ADDENDUM NO. 3
TO
PROJECT MANUAL AND CONTRACT DRAWINGS
FOR
ORANGE WATER AND SEWER AUTHORITY
GRAVITY SEWER REHABILITATION (GSR) PROGRAM, GROUP 1 PACKAGE
(MINI BASIN 23)

Issued: May 19, 2026

To: Official Plan Holders

The following revisions, additions, and clarifications are hereby made part of the Contract Documents for the above-referenced project and shall be taken into account in the preparation of all Bids and the execution of all Work. All items in conflict with the Addenda are hereby deleted. This addendum is made part of the Contract Documents and shall be noted on the proposal.

I. PROJECT MANUAL

Ad-3-I-1. REPLACE Section 33 01 37 with the attached.

II. CONTRACT DRAWINGS

Ad-3-II-1. None.

III. QUESTIONS AND ANSWERS

Ad-3-III-1.	Question:	We respectfully request that Refratta's 100% pure-fused calcium aluminate coating be approved as an equal under that manhole rehabilitation specifications.
	Answer:	As of the date of this addendum, the information submitted for Refratta's aluminate coating was not sufficient to approve or deny Refratta's product as an equal under the manhole rehabilitation specifications.
Ad-3-III-2.	Question:	We would like to request approval to substitute the specified chimney seal product with Cemtec FD Standard for this project.
	Answer:	The only manhole chimney seal product that OWASA has approved for this project is Flex Seal Utility Sealant, by Sealing Systems, Inc. Cemtec FD Standard is not approved for use as a substitute.
Ad-3-III-3.	Question:	On map page C-14 key notes part 1 the note states 6'-point repair 98' to 114' downstream from manhole 2775 there is no MH 2775 on the plans. Could you please verify where this manhole and or repair is to be observed.

Answer: MH2775 and the repair in question is on C-14 as shown in the screen capture below. No drawing revisions are needed.



Ad-3-III-4. Question: Please confirm air testing will not be required for CIPP installation and visual inspection will suffice.

Answer: Sampling / Testing / CCTV post-construction inspection only for CIPP.

Ad-3-III-5. Question: Will Hydrotite end seals be a sufficient product for CIPP?

Answer: No. The project specification Section 33 01 37 has been modified to remove Hydrotite as an acceptable product.

Ad-3-III-6. Question: Will steam curing of CIPP be acceptable? If only acceptable with permission from an OWASA Engineer, what will determine if steam cure can be used?

Answer: Steam, Water and UV are all still acceptable curing methods per the project specifications.

Ad-3-III-7. Question: Please confirm testing of CIPP will be paid for by the owner.

Answer: Specification Section 33 01 37 3.7 A.4.a.1 confirms that required sampling and testing on installed CIPP liner shall be paid for by OWASA.

Ad-3-III-8. Question: For CIPP test plate samples, is it required that the contractor test each installed liner or industry standard 20% of installed liners?

Answer: Specification Section 33 01 37 3.7 A calls for a sample once every 1,000 linear feet for the first 5,000 linear feet of CIPP liner installed. This roughly equates to the mentioned standard 20% of installed liner.

Ad-3-III-9. Question: CIPP Spec 2.4.B calls for E' = 400 psi and soil unit weight = 100 pcf for CIPP design. Typical design assumptions for similar work are E' = 700–1,500 psi and soil unit weight = 120–130 pcf.

