PIPE REHABILITATION

MEASUREMENT AND PAYMENT

Payment shall be made only for those items included in the PROPOSAL. All costs incurred shall comply with the provisions of these Specifications and shall be included in the unit price bid for the associated items in PROPOSAL. No material, labor, or equipment will be furnished by the District unless otherwise specified. The basis of measurement and payment for each proposal item will be as described below:

1. PRE-INSTALLATION VIDEO INSPECTION

The measurement for payment of this item will be the actual number of linear feet of sewer line to be video studied, measured along the centerline of the pipe from center of manhole to center of manhole. Only those sections specifically authorized by the Engineer shall be video studied and measured for payment.

The unit price bid per linear foot for the video inspection shall include all of the Contractor's costs of whatsoever nature. The price bid shall include, but not be limited to: furnishing and setting up all equipment and labor necessary to inspect the sewer to be rehabilitated by closed circuit television; recording to digital video the TV inspections; to determine, identify and locate live sewer service taps; to determine extended sewer taps that require trimming; to locate and identify structurally deficient pipe sections that may be considered for point repairs; to supply energy required for all equipment; and all other related and necessary materials, work, and equipment required to complete this item in accordance with the Plans and Specifications.

Provide pre-installation video dvd to the Owner.

2. PRE-INSTALLATION SEWER LINE CLEANING

The measurement for payment of this item will be actual number of linear feet of sewer line to be cleaned, measured along the centerline of the pipe from inside face of manhole to inside face of manhole, from given station to given station, or from center of manhole to center of manhole with deductions made for the internal diameter or dimensions of manholes or structures. Only those sections specifically authorized by the Engineer shall be cleaned and measured for payment.

The unit price bid per linear foot for the sewer line cleaning shall include all of the Contractor's cost of whatsoever nature. The price bid shall include, but not limited to: furnishing and setting up all equipment and labor necessary to clean the sewer to be rehabilitated; to furnish water for jetting; to furnish energy required for de-rooting equipment and other power cleaning machines; removal of all foreign material from the sewer pipe walls that will prevent the proper installation of the Cured-In-Place-Plastic-Pipe; cleaning and inspection of the manholes; and all other related and necessary materials, work, and equipment required to complete this item in accordance with the Plans and Specifications.

3. POINT REPAIR

The measurement for payment of this item will be the total number of specific point repairs of sewer pipe up to ten feet (10') in length in one excavation pit. The length of pipe repaired beyond ten feet (10') of length in one excavation pit will be considered a fraction of a point repair, i.e. eighteen (18') linear foot of sewer pipe repair in one excavation pit would be paid as 1.8 point repairs. No point repairs, required for successful rehabilitation of the sewer line, shall be made and paid for unless agreed to and authorized by the Engineer in writing.

The unit price bid per linear foot for this item shall include all of the Contractor's costs of whatsoever nature. The price bid shall include, but not limited to: saw cutting of concrete paving or cutting of asphalt paving; excavation; repair of the sewer pipe or connecting taps; pipe splicing; grouting, etc.; bedding; backfill and compacting the backfill; re-paving of street; transporting and disposing of all debris and excess material; and all other related and necessary materials, labor and equipment required to complete this item in accordance with the Plans and Specifications.

4. SEWAGE BY-PASSING

No quantity measurement will be made for any of the work required to complete this item. Payment will be based upon completion of the work in accordance with the Plans and Specifications.

The price bid shall include, but not limited to: furnishing and setting up all equipment, labor, and materials necessary to pump sanitary sewage in the sewer to by-pass the segments being rehabilitated; energy required for power equipment; temporary installation of by-pass pipes under the pavement of cross streets as may be required for traffic; re-paving of cross streets after removal of temporary by-pass pipes; and all other necessary equipment, work, and materials required to accomplish sewage by-passing until completion of the rehabilitation process in accordance with the Plans and Specifications.

5. CURED- IN-PLACE-PIPE

The measurement for payment of this item will be the actual number of linear feet of sewer line to be installed, measured along the centerline of the pipe from the inside face of manhole to inside face of manhole, from inside face of manhole to given station, from given station to given station, or from center of manhole to center of manhole with deductions made for the internal diameter or dimensions of manhole or structures. Where cured-in-place pipe runs through manhole, payment will be made for the length through the manhole.

