**SECTION 0000**

**REHABILITATION OF UNDERGROUND PIPES**

**WITH CURED-IN-PLACE-PIPE LINER**

# PART 1 GENERAL

* 1. SUMMARY

1. The intent of this work is to provide for the reconstruction of pipelines and conduits by the installation of a resin-impregnated flexible tube via a process commonly referred to as Cured-In-Place-Pipe (CIPP). This tube shall be inverted into the original pipeline/conduit and expanded to fit tightly against said pipeline by the use of water or air pressure. The resin system shall then be cured by elevating the temperature of the water or air used for the inflation to a level sufficient for the initiators in the resin to affect a thermosetting reaction.
   1. SCOPE OF WORK
2. Pre-Cleaning and Inspection – The Contractor shall clean the pipes or conduits to be lined thoroughly before commencement of the CIPP process. Root masses, debris, protruding laterals, mineral or other attached deposits, or any other matter not herein defined, shall be removed from the conduit at this time. A complete closed-circuit television (CCTV) inspection of each line segment shall be included in this process to document the condition of the pipe or conduit post cleaning but prior to CIPP lining.
3. Cured-In-Place- Pipe Lining – The intent of the CIPP process is to rehabilitate the pipes and other conduits identified by the Engineer or Owner to the extent required by the applicable ASTM standards referenced below. This process shall conform to all requirements for liner thickness, cure time, inversion method(s), testing, quality control, and other methods and process as may be specified herein.
4. Bypass Pumping – Contractor shall provide such piping, pumping, connections, fittings, and other appurtenances as necessary to bypass flows. There shall be no disruption of flow to the existing lines caused by the installation of this bypass, nor shall any sewer spills or overages be caused as a result of this action.
5. Reinstatement of Laterals and Connections – This work includes the reinstatement of all laterals and other connections that may be temporarily blocked as a result of the CIPP process. The Contractor shall use a mechanical cutter or other means as approved by the Engineer to place these connections back in service as soon as practicable after the curing process is complete.
6. Post Installation Inspection and Documentation – After the installation and curing of the CIPP liner, and after the reinstatement of laterals or other connections, the Contractor shall perform a CCTV inspection to document the condition of the rehabilitated pipes and reinstated lateral connections (if any).
7. Traffic Control – The Contractor shall be solely responsible for all signage, flagging, cones, personnel and any other item or personnel required for traffic control.  
   1. related sections  
        
      **insert related sections here or delete**
   2. references
8. American Society for Testing and Materials (ASTM):

1. ASTM D543 Test Method for Resistance of Plastics to Chemical Reagents

2. ASTM D638 Test Method for Tensile Properties of Plastics

3. ASTM D790 Test Method for Tensile Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

4. ASTM F1216 Rehabilitation of Existing Pipelines and Conduits by Inversion and Curing of a Resin-Impregnated Tube

* 1. pre-qualification and approval

1. Pre-Approval of Products - The system proposed (materials, methods, and workmanship) must be proven through previous successful installations to an extent and nature satisfactory to the Owner and the Engineer. Only previous installations that are commensurate with the size of the current project being proposed will be considered for approval purposes. Since CIPP is intended to have a fifty (50) year design life, only products deemed to have this performance will be accepted. All products and installers must be pre-approved prior to the formal opening of bids/proposals.
2. Criteria for Acceptance - Products and Installers seeking approval must meet *all* of the following criteria to be deemed commercially acceptable:
   1. Minimum Footage Installed - For a Product to be considered Commercially Proven, a minimum of one million (1,000,000) linear feet must have been successfully installed. The Manufacturer (Licensor) shall have completed sufficient testing to document that the materials and the method(s) of installation proposed will produce the desired long-term performance.
   2. Financial Means and Related Experience - For an Installer (a/k/a the Contractor) to be considered Commercially Proven, the Installer must satisfy all insurance, financial, and bonding requirements of the Owner, and must have at least three year’s active experience in the commercial installation of the product bid. The Installer’s key personnel shall have at least two hundred fifty thousand (250,000) linear feet of successful experience, including sufficient quantities of installations in diameter and linear footage similar to in diameters and linear footage proposed for this project. The Installer shall be trained in appropriate CIPP installation and shall have installed a minimum of five hundred thousand (500,000) linear feet of CIPP.
3. Pre-Approval Deadline – To allow for adequate consideration by the Engineer and Owner, documentation for Products and Installers seeking pre-approved status must be submitted no less than seven (7) working days prior to the bid/proposal due date. The Engineer or Owner will advise of acceptance (or rejection) a minimum of three (3) days prior to the due date. All required submittals must be satisfactory to the Engineer and/or Owner.
4. Required Pre-Approval Information - The Contractor shall submit the following pre-approval information:
   1. Manufacturer’s certification that the materials to be used meet the referenced standards and these specifications.
   2. License or certificate verifying Manufacturer’s/Licensor’s approval of the Installer.
   3. Reference lists demonstrating compliance with the minimum requirements listed as per above.