		Please confirm that the listed values are intentional and shall be used for bid/design purposes or provide revised design parameters.
	Answer:	The values listed in the project specification shall be used for bid purposes.
Ad-3-III-10.	Question:	Please confirm the required CIPP end seal configuration, as the specification contains conflicting information between the performance description and the listed acceptable products. Section A requires a "360 degree hydrophilic rubber gasket, three inch wide cylinder" at each pipe end, which describes a molded cylindrical end seal system, while Section B lists LMK Enterprises, Perma Liner, Hydrotite, or equal, and Hydrotite is a hydrophilic strip material that does not match the three inch wide cylindrical gasket description. Which requirement governs for bidding and installation?
	Answer:	The project specification Section 33 01 37 has been modified to remove Hydrotite as an acceptable product.
Ad-3-III-11.	Question:	Section 3.4 requires us to stop all infiltration runners and gushers using chemical hydrophilic grout, but the bid schedule does not include a chemical grouting pay item and the quantity of infiltration cannot be determined from the bid documents; can the Owner add a dedicated chemical grout bid item?
	Answer:	Infiltration codes potentially requiring hydrophilic grout were not encountered during the design phase of this project, therefore a chemical grouting pay item was not included. However, as stated in specification Section 33 01 37, stopping infiltration as needed should be built into the unit price for CIPPL.
Ad-3-III-12.	Question:	Will the Owner provide a disposal site for pipe cleaning debris at no cost to the Contractor?
	Answer:	No, it shall be the contractor's responsibility for construction debris disposal.
Ad-3-III-13.	Question:	Can the contractor utilize the hydrants onsite and water for the project at no cost to the contractor?
	Answer:	Yes, OWASA does permit utilization of their hydrant assemblies at no charge for the water usage. Note that the contractor will be required to utilize an OWASA backflow meter assembly.
Ad-3-III-14.	Question:	Will the Owner/Engineer please provide the budget for this project?
	Answer:	The answer provided in item Ad-2-III-1. stated that the Engineer's Opinion of Probable Construction Cost for the base bid work is $2.1M.
Ad-3-III-15.	Question:	Will the Owner/Engineer please provide any previous itemized bid tabulations for projects of similar scope?
	Answer:	No, OWASA does not have a project of similar scope for which to provide bid tabulations.
Ad-3-III-16.	Question:	Will the Owner/Engineer please provide the anticipated NTP date for this project?
	Answer:	OWASA will initiate a NTP once the contract between the contractor and OWASA is executed. A reasonable estimation is to expect NTP in August or September 2026.

Ad-3-III-17.	Question:	Will the Owner/Engineer provide copies of existing CCTV files for pipe segments proposed for rehabilitation?
	Answer:	OWASA will provide copies of existing CCTV files for pipe segments requiring repairs and/or replacement to the selected contractor.
Ad-3-III-18.	Question:	Can the Owner confirm any permits required and costs of them that the contractor will need to obtain for this project?
	Answer:	It is the contractor's responsibility to obtain all required permits for the project. Permit fees shall be paid through the permit allowance. A ROW permit from the Town of Chapel Hill is expected.
Ad-3-III-19.	Question:	Will the Owner provide an overnight parking site for equipment at no cost to the contractor?
	Answer:	No.
Ad-3-III-20.	Question:	Please confirm the DBE percentage goals for this project.
	Answer:	10%
Ad-3-III-21.	Question:	Will the Owner kindly consider a one week bid due date extension to allow additional time for subcontractors and DBE firms to participate?
	Answer:	No.
Ad-3-III-22.	Question:	To avoid confusion and potential issues after award, can the Owner/Engineer please release a consolidated, fully updated drawing set?
	Answer:	After award, Issued for Construction documents which fully update the drawings and specifications will be issued.

IV. CLARIFICATIONS

Ad-3-IV-1. None.

Respectfully submitted,

HDR Engineering, Inc. of the Carolinas



SECTION 33 01 37

CURED-IN-PLACE PIPE (CIPP) REHABILITATION (SANITARY SEWER)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Installation of cured-in-place pipe (CIPP) liner in existing sewers, and CIPP end and connection sealing, including all labor, materials, and equipment necessary to complete the work where indicated on Drawings.

B. Related Specification sections include but are not necessarily limited to:

1. Division 00
2. Division 01
3. Section 33 01 16
4. Section 33 01 32
5. Section 33 01 33
6. Section 33 05 16
7. Section 33 05 31

C. Perform CIPP installation prior to manhole lining work. Open lined-through manholes prior to manhole lining work.

D. Consider incidental work necessary for installation of CIPP to be part of CIPP work (e.g., removing and replacing manhole cones, risers, frame and cover, and concrete collars). Refer to Section 33 05 16 for manhole requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. HS20 – Vehicle Loading Standard.
   b. E80 – Vehicle Loading Standard.
2. ASTM International (ASTM):
   a. D543 – Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
   b. D638 – Standard Test Method for Tensile Properties of Plastics.
   c. D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
   d. D792 - Standard Test Methods for Density and Specific Gravity of Plastics by displacement.
   e. D2990 – Test Method for Tensile, Compressive and Flexural Creep and Creep-Rupture of Plastics.
   f. D5813 – Standard Specification for Cured-in-Place Thermosetting Resin Sewer Pipe.
   g. F1216 – Rehabilitation of Existing Pipelines and Conduits by Inversion and Curing of a Resin Impregnated Tube.
   h. F1743 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-In-Place Installation of Cured-In-Place Thermosetting Resin Pipe.
   i. F2019 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP).
3. National Association of Sewer Service Companies (NASSCO):

a. Pipeline Assessment and Certification Program (PACP) Reference Manual, current edition, including addenda.

