

**STORMWATER PIPE LINING AND RELATED SERVICES****1. SCOPE OF SERVICES**

- 1.1. The Contractor will have the experience, ability, equipment, and tools to perform the point repair or full reconstruction of storm water lines by the installation of a resin-impregnated flexible felt tube, which is inverted into the existing conduit by use of hydraulic head. Where inversion is not appropriate, a pull and inflate method will be acceptable.
- 1.2. Curing will be accomplished by circulating hot water (or other approved method) within the liner tube to cure the encapsulated resin system.
- 1.3. When cured, the finished pipe will be continuous, watertight, and formed to the original conduit. Cleaning and inspections of conduits, bypass pumping, line obstruction removal, reestablishment of services, pre-installation, video recording, installation of Resin Impregnated Cured-in-Place Pipe (RICIPP) including installation television inspection, post-installation video recording, connections, testing, and final inspections are all part of this work.

**2. CONTRACTOR'S RESPONSIBILITIES**

The Contractor will:

- 2.1. Provide services to the County on an As-Needed Basis.
- 2.2. Designate a project manager that will speak English and have available communication devices with internet access to ensure proper communication and documentation during operations.
- 2.3. Have a minimum of three (3) years' experience with the means and methods utilized in installing RICIPP to include all size pipes of various lengths in the state of Florida.
- 2.4. Be responsible for contacting each home or business in close proximity to the storm sewer to be RICIPP lined. Resident shall be informed of the work to be conducted and the projected length of time for the lining. The contact will be by approved letter or door hanger 48 hours prior to work beginning on the affected section of pipe.
- 2.5. Submit one (1) video copy that shows the conduit prior to lining, the liner being inverted through the pipe in-situ demonstrating that the resin does not drain out of the saturated liner tube and the final inspection of the completed conduit lining.
- 2.6. Submit a sample television inspection after the first liner is installed so that the Contractor and Project Manager can agree on performance and quality of the inspections, which will be met throughout the Contract. Pipes not inspected to the Project Manager's satisfaction will be re-inspected by the Contractor at no additional cost to the County.
- 2.7. Include in the television inspection reports physical locations such as street address

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or street intersection to identify manhole or other locations, which are used to reference where the camera is located.

- 2.8. Submit an invoice to the County's Project Manager within 30 days of project completion.

**3. COUNTY'S RESPONSIBILITIES**

- 3.1. The County reserves the right to award to one or more vendors.
- 3.2. The County will provide a Project Order Form for each project.
- 3.3. The County shall locate and designate all manhole access points for the work, provide right of entry to these points.

**4. ADDITIONAL ITEMS - UPON REQUEST**

Contractor shall submit upon request the following information regarding quality:

- 4.1. Contractor shall submit three copies of manufacturer's technical literature and recommended installation procedure.
- 4.2. A signed and notarized certification from the resin manufacturer (not supplier/distributor) that the polyester resin to be furnished for this project will not mix with storm water, lake water or moisture on inversion/insertion.
- 4.3. A viscosity profile and procedure showing that the resins to be supplied on this project will not absorb/mix with water.
- 4.4. A Contractor's representative will remove a small amount of catalyzed resin from the saturated liner, when requested and in the presence of the County's project manager, prior to inversion. The material will exhibit the characteristic of an elastic gel. A water mix test will be performed on site, catalyzed resin shall be placed in a jar and an equal amount of water added, the jar sealed and shaken vigorously. The material shall not mix or form an emulsion. If the resin material mixes, the saturated liner tube will be rejected and shall be removed from the site. The rejected liner will be removed from the site and disposed of in accordance with federal, state, and local requirements. A pre-liner will be required and the thickness of the entire circumference of the liner will have to meet or exceed the minimum thickness required by the owner.
- 4.5. At the County's request, at no more than 5 times per 10 inversions, a CCTV camera shall be inserted into the pipe to be lined and positioned within 10 feet of the inverting tube in the presence of the County's project manager. The project manager shall view the inversion of the tube from the video monitor in the Contractor's CCTV truck. If resin discharge from the tube is observed, the Contractor will immediately stop the inversion and remove the tube from the pipe. The rejected liner will be removed from the site and disposed of in accordance with Federal, State and Local requirements.