1.06 SUBMITTALS

1. Safety Plan –The Contractor shall provide a confined space entry plan and identify designated safety supervisory personnel to the Engineer. The plan shall include confined space entry training certification of each employee assigned to the project.
2. CCTV Technician NASSCO PACP Certification – The Contractor shall provide certification documentation for all technicians on the project who are performing pre-installation and post-installation CCTV inspections. These technicians shall hold National Association of Sewer Service Companies (NASSCO) certification for NASSCO’s Pipeline Assessment and Certification Program (PACP).
3. Bypass Plan – The Contractor shall provide and otherwise develop a plan for bypass pumping. The pump and bypass lines shall be of adequate capacity and size to handle the anticipated flow. This plan shall be approved by the Engineer or Owner before work begins on the section(s) requiring bypass.
4. Required Submittal Information - The Contractor shall submit the following information to the Engineer prior to commencement of the work:

1. Manufacturer's product literature, application and installation requirements for materials used in liner.

2. Manufacturer's product certification for materials used in liner.

3. Liner Pipe Thickness Design for each pipe section. Liner pipe thickness design shall be in accordance with Appendix XI of ASTM F1216 but not less than 6.0MM. The existing pipe *shall not* be considered as providing any structural support to the liner pipe. In the liner thickness calculations, the following specifications shall apply:

1. The minimum ovality of the host pipe shall be two percent (2%),
2. The height of ground water shall be a minimum fifty percent (50%) of the pipe depth,
3. The enhancement factor (K) shall be no greater than seven point zero (7.0),
4. The minimum safety factor shall be two point zero (2.0), and
5. The flexural modulus of elasticity shall be reduced 50% to account for long term effects and used in the design equation EL.
6. *All final thickness shall be considered as finished thickness (post curing).*
   1. A sample of public notices, door hangers, and other materials to be used by the Contractor for public communications purposes shall be provided to the Engineer or Owner.
   2. No liners will be approved for installation until all items have been submitted, reviewed for conformance with the specifications and approved by the Engineer.

1.07 QUALITY ASSURANCE

1. Corrosion – The Contractor or Installer shall fabricate finished liner from materials which, when cured, will be chemically resistant to internal exposure to domestic sewage.

B. Appearance – Liner(s) shall be continuous over the entire length of the insertion run and be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes, winkles and delamination.

# PART 2 PRODUCTS

* 1. CURED- IN-PLACE-PIPE LINER

1. Resin – Resin used in the curing process shall have specific characteristics, including:
2. The resin system shall be corrosion-resistant polyester, vinyl ester, or epoxy that when properly cured meets the minimum requirements given herein.
3. Resins may contain pigments, dyes or colorants which will not interfere with visual inspection of the cured liner.
4. Tube – The tube that is inverted into the host pipe and ultimately cured-in-place shall have specific characteristics, including:
5. The tube shall consist of one or more layers of a flexible needled felt or otherwise be capable of carrying resin and withstanding the installation pressures and curing temperatures. The tube shall be compatible with the resin system to be used on this project. The material shall be able to stretch to fit irregular pipe sections and negotiate bends.
6. The tube shall be fabricated to a size that, when installed, will tightly fit the internal circumference and the length of the original conduit. Allowances shall be made for the longitudinal and circumferential stretching that occurs during placement of the tube.
7. The tube shall be uniform in thickness and, when subjected to the installation pressures, shall meet or exceed the designed finish wall thickness.
8. Any plastic film applied to the tube on what will become the interior wall of the cured liner shall be compatible with the resin system used. The film shall also be of such translucence that the resin is clearly visible and shall be firmly bonded to the felt material.
9. The tube shall be marked for distance at regular intervals along its entire length, not to exceed ten feet (10’). Such markings shall include the lining manufacturer’s name.
10. Fit and Thickness - The finished CIPP liner shall fit tightly to the host pipeline at all observable points and shall meet or exceed the 6.0mm minimum thickness or the thickness submitted per the design process. The material’s properties shall meet or exceed the physical requirements as listed in the most current edition of ASTM F-1216.