B. Where reference is made to one of the above standards, the latest revision/update in effect at time of bid opening shall apply.

1.3 CONTRACTOR SUBMITTALS

A. See Section 01 33 00.

B. Provide submittals in three-ring binders and/or electronic format.

C. Manufacturer qualifications (submit with Bid):

1. Document all qualifications with verifiable references.
2. CIPP felt and resin manufacturer(s):
   a. Minimum 500,000 feet of proposed liner successfully supplied.
   b. Minimum one million (1,000,000) pounds of resin successfully supplied.

D. Installer qualifications (submit with Bid):

1. Document all qualifications with verifiable references.
2. Contractor or installation subcontractor:
   a. Experience in CIPP lining sewers of similar diameter and length as the proposed work.
   b. Certification showing Contractor is currently licensed by appropriate licensor to perform CIPP installation.
3. Certification letter:
   a. Submit letter certifying that the CIPP will conform to the project requirements outlined in scope of work and delineated in these specifications. Include:
      1) Number of years of Contractor's experience in installing CIPP.
      2) CIPP felt tubes and resin materials to be used:
         a) Product names and information.
         b) Supplier name and contact information.
4. Submit recent projects list:
   a. At least five (5) projects.
   b. Within the last five (5) years.
   c. In United States.
   d. For municipal owners.
   e. Minimum 100,000 total feet of CIPP liner.
   f. Sewer pipes of similar size, length, and configuration as the proposed work.
   g. Include for each project:
      1) Diameter of pipe.
      2) Length of installation.
      3) Name and telephone number of pipe owner.
         a) To be called to verify satisfactory performance.
      4) Date of installation.
      5) Name of CIPP lining manufacturer and supplier.

E. Lead personnel qualifications (submit after Bid):

1. Document all qualifications with verifiable references.
2. Each scheduled CIPP superintendent for the project:
   a. Submit name(s) and qualifications:
      1) Minimum three (3) years CIPP lining supervisory field experience.
      2) Minimum three (3) successfully completed similar projects.

3) Minimum total of 50,000 feet CIPP liner.

b. Superintendents named shall be those assigned to the project.

c. Have at least one qualified CIPP superintendent on the job at all times during construction activities.

3. Each lead personnel including superintendent, foreman, and lead crew personnel:
   a. Minimum three (3) years total experience with proposed CIPP technology.
   b. Demonstrated competency and experience to perform the scope of work.
4. Lateral cutter:
   a. At least six (6) months experience reinstating connection between sewer main and lateral lining.

F. Shop drawings:

1. For all component materials and composite materials:
   a. Demonstrate compliance with these specifications.
   b. Details of short and long-term properties (providing all supporting test data).
   c. Recommendations for material storage and temperature control.
   d. Manufacturers' shipping, storage, and handling recommendations for all components of the CIPP System.
   e. Identify:
      1) Materials of construction (including resins, catalysts, felt, etc.).
      2) Felt manufacturer.
      3) Location of felt manufacturing facility.
      4) Location of the wet-out facility.
      5) Flexible membrane (coating) material.
         a) Including recommended repair/patching procedure, if applicable.
   f. CIPP handling and installation procedures, including:
      1) Wet out.
      2) Insertion.
      3) Heating.
      4) Cool down.
      5) Curing.
      6) Trimming and finishing.
      7) QA/QC (quality assurance/quality control) procedures.
2. Proposed CIPP thickness:
   a. Submit required minimum thickness for the CIPP to be installed in each pipe reach.
      1) Submit prior to ordering any material.
      2) Perform calculations:
         a) Separately for each section to be lined, using exact depths and field conditions for that section.
         b) Based on:
            (1) Field-verification of pipe sizes.
            (2) Internal inspection data.
            (3) CIPP manufacturer's specifications.
            (4) ASTM F1216 for fully deteriorated pipe.
         c) To be signed and sealed by a Professional Engineer licensed in the state where the project is located.
3. CIPP end and connection sealing:
   a. Materials and methods to be used to reinstate connecting sewers.