**STORMWATER PIPE LINING AND RELATED SERVICES****5. WARRANTY**

- 5.1. Installation: Provide a full labor and materials warranty for a period of twenty-four (24) months from the date of acceptance by the County.
- 5.2. Liner: Manufacturer's standard warranty.

**6. MATERIALS**

- 6.1. The RICIPP shall be fabricated to a size that when installed will fit the internal circumference of the conduit specified. Allowance shall be made for circumferential / radial stretching during insertion.
- 6.2. The finished RICIPP shall be fabricated from materials which when cured will be chemically resistant to withstand internal exposure to contaminants associated with storm water.
- 6.3. The outside layer of the tube (before inversion) shall be plastic coated with a transparent flexible material that is compatible with the resin system used. The plastic coating shall not be subject to delaminating in the cured pipe.
- 6.4. The tube shall contain no intermediate or encapsulated layers. No materials shall be included in the tubes that are subject to delaminating in the cured pipe.
- 6.5. The wall color of the interior pipe surface of the RICIPP after installation shall be a light reflective color so that a clear detail examination with closed circuit television inspection equipment may be made.
- 6.6. A general purpose, Polyester resin or Epoxy Vinyl Ester and catalyst system shall be furnished that provides cured physical strengths specified herein.
- 6.7. Physical Strength: The cured RICIP shall conform to the minimum structural standards, as listed below.

CURED RICIP	STANDARD	RESULTS
Flexural Stress	ASTM	D-790 4,500 psi
Flexural Modulus of Elasticity	ASTM	D-790 250,000 psi

- 6.8. All pipes shall be considered fully deteriorated.
- 6.9. Hydraulic capacity calculations shall support the CIPP requirement for 100% of the full flow capacity of the original pipe as installed.
- 6.10. The Contractor shall submit liner thickness calculations to the Engineer for review. The RICIPP shall be designed in accordance with the applicable provisions of ASTM F1216 and D2412 for fully deteriorated gravity pipe conditions and shall meet the following

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design conditions:

- 6.10.1.** AASHTO H-20 Live Load with two trucks passing for RICIPP in streets.
- 6.10.2.** A soil modulus of elasticity of 700 psi shall be used. A soil weight 120 pounds per cubic foot and a coefficient of friction of  $K_u' = 0.130r$  shall be used for the installed depths.
- 6.10.3.** The long-term flexural modulus used in the design calculations shall be estimated by multiplying the lowest short-term flexural modulus specified in the ASTM standards by a retention factor of 0.50.
- 6.10.4.** Safety factor of 2.0 shall be used.
- 6.10.5.** Groundwater levels shall be estimated to be at the ground surface.
- 6.10.6.** Service temperature range shall be 40 to 140 degrees F.
- 6.10.7.** Maximum long-term deflection shall be 5 percent.
- 6.11.** The minimum length shall be that deemed necessary to effectively span the footagethat is requiring repair. The Contractor shall verify the length in the field before impregnation.
- 6.12.** The thickness (in millimeters) to be used for the liner shall be the largest thickness as determined by calculations for deflection, bending, buckling and minimum stiffness. The minimum installed liner thickness with the pre-determined resin/felt ratio shall be as follows:
- 6.13.** Liner Thickness Chart:

<u><b>LINER THICKNESS CHART</b></u>											
GROUND COVER IN											
FEET											
Pipe Diameter in Inches	1	Q	§	<u>10</u>	<u>12</u>	<u>14</u>	<u>16</u>	<u>18</u>	<u>20</u>	<u>22</u>	<u>24</u>
8	6	6	6	6	6	6	6	6	6	7.5	7.5
10	6	6	6	6	6	7.5	7.5	7.5	7.5	9	9
12	6	6	6	7.5	7.5	9	9	9	9	10.5	10.5
14	7.5	7.5	7.5	7.5	9	9	10.5	10.5	10.5	12	12
16	9	9	9	9	10.5	10.5	12	12	12	13.5	13.5
18	9	9	9	10.5	10.5	12	12	13.5	13.5	15	15
21	12	12	12	12	13.5	13.5	15	15	16.5	16.5	18
24	12	12	12	13.5	15	16.5	16.5	18	18	19.5	19.5
27	12.5	15	15	15	16.5	18	19.5	19.5	21	21	22.5
30	13.5	15	15	16.5	18	19.5	21	22.5	22.5	24	27
36	16.5	18	18	19.5	21	24	24	27	27	28.5	30
42	19.5	19.5	21	22.5	27	27	28.5	30	33	33	34