# PART 3 EXECUTION

3.01 PREPARATION

A. Locating Manholes and Access Points - It shall be the responsibility of the Owner to locate, designate, and otherwise provide all manhole or access points for the work, and to provide to the Contractor rights of access to these points.

B. Access to Water - The Owner shall provide free access to and usage of water hydrants for cleaning, installation of the tube, and other work items requiring water.

C. Debris Removal Prior to CIPP Installation - The Contractor shall remove all internal debris from the pipeline that will interfere with the installation of the CIPP. The Owner shall provide at its expense a dumpsite for debris removed during the cleaning operations. Unless stated otherwise, it is assumed that this site will be at or near the local sewage treatment facility. Any hazardous waste encountered during this project will be considered as a change of conditions.

D. Bypass Pumping - The Contractor shall provide for the flow of sewage around the section, or sections, of pipe designated for rehabilitation (if applicable). The pump and bypass lines shall be of adequate capacity and size to handle the anticipated flow.

E. Inspection of Lines Prior to CIPP Installation - Experienced personnel trained in locating breaks, obstacles, and service connections by CCTV shall perform inspection of the pipelines. The interior of the pipeline shall be carefully inspected to determine the location of any conditions that may prevent proper installation of the CIPP.

F. Video and Logs - A video recording and suitable log shall be kept for later reference by the Owner.

G. Removal of Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions such as solids, roots, mineral or attached deposits, protruding taps, etc. that will prevent the insertion of CIPP. These items shall be removed to within one half inch (½”) of the pipe wall. Unless otherwise provided as a separate pay item, the removal of these materials shall be considered incidental to the CIPP installation.

H. Necessary Point Repairs - If pre-installation inspection reveals an obstruction that will prevent the CIPP installation process, and this obstruction cannot be removed by conventional sewer cleaning or cutting equipment, the Contractor shall make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the Owner's representative prior to the commencement of the work and shall be considered as a separate pay item.

3.02 INSTALLATION

A. Resin Impregnation and Wet Out – Each liner to be installed in the project shall be infused or impregnated with a thermosetting resin. This process shall include the following procedures:

1. The Contractor shall designate the location where the liner will be impregnated with resin prior to installation; this is the so called “wet-out” process. A vacuum impregnation process shall be used in conjunction with a roller system to achieve a uniform distribution of the resin throughout the tube. The Installer or Contractor shall allow the Engineer to inspect materials and the "wet out" procedure at its (the Engineer’s) discretion.

2. Only resin and catalyst systems which are approved by the liner manufacturer(s) shall be utilized.

3. The Contractor shall transport resin-impregnated liners to the job site(s) in suitable light-proof containers. Temperatures in said containers shall be maintained below forty degrees Fahrenheit (40°F).

4. The quantity of resin used for the tube’s impregnation shall be sufficient to fill the volume of air voids in the tube. Additional allowances shall be made for polymerization shrinkage and the anticipated loss of any resin through cracks and irregularities in the original pipe wall.

B. Public Notification – Those persons living or working at businesses in the area contiguous to the pipes being lined shall be notified in writing prior to the installation of CIPP. This process shall include:

1. A public notification program shall be implemented by the Contractor. The Contractor shall be responsible for contacting each home or business connected to the sanitary sewer and informing them of the work to be conducted, and when the sewer will be off-line.

2. Written notice to shall be delivered to each home or business describing the scope of work, work schedule, how the liner installation and necessary work affects them (the homeowner or business owner). This notice shall include the telephone number of the Contractor so that affected persons can call to discuss the project or any problems that could arise.