4. Certified test reports:
    a. Submit prior to each shipment of CIPP lining.
    b. Stating that CIPP lining for this Contract was manufactured and tested in accordance with all ASTM standards specified and referenced herein.
5. CIPP lining schedules:
    a. Include field-verified lengths and diameters of all required CIPP lining and appurtenances.
    b. To prove that Contractor has physically measured every pipe to be rehabilitated.
    c. On plans, include map(s) that show insertion points for all CIPP installations.
6. Installation and curing procedures:
    a. For each diameter and thickness of CIPP liner to be installed:
        1) Detailed installation procedures.
        2) Manufacturer's recommended cure method.
    b. Include:
        1) CIPP lining production schedule.
        2) Acceptable inversion heads and pressures.
        3) Inversion or winching procedures.
        4) Curing and cool-down procedures.
            a) Detail the following:
                (1) Curing rate of temperature increases and cool down.
                (2) Method of application.
                (3) Times for each stage of the process.
7. Repair/Replacement procedures:
    a. Provide specific repair or replacement procedures for potential defects that may occur in installed CIPP.
        1) As recommended by CIPP system manufacturer.
        2) For review by OWASA's Engineer.
    b. Include the following:
        1) Define defects in installed CIPP that will not affect the operation and long-term life of the product.
        2) Define repairable defects that may occur in the installed CIPP:
            a) Define based on manufacturer's recommendations.
            b) Include a detailed step-by-step repair procedure, resulting in a finished product meeting the requirements of these contract specifications.
            c) Repairable defects may include:
                (1) Blisters.
                (2) Wrinkles.
                (3) Fins.
                (4) Pinholes.
                (5) Over- or under-cut lateral connections.
                (6) Any voids found between liner and host pipe.
        3) Define un-repairable defects that may occur in the installed CIPP:
            a) Define based on manufacturer's recommendations.
            b) Include a recommended procedure for removing and replacing the CIPP.
            c) Un-repairable defects may include:
                (1) Thickness below required minimum thickness.
                (2) Structural strength below required limits.

(3) Lifts.
(4) Shrinkage.
(5) Folds.
(6) Bulges.
(7) Delamination.

8. Odor control:
   a. Provide written description and/or plan to ensure that project specific odors such as styrene will be minimized at project site and surrounding area.
9. Information on any materials Contractor is proposing to use for sealing at manholes or for other uses, including:
   a. Grouts.
   b. Epoxy.
   c. Cements.

G. Other submittals:

1. Wet-out forms/reports:
   a. Submit for each CIPP segment.
   b. Provide detailed information including:
      1) Date and time of wet-out.
      2) Wet-out facility address.
      3) Volumes and/or weights of resin.
      4) Length and diameter of CIPP liner (both wet-tube and dry-tube).
      5) Roller gap settings.
      6) Start times.
      7) Finish times.
      8) Resin used:
         a) Product name.
         b) Batch/shipment number.
         c) Quantity.
      9) Gel times.
      10) Resin injection locations.
      11) Thickness of CIPP liner (dry and wet).
      12) Catalyst name and quantity used.
      13) Any other pertinent data documenting the wet-out for each section of CIPP liner manufactured.
   c. Submit wet-out forms:
      1) Prior to CIPP liner installation.
      2) Without delay or claim to any confidentiality.
      3) To OWASA's Engineer on day of delivery.
2. CIPP liner reports:
   a. Submit for all sewer segments.
   b. CIPP liner field curing reports documenting liner installation for all sewer segments.
   c. Document all details of liner installation, including:
      1) Manhole numbers.
      2) Street names/sewer location.
      3) Project number.
      4) Date and time.

5) Ambient temperature.
6) Heads used during inversion process.
7) Pressures and/or heads used during curing.
a) Minimum inversion pressure.
b) Heads:
(1) Ideal head.
(2) Maximum hot head.
(3) Maximum cold head.
c) Include cool down if applicable.
8) Curing temperature.
9) Curing time.
10) Rate of cool down.
11) CIPP liner thickness.

d. Submit sample report to OWASA's Engineer for approval:
1) Prior to installing any CIPP lining.
2) Prior to requesting payment.
3) Without delay or claim to any confidentiality.

3. UV-cured liner records:
a. Curing and light train speed (feet per minute).
b. Light source:
1) Number of lamps.
2) Intensity.
3) Wattage.
c. Inner air pressure (psi)
d. Exothermic (curing) temperatures per unit time over the length of the liner.
e. Temperature of internal liner surface.
f. Include liner manufacturer recommended citations.