The unit price bid per linear foot of this Cured-In-Place-Plastic-Pipe shall include all of the Contractor's costs of whatsoever nature. The price bid shall include, but not limited to: furnishing and setting up all equipment, materials, and labor necessary for the construction process; to furnish water and energy required for the rehabilitation process; to furnish and apply the Cured-In-Place-Pipe Material; curing and trimming; testing;

incidentals referenced in other sections of these Specifications; and all other related and necessary materials, work, and equipment required to complete this item in accordance with the Plans and Specifications.

6. RECONNECT SEWER SERVICE LINES (TAPS)

The measurement for payment of this item will be the actual number of sanitary sewer service taps to be reactivated as determined to be active per the video engineering study.

The unit price bid shall include all of the Contractor's costs of whatsoever nature. The price bid shall include, but not limited to: furnishing and setting up all equipment and labor necessary to locate and reactivate active sanitary services; cutting the Cured-In-Place-Pipe covering the opening of sewer service connections; sealing tight the Cured-In-Place-Pipe to the existing taps, if required; removal and disposal of all debris; and all other necessary materials, work, and equipment required to complete this item in accordance with the Plans and Specifications.

7. POST-INSTALLATION VIDEO INSPECTION

The measurement for payment of this item will be the actual number of linear feet of sewer line to be video studied, measured along the centerline of the pipe from center of manhole to center of manhole. All sections rehabilitated in this project must be included.

The unit price bid per linear foot for the video inspection shall include all of the Contractor's costs of whatsoever nature. The price bid shall include, but not be limited to: furnishing and setting up all equipment and labor necessary to inspect the rehabilitated sewer by closed circuit television; recording to digital video the TV inspections; to show proper installation of CIPP lining; to show proper reinstatement of all active service lines; to supply energy required for all equipment; and all other related and necessary materials, work, and equipment required to complete this item in accordance with the Plans and Specifications.

Provide post-installation video dvd to the Owner.

8. MOBILIZATION

No quantity measurement will be made for any of the work required to complete this item. Payment will be based upon completion of the work in accordance with the Plans and Specifications.

The lump sum price bid shall include all of the Contractor's costs of whatsoever nature. The price bid shall include, but not limited to, transporting all equipment, materials, and labor of whatsoever nature to the various areas of construction as necessary to complete the work in accordance with the Plans and Specifications.

9. TRAFFIC CONTROL

No quantity measurement will be made for any of the work required to complete this item. Payment will be based upon completion of the work in accordance with the Plans and Specifications.

The lump sum price bid shall include all of the Contractor's costs of whatsoever nature. The price bid shall include, but not limited to, transporting all equipment, materials, and labor of whatsoever nature to the various areas of construction as necessary to complete the work in accordance with the Plans and Specifications.

INTENT

It is the intent of this specification to provide for the reconstruction of pipelines and conduits by the installation of a resin-impregnated flexible tube, which is inverted into the original conduit by use of a hydrostatic head or compressed air or pulled into place. The resin is cured by circulating hot water or steam within the tube. The Cured-In-Place-Pipe (CIPP) will be continuous and tight fitting. Light-cured resin by a proven method will also be allowed.

REFERENCED DOCUMENTS

This specification references standards from the American Society for Testing and Materials, such as: ASTM F1216 (Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube), ASTM F1743 (Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)), ASTM D5813 (Cured-in-Place Thermosetting Resin Sewer Pipe), ASTM D790 (Test Methods for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials), and D2990 (Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics) which are made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.

METHODS

All bidders on this project must construct the CIPP with a process that has been approved by Cottonwood Improvement District prior to proposal deadline. All approved methods must meet these specifications. Any proposed deviation from these specifications must be submitted in writing for acceptance at least eight calendar days prior to the proposal deadline. Any and all departures from these specifications must be pointed out and shown on the material submitted.

MATERIALS

Tube - The sewn Tube shall consist of one or more layers of absorbent non-woven felt fabric and meet the requirements of ASTM F1216, Section 5.1 or ASTM F1743, Section 5.2.1 or ASTM D 5813, Sections 5 and 6. The tube shall be constructed to

withstand installation pressures, have sufficient strength to bridge missing pipe, and stretch to fit irregular pipe sections.

