SECTION 33 01 36

CURED-IN-PLACE PIPE LINING

PART 1 GENERAL

1.01 SUMMARY

A. Provide cured-in-place lining as shown and as specified. Comply with applicable provisions of Divisions 00 and 01.

B. Existing 30-inch steel outlet pipe to be lined is deteriorating, but is generally believed to be intact with no obstructions. Pipe has not been televised by Owner.

C. Cured-in-place lining shall be installed over the length of the 30-inch steel outlet pipe, both existing and newly installed, from just downstream of the intake structure elbow to the outfall structure. Lining of the intake structure elbow is not required.

D. The pipe shall be televised before and after installation of the cured-in-place lining.

1.02 RELATED SECTIONS

33 42 15 Piping and Accessories.

1.03 SUBMITTALS

A. Product Data: Submit product data for lining materials.

B. Installer Qualifications: Submit documentation of installer qualifications as specified in "Quality Assurance" article below.

C. Work Procedures: Submit proposed procedures for review at least 10 days prior to beginning lining operations. Proposed procedures shall include:

1. Proposed materials (e.g, liner, resin, end treatments, etc).
2. Manufacturer’s technical literature.
3. Installation instructions.
4. Test methods.
5. Certifications for liner materials, resins, tube, cure method, etc.

D. All design calculations for the CIPP including liner thickness for the parameters specified.

E. Pre- and Post-Installation Video Inspection Reports: Contractor shall complete video inspections of the pipe to be lined both before and after installation of the CIPP liner. Submit reports of inspections performed. Video shall be recorded on a standard definition DVD suitable for use in a computer DVD drive.

F. Curing logs.

G. Make submittals in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Liner installer shall have a minimum of 20,000 linear feet of pipe lining experience with the specified product. Liner installer shall provide contact information for the owners of such projects upon request.

1.05 PATENTS

A. Contractor shall warrant to Owner that the methods, materials and equipment used herein, where covered by patents, are furnished in accordance with applicable licenses and that the prices included on Bid Form include applicable royalties and fees in accordance with such license. Warranty shall include defense against claims from infringement of patent and shall save harmless Owner and his Representatives from loss on account thereof.

1.06 TESTING

A. Contractor shall arrange and pay for testing of the CIPP liner by a qualified testing agency, acceptable to Owner and independent of Contractor.

B. A minimum of one (1) 12-inch long restrained sample shall be taken from the installed liner at a location to be approved by A/E and SEO. The sample shall be tested for flexural modulus and flexural strength according to ASTM D790 and thickness according to ASTM D2122. Test results must meet the design requirements.

C. A minimum of three (3) flat plate samples (i.e., coupons) shall be prepared from the tube and resin system. Coupon samples must be fully bonded and cured. The samples shall be tested for flexural modulus and flexural strength according to ASTM D790. Flexural modulus and strength test results must meet the design requirements.

D. Contractor shall field measure liner thickness at a minimum of eight (8) locations along the liner's length in accordance with ASTM D2122. Measured thicknesses must equal or exceed the design thickness.

PART 2 PRODUCTS

2.01 LINING MATERIAL

A. General: Pipe lining system must be recommended by the manufacturer for the type of application shown on the Drawings. A/E and SEO approval of pipe lining system is required.

B. Size: Liner shall be properly sized to diameter and length as shown. Contractor shall field verify pipe length and diameter prior to ordering liner. The liner shall be manufactured to expand sufficiently but not greater than 10 percent, achieving a tight fit against the host pipe after installation.

C. Structural Capacity: Contractor shall design the pipe lining system according to the following parameters:

1. No less than 58 ft of overburden material with an estimated unit weight of 125 lb per cu ft (pcf).
2. Minimum live loading: HS-20.
3. Assume 2% ovality (to be refined following pre-installation inspection).
4. Assume fully deteriorated host pipe.
5. Initial Flexural Strength: 4,500 psi (minimum).
6. Initial Flexural Modulus of Elasticity: 250,000 psi (minimum).

D. Tube Material: Liner shall be constructed to meet the requirements of ASTM F2019. Glass fiber material is required for this application. Felt liners are not acceptable.

E. Curing: The glass fiber liner shall be cured with UV light sources at a constant inner pressure.

F. Service Life: A minimum service life of 50 years is required for the installed product.

2.02 RESIN MATERIAL

A. All resin must be able to cure by UV light.

B. Resin system may be of the corrosion-resistant vinyl ester or polyester type. When properly cured within the tube composite, the resin system must meet the physical property requirements of ASTM F1216 and ASTM F1743.

2.03 UV LIGHT SYSTEM

A. UV light system shall have the ability to record parameters during the curing process to ensure that the liner is properly cured. Minimum recording parameters include the project name, date and time, curing speed, light source and wattage, inner air pressure, inner temperatures, and length of liner. Recording parameters shall be documented in the curing logs to be submitted to A/E and SEO for review (see Section 1.03).