4. Temperature monitoring system reports:
a. Complete certified copies of the report(s) output(s) of the continuous temperature monitoring systems used to control curing.
b. Printed and in electronic format.
1) Also provide OWASA's Engineer access to website where secure reports can be obtained.
c. Submit reports:
1) Prior to requesting payment.
2) Without delay or claim to any confidentiality.

5. CCTV data:
a. Closed-circuit television (CCTV) inspection data as further defined herein.
1) Pre-rehabilitation.
2) Post-rehabilitation.
a) Submit post-rehabilitation within one week after CIPP segment is installed.

H. Safety information:
1. Safety Data Sheets (SDS) for all proposed products and materials.
2. Safety Plan:
a. Identify all competent persons.

b. Describe daily safety program for job site.
c. Describe all emergency procedures to be implemented in event of a safety incident.
d. All work shall be conducted in accordance with Contractor's submitted Safety Plan.

I. Sampling information:

1. Detailed procedures:
   a. Sample collection.
   b. Laboratory testing.
   c. Quality control.
2. Include:
   a. Schedule.
   b. Shipping and storage requirements.

J. Samples:

1. Samples of installed liner(s).
2. For testing to be performed by an ASTM-certified independent testing laboratory (as described further herein).

K. Sample test reports:

1. Test report of CIPP sample(s).

L. Daily production reports:

1. Submit to OWASA's field representative at end of each workday.

M. Service laterals list:

1. List all service laterals that were abandoned or reconnected as part of the work as further defined herein. Include for each lateral:
   a. Distance.
   b. Clock position.

N. Repair/Replacement records:

1. A list of all CIPP defect repairs or replacements performed by Contractor.
2. Include:
   a. Identification of segment.
   b. Location of repair.
   c. Type of repair.

O. Warranty:

1. Contractor's written 2-year warranty, as defined below.

1.4 WARRANTY

A. Contractor and manufacturer shall warrant installed CIPP lining for a period of two (2) years from Substantial Completion date.

B. OWASA may conduct an independent CCTV inspection of CIPP lining work, at OWASA's expense, prior to completion of warranty period.

C. During warranty period, serious defects discovered in CIPP lining, as determined by OWASA's Engineer and which may materially affect the integrity, strength, function, flow capacity, and/or operation of pipe, shall be removed and repaired/replaced:

1. By Contractor.
2. As recommended by manufacturer.
3. At no cost to OWASA.

4. In a manner that is satisfactory to OWASA's Engineer.

D. Defects replaced during warranty period shall be fully warranted by Contractor and manufacturer for a period of two years from date the defect was repaired.

E. Defects include the following:

1. Leakage through liner, or between liner and pipe.
2. Reduction of liner thickness of more than ten percent (10%) of the thickness designed and/or required.
    a. Final liner thickness shall be delivered by Contractor based on installed product physical properties and as specified in Contract requirements.
3. Any defects in CIPP lining that compromise the integrity, strength, or longevity of installed product; or compromise the flow capacity of the pipe; including:
    a. Separation of liner from host pipe where an annular space is clearly noticed.
    b. Shrinkages (longitudinal and/or circumferential).
    c. Dry spots where liner tube has no resin saturation.
    d. Delamination of liner.
    e. Blisters that may affect the longevity of CIPP liner.
    f. Bulges due to external loading.
    g. Reverse curvatures.
    h. Splits.
    i. Cracks.
    j. Lifts.
    k. Cured lifts.
    l. Breaks.
    m. Folds.
    n. Flats.
    o. Pinholes.
    p. Crazing.
    q. Major wrinkles (as defined further herein).
4. Circumferential defects (wrinkle, fin, bulge, etc.) located in the flow stream (i.e., between 4 o'clock and 8 o'clock positions) and exceeding maximum allowable height:
    a. Whichever is smaller:
        1) Three percent (3%) of host pipe diameter.
        2) 1/2-inch.
5. Longitudinal wrinkles or fins exceeding maximum allowable height:
    a. Whichever is smaller:
        1) Five percent (5%) of host pipe diameter.
        2) 1-inch.
6. Structural strength below the required limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. CIPP:
    a. Inliner Technologies (Inliner).
    b. Insituform Technologies, Inc. (Insituform).

c. CIPP Corp.
d. National Enviro Tech Group (National Liner).
e. JWM Environmental (Premier Pipe CIPP Liners).
f. Daystar Composites (Diamond Lining Systems).
g. Saertex.
h. Or equal.