3. Personal contact shall be implemented with any home or business that cannot be reconnected within the time stated in the written notice.

C. Insertion of Liner – The insertion of liner in the various pipe line segments shall conform to the following procedures:

1. The Contractor shall insert the liner through an existing manhole or other access point by means of an inversion process as per ASTM F1216 (latest version). Lubricant may be used to facilitate the liner inversion.

2. Temperature gauges shall be placed at the upstream and downstream ends of the section to be lined by the Contractor to monitor the pressurized fluid’s (air or water) temperature. In addition to monitoring the temperature inside the tube, temperature gauges shall be placed between the host pipe and the liner at as many points as is practical to record the heating that takes place on the outside of the liner.

D. Curing Liner – The curing of liner shall conform to the following procedures:

1. After inversion is complete, the Contractor shall apply heat source(s) and recirculation equipment to the installed liner per ASTM F1216 (latest version). Equipment shall be used that is capable of uniformly raising the temperature of the liner above the temperature required to effect cure of the resin.

2. Initial cure shall be complete when inspection of exposed portions of the liner by the Contractor indicates that the liner is hard and sound. Initial cure shall also be deemed complete when remote temperature sensors indicate that the temperature of the liner is of sufficient grade to realize an exotherm. The Contractor shall cool the hardened liner to a temperature below one hundred degrees (100°F) before relieving pressure in the liner.

3.03 CONNECTIONS

A. Service Reinstatements – The following procedures shall be adhered to by the Contractor for the reinstatement of service laterals and other connections, including:

1. Determine which service connections shall be reinstated from the pre-television inspection video survey. The Owner shall assist with the designation of which services are “active” and also indicate which services should not be reinstated.

2. Reconnect services (without excavation) by in-tandem usage or integrated CCTV camera and cutting device. The Contractor shall re-establish services to a minimum of ninety-five percent (95%) of the flow capacity prior to the mainline liner installation.

3. Sanitary services shall not be out of service for more than twenty-four (24) hours during the lining process.

4. The edges of the liner at each service reinstatement shall be cut smooth or buffed smooth by the Contractor with a wire brush. No rough or jagged connections will be allowed. This process shall be deemed incidental to the project and no pay item for said buffing will be included.

B. Manhole Connections – Where each CIPP liner connects to a manhole, the following procedure shall be required:

1. At the connection to the manhole, the Contractor shall provide a watertight seal between the host pipe and liner pipe. This seal shall be made using materials or procedures acceptable to the Engineer.

3.04 FIELD QUALITY CONTROL

A. Testing – As part of the continuous quality assurance program, the Contractor shall initiate and follow the following procedures for the entire installation phase of the project:

1. The Contractor shall prepare one random sample per week (per liner diameter installed). The samples shall be restrained samples for diameters of CIPP less than eighteen inches (< 18”) and flat plate samples for diameters of CIPP 18” and larger (≥ 18”). The flat plate samples shall be taken directly from the wet-out tube, clamped between flat plates, and cured in the down tube. The restrained samples shall be tested by a third party in accordance with ASTM F-1216 for thickness and initial physical properties. Flat plate samples shall be tested for initial physical properties only.

B. CCTV Inspection – The Contractor shall comply with the following CCTV inspection procedures, including:

1. The Contractor shall post-CCTV the completed work per the NASSCO PACP. The television inspection should be used to confirm tightness of the fit of the CIPP to the host pipe and to identify any imperfections. The finished liner shall be continuous over its entire length and be free from visual defects such as foreign inclusions, dry spots, pinholes, and delamination.

2. Each connection shall be “panned” with a color camera to confirm the smoothness of the reinstated services.

C. Post Lining Submittals – The Contractor shall provide the Engineer and/or Owner with the following information sets after completion of CIPP installation, including:

1. Testing results per ASTM 1216 (flexural modulus only).

2. CCTV video of pre-lining and post-lining condition of the sewer line. This video shall be captured in Motion Pictures Expert Group (MPEG) 1 format. Color computer-generated written reports shall also be provided for each line segment that has a CIPP installed.