2.04 END TREATMENTS

A. Provide end treatment(s) to transition from CIPP-lined pipe to unlined steel pipe. End treatments shall prevent CIPP liner from separating from the host pipe because of water pressure and high flow velocities. End treatments shall be designed for a minimum static head of 75 ft and a minimum flow velocity of 40 ft/s.

B. End treatments shall be rubber membrane seals manufactured in compliance with ASTM D3900 and ASTM D3568. Rubber membrane seals shall be secured using stainless steel retaining bands. Stainless steel retaining bands shall comply with UNS S30400 (Type 304), UNS S31600 (Type 316), UNS S31603 (Type 316L), or UNS N08367 (AL-6XN) and shall conform to ASTM A240 Standard Specifications for heat-resisting chromium and chromium-nickel stainless steel plate, sheet, and strip for pressure vessels. All material such as push tabs, shims, and wedges shall be made compatible with the base metal selected.

C. Contractor may use alternative end treatment methodology if approved by A/E and SEO.

PART 3 EXECUTION

3.01 PIPE PREPARATION

A. All internal debris shall be removed from the original pipeline. Pipeline shall be cleaned with hydraulically powered equipment, high velocity jet cleaners, or mechanically powered equipment as required for the CIPP lining operation.

3.02 PRE-INSTALLATION PIPE INSPECTION

A. Inspect pipe after cleaning.

B. Inspection of pipe shall be performed by experienced personnel trained in locating breaks, obstacles, and service connections by closed-circuit television. The interior of the pipe shall be carefully inspected to determine the location of any conditions that may prevent proper installation of the proposed pipe lining operation, such as protrusions, collapsed or crushed pipe, infiltration conditions, and reductions in the cross-sectional area. These conditions shall be noted and brought to A/E's attention immediately. The pre-installation video (copy) shall be turned over to the A/E prior to pipe lining.

C. Contractor shall measure the internal diameter of the existing pipe at least three (3) locations. Prior to ordering of the liner, verify the internal dimensions of the existing pipe to ensure that the lining utilized will be of appropriate dimension.

D. Based on the results of the inspection, Contractor shall make design modifications, as required, prior to ordering the liner.

3.03 INSTALLATION OF LINER

A. Install liner according to manufacturer's recommendations and ASTM F2019.

B. Finished lining shall be continuous over entire length of an insertion run from just downstream of the low-level intake structure elbow (upstream) to the outfall structure (downstream) and shall be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. Lining shall be impervious and free of any leakage from pipe to surrounding ground or from ground to inside of lined pipe.

C. Defects which will affect integrity or strength of lining in the foreseeable future or warranty period shall be repaired at Contractor's expense in a manner mutually agreed by Owner and Contractor.

D. Gliding Foil: A continuous heavy gauge (10mm) plastic sheet shall be pulled into place over the entire length of host pipe, covering 1/3 to 1/2 the diameter of lower portion of the host pipe, protecting liner during the pull in process.

E. Liner Installation: Liner shall be securely attached to winch and pulled into place taking care not to exceed pulling forces as stated in manufacturer's installation protocol.

F. Liner Inflation: Liner shall be inflated per manufacturer's inflation process. Once inflated to working pressures the liner shall fit tightly against the host pipe.

G. Pre-Curing Inspection: Once working inflation pressures are reached, the liner shall be inspected by closed-circuit television on light assembly checking for proper fit and expansion of the liner. Contractor shall repair any identified deficiencies or irregularities.

3.04 CURING

A. Cure liner using UV light according to ASTM F2019.

B. Initial curing speeds shall start off at a sufficient speed to ensure the first 15 ft of liner is cured properly, ramping up to working speed to properly cure the remainder of liner per manufacturer's protocol. The same process shall be adhered to during the last 15 ft of liner.

C. Provide curing logs to Owner, A/E, and SEO within 24 hours of installation.

3.05 END TREATMENTS

A. Install end treatments per manufacturer's recommendations.

3.06 POST-INSTALLATION INSPECTION

A. Upon completion, perform a visual inspection (or closed-circuit television inspection if a visual inspection is not possible) of the installed CIPP. Inspection shall be in accordance with ASTM F1743. Provide post-installation video (copy) to Owner, A/E and SEO within 24 hours of the inspection.

B. Installed liner shall be free from visual defects such as foreign inclusions, dry spots, keel, boat hull, pinholes, wrinkles, fins, and other deformities. Defects and deformities may, at the discretion of the A/E or SEO, be cause for rejection of the entire liner.

3.07 WARRANTY

A. The finished liner shall be warranted against defects in material and installation for a period of 1 year from the date of completion of the installation. The Contractor shall be responsible to repair all installation defects, for the one year warranty period. The Contractor shall be responsible to cover all costs, including materials and labor, associated with these repairs.

Contractor shall also be responsible to repair damage to the installed liner that may occur because of other ongoing construction activities.

END OF SECTION