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48	22.5	22.5	24	27	28.5	30	33	34	36	38	39
54	27	27	27	30	33	34	36.5	39	40.5	42	44
60	28.5	28.5	30	33	35.5	38	41	43	44.5	46.5	48.5
66	30	33	33	35.5	39	42	45	47	50	52	54
72	33	33.5	36	39	42.5	45.5	48.5	51	54	56	58

**6.14.** The CIPP shall be designed per ASTM F-1216, with the following additional requirements.

**6.14.1.** The design will assume no bonding to the original pipe wall.

**6.14.2.** External hydraulic design based on acceptable third-party testing and verification of the enhancement factor, K, shall be submitted for review.

**6.14.3.** The bond between the RICIPP layers shall be strong and uniform. All layers, after cure, must form one homogeneous structural pipe wall with no part of the tube left unsaturated.

**6.14.4.** The cured pipe material (RICIPP) shall conform to the following structural properties:

PROPERTY RESULTS	TEST METHOD	MINIMUM TEST RESULT
Modulus of Elasticity	ASTM D-790	250,000 psi
Flexural Strength	ASTM D-790	4,500 psi

**6.14.5.** Design parameters will be in accordance with ASTM F-1216-16. Design parameters shall be for a fully deteriorated pipe with a long-term flexural modulus of 50% of the short-term modulus and the design safety factor of two (2) remaining unchanged.

**6.14.6.** If required by the County, RICIPP field tube samples shall be cured in the hot water contained in the inversion column contained within steel plates and Mylar sheeting. These sample pieces shall be at least 20 inches in length with enough width for a test laboratory to run a minimum of three samples from each specimen. A testing laboratory acceptable to the owner shall produce the tests, noting thickness and enough strength as specified without a laboratory post cure. Post cure shall be accomplished in the initial in ground curing cycle.

**7. PREPARTATION**

**7.1.** Safety - The Contractor shall carry out his operations in strict accordance with all OSHA Regulations and manufacturer's safety requirements. Particular attention is drawn to those safety requirements involving entering confined spaces. In addition, the Contractor shall be responsible for implementing traffic control procedures as needed in conformance with FDOT/County standards. Contractor shall submit their MOT plan

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to the county for review and approval prior to work.

**7.2. Prior to Liner Installation:**

**7.2.1.** Cleaning of Storm Water System - It shall be the responsibility of the Contractor to perform cleaning of internal debris / sediments from the storm water lines unless the Contractor is directed otherwise. The Contractor shall be responsible for the disposal of any removed debris. Any hazardous waste material encountered during this contract will be considered as a changed condition. The county does not have a water supply; Therefore, the contractor shall secure and pay for any water needed to complete work as outlined in this contract.

**7.2.2.** Television Inspection - The Contractor shall inspect the interior of the pipeline prior to lining by closed circuit television and determine the pre-lining condition of the pipe. Videotape and a suitable Log of inspection shall be made available and given to the County.

**8. INSTALLATION**

**8.1.** The method of installation of the RICIPP shall be in accordance with design criteria supplied by the manufacturer and approved by the County Engineer or designee.

**8.2.** The finished RICIPP shall be continuous over the entire length of the repair and be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pin holes and delaminating.

**8.3.** The Contractor, when required, shall provide for the flow of storm water around or through the section or sections of pipe designated for RICIPP rehabilitation. Plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system shall make a bypass. The primary pump, standby pump and the piping shall be of adequate capacity and size to handle the maximum flow experienced in the line. The Contractor shall be responsible for continuity of the storm water system during the execution of the work of this contract. In the event that storm water backup occurs, the Contractor shall be responsible for cleanup, repair, and property damage costs and claims.

**8.4.** Resin Impregnation - The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube assuring no resin loss through cracks and irregularities in the original pipe wall with viscosity control. A vacuum impregnation process shall be used. A roller system shall be used to uniformly distribute the resin throughout the tube.