3.05 CLEANING AND RESTORATION

1. General Clean Up - At completion of the CIPP work, the Contractor shall remove rubbish, debris, dirt, equipment and excess material from site. The Contractor shall also clean and restore adjacent surfaces soiled by and during course of the CIPP work.

**PART FOUR DELIVERABLES AND PAYMENTS**

* 1. MEASUREMENT

1. Distance Measurement - Measurement of the actual number of feet of CIPP installed shall be made from the center of the manhole wall of the structure where inversion occurs to the center of the manhole where the CIPP terminates.
2. Other Payment Units - Any ancillary items (if not deemed incidental to the project by the Engineer or Owner) shall be paid at a unit price basis as specified by the contract’s payment schedule as per below:
   1. Removal of Roots – will be paid on a per foot basis for the footage of the entire line segment (upstream manhole to downstream manhole);
   2. Removal of Mineral or Attached Deposits – will be paid per foot basis for the footage of the entire line segment (upstream manhole to downstream manhole);
   3. Removal of Protruding Taps – will be paid per each;
   4. Reinstatement of Laterals – will be paid on per each.
   5. ACCEPTANCE
3. Defective Work – Within sixty (60) days of the final delivery of written and video reports, the Engineer will notify the Contractor of any defective work. Defective work (if any) will be corrected by the Contractor within sixty (60) days of receipt of this written notification.
   1. DELIVERABLES
4. Video Files - As part of the final submittal on this project, the Contractor shall submit all video recordings and database information (in approved PACP format), on DVDs or external hard drives (as dictated by the size and quantity of the files submitted). If a hard drive is submitted, the submittal shall include the power cord and USB connection cable. The external hard drive shall become the property of the Owner unless otherwise indicated or specified.
5. Written Reports – As part of the final submittal on this project, the Contractor shall provide two copies of a bound written report in the approved PACP format. This report shall include a cover page with the name of the project, scope of the project, and date of submission; an index page with listing of line segment reports; a complete set of line segment reports and a page or pages of holders containing the DVDs of this project’s data (if applicable).
   1. PAYMENTS
6. Pay Estimates - Pay estimates will be submitted on a regularly scheduled basis to the Engineer by the Contractor.
7. Approval of Quantities - The Engineer shall review the quantities submitted by the Contractor and shall immediately inform the Contractor of its certification or disallowing of any quantities submitted for payment. If the quantities of work in question by the Engineer can’t be immediately resolved to the satisfaction of both parties, the pay estimate shall move forward without those quantities included. Said denied quantities may be resolved and submitted on the next pay estimate.

**END OF SECTION**

**RECOMMENDED PAYMENT SCHEDULE**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Item Number** | **Description** | **Est. Qty.** | **Unit** | **Unit**  **Price $** | **Total Price $** |
|  |  |  |  |  |  |
|  | **GENERAL ITEMS** |  |  |  |  |
|  | Mobilization | 1 | Lump Sum |  |  |
|  | Traffic Control | 1 | Lump Sum |  |  |
|  | Bypass Pumping | 1 | Lump Sum |  |  |
|  | **CURED-IN-PLACE-PIPE** |  |  |  |  |
|  | 6” CIPP Installed | 000 | Linear Foot |  |  |
|  | 8” CIPP Installed | 000 | Linear Foot |  |  |
|  | 10” CIPP Installed | 000 | Linear Foot |  |  |
|  | 12” CIPP Installed | 000 | Linear Foot |  |  |
|  | 15” CIPP Installed | 000 | Linear Foot |  |  |
|  | 18” CIPP Installed | 000 | Linear Foot |  |  |
|  | 21” CIPP Installed | 000 | Linear Foot |  |  |
|  | 24” CIPP Installed | 000 | Linear Foot |  |  |
|  | **OTHER PAY ITEMS** |  |  |  |  |
|  | Removal of Roots | 000 | Linear Foot |  |  |
|  | Removal of Minerals or Attached Deposits | 000 | Linear Foot |  |  |
|  | Removal of Protruding Taps | 000 | Per Each |  |  |
|  | Reinstatement of Service Laterals | 000 | Per Each |  |  |
|  | **TOTAL BID** |  |  |  | **0,000,000.00** |