2. CIPP end seals:
a. LMK Enterprises
b. Perma-Liner.
c. Or equal.

B. Submit request for substitution in accordance with Specification Section 01 25 00.

2.2 GENERAL

A. Contractor is responsible for control of all material and process variables to provide a finished CIPP possessing the minimum properties specified in ASTM F1216 and required herein.

B. Outside of each liner tube shall be labeled by liner manufacturer with:

1. Liner manufacturer location.
2. Project name.
3. Liner thickness.
4. Liner diameter.
5. Liner length.
6. Location where liner is to be installed.

2.3 MATERIAL PROPERTIES

A. Fabric Tubing:

1. Free from:
a. Tears.
b. Holes.
c. Cuts.
d. Foreign materials.
e. Other surface defects.

2. Designed for use in gravity sanitary sewers.
a. In strict conformance with all applicable sections of:
1) ASTM D5813.
2) ASTM F1216.
3) ASTM F1743.
4) ASTM F2019.
b. Felt content:
1) Determined by Contractor.
2) Not to exceed 15% of total impregnated liner volume.
c. Capable of:
1) Absorbing and carrying resins.
2) Withstanding installation pressures and curing temperatures.
3) Stretching to fit irregular pipe sections.

3. CIPP liner tube:
a. Single or multiple layer construction.
1) No layer less than 1.5 mm thick unless tube is made of fiberglass.

b. Wet-out fabric tube:
    1) Uniform thickness and void space for resin distribution.
    2) Predictable finished thickness:
        a) When compressed at installation pressures.
        b) Meet or exceed design thickness after cure.
c. Fabricated size:
    1) To tightly fit internal circumference and length of original sewer pipe when installed.
d. Distance markings:
    1) On exterior of manufactured tube.
    2) At regular intervals along length of tube.
        a) Not to exceed 5 feet.
    3) To be used as a gauge to measure elongation during insertion.
        a) Maximum overall elongation of each reach: 5 %.
            (1) Reject and replace liner tubes exceeding this value.
e. Make allowance for:
    1) Circumferential stretching during installation.
    2) Resin shrinkage during curing and aging.
f. Compatible with resin system used.
g. The outside layer of tube:
    1) Coated with an impermeable membrane that contains the resin.
h. Wall color of interior pipe surface:
    1) A light color.

B. Resin system:
1. Compatible with CIPP system used.
2. Designed for use in gravity sewers.
3. Corrosion-resistant polyester, vinyl ester, or epoxy and catalyst system.
4. Manufactured specifically for sewer rehabilitation.
5. Meets the requirements of:
    a. ASTM F1216,
    b. ASTM F1743, or
    c. ASTM F2019.
    d. When properly cured within the tube composite.
6. Compatible with CIPP system that provides cured physical strengths and properties specified herein.
7. Tinted for visibility:
    a. Suitable for internal inspection.
    b. Provide positive indication of adequate liner wet-out.
8. Quantity of resin used for tube impregnation:
    a. Sufficient to fill volume of air voids in tube.
    b. With additional allowances for:
        1) Polymerization shrinkage.
        2) Loss of resin through cracks and irregularities in original pipe wall.
9. To maximize resin impregnation throughout tube, use:
    a. Serial vacuum impregnation, or
    b. Serial pressure impregnation, or
    c. Equal.

2.4 DESIGN CRITERIA

A. Design liner per ASTM F1216.

1. Use long-term (time-corrected) values for all material properties in design calculations.

B. Assume the following parameters for liner design for bid purposes:

1. Modulus of soil reaction: E' = 400 psi.
2. Groundwater depth = Ground surface.
3. Unit weight of soil: 100 pcf.
4. Live load:
   a. AASHTO HS20 vehicle loading for street loading.
   b. AASHTO E80 vehicles loading for railroad loading.
5. Design CIPP for fully deteriorated conditions.
6. Safety factor: 2.0.
7. Ovality factor: 2 %.

2.5 CURED CIPP PROPERTIES

A. Finished CIPP shall meet or exceed the following structural standards:

1. Flexural strength:
   a. 4,500 psi per ASTM D790 for felt CIPP.
   b. 6,500 psi per ASTM D790 for GRP CIPP.
2. Flexural modulus (initial):
   a. 250,000 psi per ASTM D790 for felt CIPP.
   b. 725,000 psi per ASTM D790 for GRP CIPP.