The wet out Tube shall have a relatively uniform thickness that when compressed at installation pressures will equal or exceed the calculated minimum design CIPP wall thickness.

The Tube shall be manufactured to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential stretching during installation.

The outside layer of the Tube shall be coated with an impermeable, flexible membrane that will contain the resin and allow the resin impregnation (wet out) procedure to be monitored.
The Tube shall contain no intermediate or encapsulated elastomeric layers. No material shall be included in the Tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be evident.

The wall color of the interior pipe surface of CIPP after installation shall be a relatively light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.

Seams in the Tube shall be stronger than the non-seamed felt material.

The Tube shall be marked for distance at regular intervals along its entire length, not to exceed 5 ft. Such markings shall include the Manufacturers name or identifying symbol. The tubes must be manufactured in the USA.

Resin - Resin - The resin system shall be a corrosion resistant polyester or vinyl ester system including all required catalysts, initiators that when cured within the tube create a composite that satisfies the requirements of ASTM F1216, ASTM D5813 and ASTM F1743, the physical properties herein, and those which are to be utilized in the submitted and approved design of the CIPP for this project. The resin shall produce a CIPP that will comply with the structural and chemical resistance requirements of this specification.

The owner authorizes the use of proven materials that serve to enhance the pipe performance specified herein. Proven materials have passed independent laboratory testing, not excluding long-term (10,000 hour) structural behavior testing, and have been successfully installed to repair failing host pipes in the U. S. for at least 4 years. In addition to the aforementioned, the owner may require that the contractor demonstrate that the enhancements proposed exceed the specifications herein, prior to the installation of the enhanced material systems. This section in no way shall be interpreted as authorization to deviate from the minimum standard practices set forth herein.

GENERAL CORROSION REQUIREMENTS

The finished CIPP shall be fabricated from materials which when cured will be chemically resistant to withstand internal exposure to domestic sewage. The Contractor

shall certify that CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical testing requirements.

STRUCTURAL REQUIREMENTS

The CIPP shall be designed as per ASTM F1216, Appendix X1. The CIPP design shall assume no bonding to the original pipe wall.

The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or the probe or knife blade moves freely between the layers. If separation of the layers occurs during testing of field samples, new samples will be cut from the work. Any re-occurrence may cause rejection of the work.

The cured pipe material (CIPP) shall conform to the structural properties, as listed below:

Minimum CIPP Physical Properties

Test Method		Minimum Resin per ASTM F1216	Enhanced Resin
Modulus of Elasticity	ASTM D-790 (short term)	400,000 psi	400,000 psi
Flexural Stress	ASTM D-790	4,500 psi	4,500 psi

The required structural CIPP wall thickness shall be based as a minimum, on the physical properties in above section and in accordance with the Design Equations in the appendix of ASTM F1216, and the following design parameters:

Design Safety Factor	= 2.0
Retention Factor for Long-Term Flexural Modulus to be used in Design (To be multiplied by short-term modulus to obtain long-term modulus)	= 50%
Ovality	= 2%
Enhancement Factor K	= NA
Ground Water Depth (above invert)	= ½ Soil Depth ft.
Soil Depth (above crown)	= 14 ft.
Soil Modulus	= 700 psi
Soil Density	= 120 pcf
Live Load	= AASHTO H-20
Design Condition (partially or fully deteriorated)	= fully deteriorated

Refer to Table #1 for Dimensional Ratios (DR's) required for pipe sections, based on the pipe condition, depth, ovality, etc. as computed for the conditions shown, using ASTM F 1216 Design Equations.

Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the structural CIPP wall thickness computation.

The Enhancement Factor 'K' to be used in 'Partially Deteriorated' Design conditions shall be assigned a value of 7.

TESTING REQUIREMENTS

CHEMICAL RESISTANCE - The CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical-testing requirements.

HYDRAULIC CAPACITY - Overall, the Hydraulic profile shall be maintained as large as possible. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition. The roughness coefficient of the CIPP shall be verified by third party test data.

