to the adjoining sewer. If this occurs, the Contractor will be responsible to clean affected downstream sewer segments at no additional cost to the Owner.
- C. The Contractor shall haul and dispose of all debris removed from the sewer pipe at the Holland Area Waste Water Treatment Plant.

3.5 CCTV INSPECTION

- A. CCTV Inspection shall be considered incidental. Prior to lining of sewer segments and after the lining of sewer segments, the sewer shall be inspected by closed-circuit television and digitally recorded.
- B. The Contractor shall furnish all labor, electronic equipment and technicians to perform the closed-circuit television inspection of the sewers. Operations of the equipment shall be controlled from above ground with a skilled technician at the control panel in the television studio, controlling the movement of the television camera. The technician shall have the capability to adjust the brilliance of the built-in lighting system and be able to change the focus of the television camera by remote control.
- C. All television inspection shall be recorded digitally on compact disks that shall be turned over to the Owner. The recording must be made on a continuous running video file on which sound and color video information can be recorded. The speed and electronics of the compact disk shall be equal to that which can be played back on a standardized CD ROM of the computer industry. The recording shall be made digitally in MPEG file format on compact disk.
- D. The Contractor shall provide the Owner with a copy of suitable viewing software if the Owner does not already have compatible software.

- E. The inspection shall involve the visual observation by closed circuit television. The inspection shall be performed at a rate of speed which will allow examination of all points of infiltration, cracked or crushed pipe, defective joints, misalignment in line or grade and location of wye openings.
- F. As part of the television inspection, the precise location of each wye and problem areas shall be noted in relation to the downstream manhole. These locations shall be entered on the wye location sheet supplied by the Contractor.
- G. The color television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions, and have a high-resolution lens capable of scanning 360-degrees circumference and 270-degrees on a horizontal axis to televise sewer lines and laterals. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the Owner's Representative; and if unsatisfactory, equipment shall be removed and no payment will be made for an unsatisfactory inspection.
- H. If the camera encounters a dip in the sewer such that water is standing above the springline of the pipe, and the camera lens becomes submerged due of this condition, the camera rig shall be withdrawn from the sewer and inserted from the other end as far as possible. At all times, backflooding into the reach from the adjacent section shall be prevented.
- I. If camera or other equipment becomes seized in a sewer and excavation is required to retrieve the equipment, all excavation, material, backfill and restoration shall be completed at no additional cost to the Owner.
- J. One copy of pre-inspection reports and digital recordings on compact disk are to be turned over to the Owner immediately upon conclusion of each line segment for Owner's review. Post-inspection reports and digital recordings on compact disk are to be completed and turned over to the Owner within five (5) business days of liner installation. All inspection reports and digital recordings shall become the property of the Owner.
- K. The Contractor shall furnish all equipment required for taking instant photographs of the view that appears on the monitor. During the course of the inspection, the Owner shall indicate the specific views that are to be photographed. Instant photographs shall be in JPEG, GIF, or BMP file format, or equal.
- L. The digital video files shall be recorded so that there is one line segment per video file. The digital file shall be named with date of recording and line segment. Reports shall follow in the same order as the digital files. The following information shall be recorded on the reports:
 - 1. Date
 - 2. Pipe Size
 - 3. Engineer or Inspector
 - 4. Customer's Name
 - 5. Project Name
 - 6. Location of Current Recording

7. Upstream and Downstream Manhole Numbers, Address of Closest House and Street Name
 8. Camera Direction
 9. Direction of Flow
 10. Sewer Service Wye Location by Station and Quadrant including sewer leads in Manholes
 11. Defect Location by Station and Quadrant
 12. Type of Pipe
 13. Type of Joint
 14. Manhole Condition
 15. Drop from Manhole Rim to Invert of Sewer
- M. In addition, other points of significance such as locations of building sewers, unusual conditions, roots, mineral deposits, storm sewer connections, broken pipe, presence of scale and corrosion, and other discernible features will be recorded and a copy of such records will be supplied to the Owner.
- N. The original pipeline should be clear of obstructions such as solids, dropped joints, protruding service connections, crushed or collapsed pipe, and reductions in ovality of more than 10% that will prevent the insertion of the resin impregnated tube. If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, then a point repair excavation should be made to uncover and remove or repair the obstruction. Such point repairs must be first approved by the Owner and may be considered for separate payment.
- O. The view seen by the television camera shall be transmitted to a monitor of not less than 17 inches. The monitor shall be located inside a mobile TV studio. The stationing of the television camera shall be continuously displayed on the television monitor while the sewer line is inspected. The Contractor's mobile studio shall be large enough to accommodate up to 3 people for the purpose of viewing the monitor while the inspection is in progress. The Owner's representative shall have access to view the monitor at all times.
- P. The Contractor shall furnish the electricity for all operations. If required to improve the quality of the television inspection, a ventilating system shall be furnished by the Contractor and installed between manhole sections.
- Q. Upon successful installation of the CIPP pipe and reconnection of the service and branch connections, Contractor shall televise the final product for submittal to the Owner. Post-inspection reports and digital video files shall be turned over to the Owner within 5 business days of liner installation.