2.6 WALL THICKNESS

A. Nominal CIPP thickness:

1. At least the calculated design thickness per ASTM F1216.
   a. Where fabric layers overlap, thickness may exceed this value.

B. Void locations in existing pipe to be lined:

1. Increase nominal wall thickness to provide the minimum design thickness.
   a. Take into consideration stretch and expansion of liner into void area.
2. Determine void locations accurately during video inspection.

C. Gap thickness of wetting out equipment:

1. Sized to allow 5 % to 10 % excess resin to pass during impregnation.
2. Unless otherwise specified.

2.7 DIMENSIONS OF CIPP

A. Felt tube length and circumference:

1. Make allowances for:
   a. Stretch during installation.
   b. Shrinkage during curing and aging.
2. Minimum length:
   a. That which continuously spans distance from center of inlet manhole to center of outlet manhole.
3. Verify lengths in field before liner tube is cut and impregnated.

B. Individual installation runs may include one or more manhole-to-manhole sections as authorized by OWASA's Engineer.

C. Take responsibility to:

1. Measure actual inside diameter at different locations of sewer.
2. Determine appropriate size of CIPP liner to use.

2.8 CHEMICAL RESISTANCE

A. Cured pipe:

1. Resistant to a variety of chemical effluents:
   a. Per ASTM D543.
2. Testing for chemical resistance:
   a. May be performed on sample of finished product prior to this contract.
      1) Submit a certified affidavit, signed by an officer of the company, stating the resin the tests apply to and the resin submitted for this project are the same.
3. Finished and cured CIPP liner properties shall perform as specified.
4. Previous test data will not be acceptable.

B. Chemical resistance tests:

1. Provide results per ASTM D543 on samples of cured liner material.
   a. Same material as that proposed for installation.
2. Minimum exposure (test period):
   a. One month.
   b. At 73.4 degrees F.
3. Maximum allowable losses during test period:
   a. Flexural strength: 20% of initial value.
   b. Flexural modulus: 20% of initial value.
   c. Per Section 8 of ASTM F1216.
4. Chemical solutions for testing:

CHEMICAL SOLUTION	CONCENTRATION, PERCENT
Tap Water (pH 6-9)	100
Nitric Acid	5
Phosphoric Acid	10
Sulfuric Acid	10
Gasoline	100
Vegetable Oil	100
Detergent	0.1
Soap	0.1

5. Contractor is responsible for all costs associated with chemical resistance tests.

C. Provide proof of meeting requirements for specified design:

1. To OWASA's Engineer.
2. For approval.
3. Before ordering the material.

2.9 CIPP END SEAL

A. CIPP End Seal:

1. Use a 360-degree hydrophilic rubber gasket, three-inch wide cylinder.
2. To seal between existing sewer pipe and CIPP at each pipe end.

2.10 SERVICE LATERAL INTERNAL CONNECTION SEAL

A. Install where indicated on Drawings.

B. Compatible with CIPP liner system.

C. Composed of a hat:

1. Made of hydrophilic polymeric neoprene rubber.
2. Designed with a specified wall thickness.
3. To provide a compression seal at connection of a lateral and a mainline pipe.

2.11 CIPP SPOT REPAIRS

A. Install a sectional CIPP spot repair:

1. For areas where longitudinal shrinkage of installed CIPP liner near manholes is three inches (3”) or more.
2. For any other longitudinal shrinkage observed within a pipe segment.
3. At no cost to OWASA.

2.12 SOURCE QUALITY CONTROL

A. Follow the quality control plan submitted by Contractor.

B. Provide CIPP linings from a single manufacturer.

1. Responsible for provisions of all test requirements specified herein as applicable.
2. CIPP lining to be installed under this Contract may be inspected at plant:
   a. For compliance with these specifications.
   b. By an independent testing laboratory provided by OWASA’s Engineer.
      1) Cost of plant inspection will be OWASA’s responsibility.
   c. Require manufacturer's cooperation with these inspections.

PART 3 - EXECUTION

3.1 STORAGE AND DELIVERY

A. Take responsibility for delivery, storage, and handling of all materials for CIPP and sealing material in accordance with manufacturer’s written requirements.

B. Exercise adequate care during transportation, handling, and installation to ensure CIPP material is not torn, cut, or otherwise damaged.