CIPP FIELD SAMPLES - When requested by the Owner, the Contractor shall submit test results from previous field installations in the USA of the same resin system and tube materials as proposed for the actual installation. These test results must verify that the CIPP physical properties specified in above have been achieved in previous field applications.

INSTALLATION RESPONSIBILITIES FOR INCIDENTAL ITEMS

MANHOLE ACCESS POINTS - Cottonwood Improvement District will endeavor to locate and designate all manhole access points, and open and make access points available to the work.

CLEANING OF SEWER LINES - The Contractor, when required, shall remove all internal debris out of the sewer line that will interfere with the installation of CIPP. The Owner shall also provide a dumpsite for all debris removed from the sewers during the cleaning operation. Unless stated otherwise, it is assumed this site will be at or near the sewage treatment facility to which the debris would have arrived in absence of the cleaning operation. Any hazardous waste material encountered during this project will be considered as a changed condition.

BYPASSING SEWAGE - The Contractor, when required, shall provide for the flow of sewage around the section or sections of pipe designated for repair. The bypass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a

downstream manhole. An adjacent District system may only be used when District Engineer has determined increased flow will not cause overflow. The pump and bypass lines shall be of adequate capacity and size to handle the flow. The Owner may require a detail of the bypass plan to be submitted. Any damage caused by flooding or sewage backup resulting from inadequate bypass pumping shall be remedied by the Contractor.

INSPECTION OF PIPELINES - Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by close circuit television. The interior of the pipeline shall be carefully inspected to determine the location of any conditions, which may prevent proper installation of CIPP. Adverse conditions it shall be noted for correction. A videotape or dvd and suitable log shall be kept for reference by the Owner.

LINE OBSTRUCTION - It shall be the responsibility of the Contractor to clear the line of obstructions such as solids, roots, exposed gaskets or protruding service connections that will prevent the insertion of CIPP. If pre-installation inspection reveals an obstruction such as a protruding service connection, dropped joint, or a collapse that will prevent the inversion process, and it cannot be removed by conventional sewer cleaning equipment, then 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. The owner may opt to have the spot repair made by a different independent contractor provided the independent contractor can complete the work in a timely manner.

See requirement under "Inspection, Visual Inspection" requiring that District's 8" crawler camera pass readily through all rehabilitated lines. Remove any obstructions that will cause a failure of this test prior to installation of the CIPP.

PUBLIC NOTIFICATION

The Contractor shall make every effort to maintain service usage throughout the duration of the project. In the event that a service lateral will be out of service, the maximum amount of time of no service shall be 12 hours. A public notification program shall be implemented, and shall as a minimum, require the Contractor to 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 unavailable. The Contractor shall also provide the following:

1. Written notice to be delivered to each home or business describing the work, schedule, how it affects them, and a telephone number of the Contractor they can call to discuss the project or any problems, which arise.

2. Personal contact and written notice the day prior to the beginning of work being conducted on the section relative to the residents affected.

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

The contractor shall be responsible for confirming the locations of all branch service connections prior to inversion and curing of the CIPP.

INSTALLATION

CIPP installation shall be in accordance with ASTM F1216, Section 7 or ASTM F1743, Section 8, with the following additional requirements:

RESIN IMPREGNATION - The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. A vacuum impregnation process shall be used. To insure thorough resin saturation throughout the length of the felt tube, the point of vacuum shall be no further than 25 feet from the point of initial resin introduction. After vacuum in the tube is established, a vacuum point shall be no further than 75 feet from the leading edge of the resin. The leading edge of the resin slug shall be as near to perpendicular as possible. A roller system shall be used to uniformly distribute the resin throughout the tube. If the Installer uses an alternate method of resin impregnation, the method must produce the same results. Any alternate resin impregnation method must be proven.

TUBE INSERTION METHOD - The tube shall be inverted into place using fluid pressure in accordance with ASTM F1216, or pulled into place by ASTM F1743.

TEMPERATURE CONTROL - Temperature gauges shall be placed to determine the temperature of the incoming and outgoing fluid from the heat source. Another such gauge shall be placed inside the tube at the invert level at the remote end to determine the temperature at that location during the cure cycle.