**8.5.** Thermocouples shall be placed between the RICIPP tube and the existing pipe wall at the inversion and discharge locations to monitor the liner temperature. Readings shall be entered on logs that are submitted to the County at the end of each lining.

**8.6.** Reforming - After insertion is completed, the Contractor shall supply a suitable

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heat source. The equipment shall be capable of delivering hot fluids throughout the section to uniformly raise the temperature of the liner mass to the temperature required to cure the liner. The heat source shall be fitted with monitors to gauge the temperature and pressure of the fluid injected.

- 8.7. Cool down may be accomplished by the introduction of cool water and air or other approved method.
- 8.8. During the warranty period, any defects that will affect the integrity or strength of the liner shall be repaired at the Contractor's expense in a manner mutually agreed by the County and the Contractor.
- 8.9. The discharge of water from the installation of Liner must not be allowed into any surface area waters.

**9. SEALING RICIPP AT MANHOLES**

- 9.1. Leakage testing of the pipe shall be accomplished during the cure while under positive head.
- 9.2. If the RICIPP fails to make a leak tight seal, the Contractor shall apply a sealing material at that point. The seal shall be of a resin mixture compatible with the RICIPP.
- 9.3. There shall be no visible leaks in the completed system. During the warranty period, any defects that will affect the integrity or strength of the RICIPP or any visible leaks shall be repaired at the Contractor's expense.

**10. INSPECTION**

- 10.1. The Contractor shall inspect all piping to assure that the RICIPP is free from defects in materials and workmanship.
- 10.2. Video shall be provided to the County showing the completed work in the format of USB flash drive or DVD. The video shall include the pre-installation footage, the tube inversion/installation footage (when required) and the post-installation footage. NO INVOICE WILL BE INITIATED FOR PAYMENT WITHOUT ACCOMPANYING VIDEO FOOTAGE.
- 10.3. RICIPP samples shall meet or exceed the specified structural properties of:

PROPERTY RESULTS	TEST METHOD	MINIMUM TEST RESULT
Modulus of Elasticity	ASTM 0-790	250,000 psi
Flexural Strength	ASTM 0-790	4,500 psi

- 10.4. Visual inspection of the CIPP shall be in accordance with ASTM F-1216, section 8.6.
- 10.5. At least one (1) Miscibility Test will be performed on-site for each five installations.

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- 10.6.** No payment will be made for rejected liner tubes or for liner tubes not meeting this specification requirements including testing.

**11. DISPOSAL OF DEBRIS**

- 11.1.** Under no circumstances shall debris, sediment, untreated storm water be dumped onto the ground surface, streets or into ditches, catch basins or storm drains.
- 11.2.** The Contractor shall remove all solids or semi-solids resulting from the operations from the site. Trucks hauling solids or semi-solids from the site shall be watertight so that no leakage or spillage will occur.
- 11.3.** Disposal shall be at a suitable site selected by the Contractor and approved by the County.

**12. PRICING – PROJECT COMPLETION**

- 12.1.** All pricing must include pre- and post-video inspection of storm water lines and all cleaning necessary to be done before inspection and installation of the RICIPP liner. Prices also to include any or all de-watering and plugging and pumping that might become necessary in the performance of job.
- 12.2.** Installation of RICIPP must be done in a timely manner. Work must be initiated, executed, and completed in no more than 90 days after issuance of Notice to Proceed to the Contractor, unless extended by the County.

**13. CHEMICAL THICKENED SYSTEM MISCIBILITY GUIDELINES**

The purpose is to define properties that the resin / resin-impregnated flexible tube must have to perform effectively and consistently in all field conditions.

All resin/resin-impregnated flexible tube materials used must have the following properties:

- 13.1.** Must react/ perform in the presence of water.
- 13.2.** Must withstand submergence in water without degradation (pre-cure and post-cure).
- 13.3.** Must prevent the passage of water through the storm pipe joint (infiltration).
- 13.4.** Must stay at a constant viscosity during reaction period.
- 13.5.** Must stay in the confines of the host pipe being rehabilitated.
- 13.6.** Must not produce slugs that require excavation.
- 13.7.** Residual must not impede on downstream lines or water tables.

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