3.6 BY-PASS PUMPING

- A. By-pass pumping shall be considered incidental. The Contractor shall by-pass all effluent around the section or sections of sewer to be lined.
- B. By-pass pumping shall be by plugging an existing upstream manhole and pumping the effluent into a downstream manhole or separate system. The pump and by-pass line shall be of adequate size to accommodate the flow, even in wet weather.

3.7 TRAFFIC CONTROL

- A. Traffic Control shall be considered incidental. All Traffic Control shall conform to the latest edition of the Michigan manual of Uniform Traffic Control Devices (MMUTCD).

3.8 PROTRUDING SERVICE CONNECTIONS

- A. Existing service connections protruding into the main sewer shall be cut flush to the host pipe prior to the lining process by internal means only. The cost of cutting protruding taps shall be paid per each at the contract unit price that shall include all labor, materials, and equipment for complete cutting. Removal of protruding service connections shall be done by cutting machinery, not by impact with such a device as a chain cutter or similar device. All pieces of the protruding service eliminated shall be removed from the sewer main.

3.9 SEWER PIPE

- A. CIPP installation shall be in accordance with ASTM F1216. In addition, the Contractor shall perform operations in accordance with applicable OSHA/MIOSHA standards. The Contractor shall obtain all required permits and have available on-site required safety apparatuses.
- B. The Contractor shall provide all field measurements such as length and size of each pipe segment lined.

3.10 RECONNECTION OF LATERALS

- A. Reconnection of laterals shall be considered incidental and made per ASTM F1216.
- B. Prior to lining, the Contractor shall certify that a minimum of two (2) complete working systems for reconnecting laterals are on site. In addition, the Contractor shall certify that spare key components are on site. Additional payment will not be made for excavation required to reconnect laterals. Contractor will be responsible for all costs and liability associated with excavation and restoration work.
- C. Before a lateral is fully opened to the newly lined sewer, a relief hole may be cut through the liner to relieve any water that has accumulated in the lateral during the lining process. After the relief hole has been cut, the lateral may then be fully opened.
- D. Contractor shall have one (1) cutting crew per line segment that contains more than twelve (12) lateral reconnections. A line segment is defined as a length of sewer between two (2) manholes.
- E. The opening in the liner shall be equal to the diameter of the original sewer lateral. Contractor shall remove all burrs and extraneous resin build-up so that there is a smooth transition from the lateral to the mainline sewer.
- F. Contractor shall remove all materials from the mainline sewer deposited on account of his actions. In no instance shall such debris be flushed to the adjoining mainline sewer. If this occurs, the Contractor will be responsible to clean additional affected sewer segments at no additional cost to the Owner.

3.11 SEALING CURED-IN-PLACE-PIPE AT MANHOLES

- A. If the liner fails to make a tight seal at the manhole wall, the Contractor shall apply a seal consisting of a resin mixture compatible with the CIPP in accordance with ASTM F1216. This shall be considered incidental.

3.12 VERIFICATION OF INSTALLATION

- A. Testing and visual inspection of the CIPP shall be in accordance with ASTM F1216. The Contractor shall supply the Owner with samples of each line segment for testing. This shall be considered incidental.

3.13 RESTORATION

- A. Restoration of all disturbed areas shall be considered incidental. Upon acceptance of the installation and testing of the CIPP, the Contractor shall restore the entire disturbed project area affected by the CIPP operations.

END OF SECTION