SEWER LINE CLEANING AND BYPASSING – Prior to insertion and installation of the Cured-In-Place-Plastic-Pipe, the sewer line shall be cleaned. During the rehabilitation process the sewage shall be by-passed as needed to complete the work. In no case shall the water level in the upstream manhole be allowed to rise above the crown of the pipe. Contractor shall be responsible for any damage caused by sewer overflows occurring during the rehabilitation process.

CALIBRATION HOSE - If a calibration hose is required to be used during the process of the installation of the Cured-In-Place Plastic Pipe, this calibration hose shall be wet and impregnated with sufficient amount of resin prior to inversion

INSURANCE OF EXCESS RESIN - The tube shall be impregnated with sufficient amount of resin to insure that the resin will be observed on the outer surface of the tube when squeezed and insure that the cured CIPP meets the approved minimum design thickness.

REINSTATEMENT OF BRANCH CONNECTIONS

It is the intent of these specifications that branch connection to buildings be reopened without excavation, utilizing a remotely controlled cutting device, monitored by a video

TV camera. The Contractor shall certify he has a minimum of 2 complete working cutters plus spare key components on the site before each inversion. No additional payment will be made for excavations for the purpose of reopening connections. The Contractor shall be responsible for all costs and liability associated with such excavation and restoration work.

Reinstatement of branch connections shall be made by experienced operators only. Cuts shall be circular, brushed smooth and shall be 100% of the service pipe diameter. Cuts not meeting this requirement shall be re-cut or, if necessary, shall be repaired by excavation at no additional cost to the District.

INSPECTION

SAMPLES

CIPP samples shall be prepared for each installation designated by the owner/engineer or approximately 20% of the project's installations. Pipe physical properties will be tested in accordance with ASTM F1216 or ASTM F1743, Section 8, using either method proposed. The flexural properties must meet or exceed the values listed in the "Minimum CIPP Physical Properties" table in this specification, Table 1 of ASTM F1216 or the values submitted to the Owner/engineer by the contractor for this project's CIPP wall design, whichever is greater.

Wall thickness of samples shall be determined as described in paragraph 8.1.6 of ASTM F1743. The minimum wall thickness at any point shall not be less than 90% of the submitted minimum design wall thickness as calculated in the "Minimum CIPP Physical Properties" table in this specification.

LEAKAGE TESTING

Leakage testing of the CIPP shall be accomplished during cure while under a positive head. CIPP products in which the pipe wall is cured while not in direct contact with the pressurizing fluid (e.g., a removable bladder) must be tested by an alternative method approved by the Owner.

FINISH

The finished CIPP shall be continuous over the entire length of an insertion run between two manholes and be free, as commercially practicable, from visual defects such as foreign inclusions, dry spots, pinholes, and delamination.

WRINKLED PIPE

The Contractor will be allowed a maximum wrinkle of .25 (twenty five hundredth) inch before deduction will occur and .5 (five tenth) inch will result in a 20 (twenty) percent deduction for the entire cost of the affected pipe reach, manhole to manhole. The District will reject any wrinkle greater than .5 (five tenth) inch. The Contractor will be required to replace the rejected line at no additional cost to the District

SEALING CIPP AT MANHOLES

If due to broken or misaligned pipe at the manhole wall, CIPP fails to make a tight seal, the Contractor shall apply a seal at that point with a material compatible with the CIPP.

VISUAL INSPECTION

Visual inspection of the CIPP shall be in accordance with ASTM F1216, Section 8.6. The Contractor will provide Cottonwood Improvement District with a color dvd. The video will include both the before and after conditions. The video will also include the location of restored connections measured as a distance from the upstream manhole.

The District's 8" crawler camera must pass readily through all rehabilitated lines. The District will perform this test at its discretion and notify the Contractor of any lines not meeting these criteria.

CIPP EDGE AT MANHOLES

All CIPP edges entering or exiting a manhole shall be ground smooth and shall not catch any rags or wastewater debris. If debris is collecting at CIPP edge, Contractor shall bypass flow and regrind edge of CIPP until desired result is achieved.

PATENTS

The Contractor and the Contractor's supplier shall warrant and save harmless the District and against any and all claims and potential litigation involving patent infringement and copyright violations and any loss thereof.

CLEANUP

Upon acceptance of the installation work and testing, the Contractor shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work.