1. If any part(s) of CIPP material becomes torn, cut, or otherwise damaged before or during insertion:
   a. Repair or replace:
      1) At Contractor’s expense.
      2) In accordance with:
         a) Manufacturer’s recommendations.
         b) OWASA’s Engineer’s approval.
      3) Before proceeding further.

3.2 PREPARATORY PROCEDURES

A. Temporary Bypass Pumping:

1. Bypass the flow per Section 33 01 33.

B. Sewer Cleaning:

1. Clean each length of existing sewer pipe to be lined:
   a. In accordance with Section 33 01 32.

b. Prior to CIPP tube installation.

2. Clear sewer of obstructions that will prevent or hinder CIPP liner installation, such as:
   a. Solids.
   b. Collapsed pipe.
   c. Intrusions.

C. Pre-CIPP Internal Inspection:

1. Carefully inspect interior of sewer:
   a. Per Section 33 01 16.
   b. To determine location of conditions that may prevent proper installation of CIPP.
   c. To document service line locations.
2. Furnish a copy of CCTV inspection report data to Engineer within two (2) weeks following inspection.

D. Host Pipe Repair:

1. Recommend host pipe preparations after reviewing pre-lined CCTV.
2. Prepare host pipe for liner insertion:
   a. Prior to inserting liner.
   b. Taking any remediation actions necessary to ensure:
      1) Proper fit.
      2) Full expansion of liner to host pipe.
   c. Including:
      1) Removal of:
         a) Obstructions.
         b) Intrusions.
      2) Smoothing of surfaces.

3.3 TRIMMING INTRUDING LATERALS

A. Trim so that service connection is flush with internal pipe wall.

1. Maximum protrusion after trimming: 1/4".
2. Document by internal inspection methods.

B. Ensure that existing pipe is not damaged during cutting operations.

1. Do not use “Chain Beaters.”

3.4 INFILTRATION

A. Stop any infiltration runners or gushers:

1. As defined by NASSCO PACP.
2. As observed during pre-rehabilitation CCTV.
3. By injecting a chemical hydrophilic grout.
   a. Using a remote packer.
   b. Unless otherwise approved by OWASA’s Engineer.
4. If pipe is larger than 36”:
   a. Man-entry with hand-applied fast-setting epoxy may be performed.

3.5 INSTALLATION

A. Install CIPP per:

1. ASTM F1216 for direct inversion installations.
2. ASTM F1743 for pulled-in-place installations.

B. Designate location where CIPP felt tube will be impregnated with resin ("wet-out").
    1. Subject to approval by OWASA's Engineer.
    2. Allow OWASA's Engineer to inspect materials and "wet-out" procedure on site.

C. Prior to inverting or pulling in uncured CIPP liner:
    1. Install hydrophilic end seals at face of each manhole at all manhole penetrations.

D. Pressure gauges for ends:
    1. Digital pressure/vacuum gauges.
    2. Pressure range: 0 to 50 psi.
    3. Test gauge accuracy: ±0.25%.

E. Water Inversion:
    1. Insert impregnated tube into sewer main:
        a. Through an existing manhole or other approved access point.
        b. By means of an inversion process:
            1) Using water.
            2) Applying sufficient hydrostatic head to fully invert tube to designated termination point.
        c. Insert tube in a vertical inversion standpipe so that a leak-proof seal is achieved.
        d. Adjust inversion head:
            1) To sufficient height to hold impregnated liner tight to pipe wall.
                a) Produce dimples at service connections.
            2) Do not overstress liner.
        e. Pressure vessels are acceptable.

F. Air Inversion:
    1. Use only with prior permission from OWASA's Engineer.
    2. Insert impregnated tube into sewer main:
        a. Through an existing manhole or other approved access point.
        b. By means of an inversion process:
            1) Using air pressure.
            2) Applying sufficient pressure to fully invert tube to designated termination point.
            3) Speed of inversion to be controlled per manufacturer recommendations.
        c. Adjust air pressure:
            1) To sufficient pressure to cause impregnated liner to fully invert.
            2) Do not overstress liner.

G. For UV-Cured CIPP:
    1. Install a plastic slip sheet inside existing host pipe:
        a. Prior to insertion.
        b. To protect liner.

H. Lower resin-impregnated tube into insertion pit through an inversion tube and reducer if needed:
    1. Install CIPP liner through:
        a. Existing manholes.
        b. Other approved access points.
    2. No separate payment will be made for additional or enhanced access to facilitate the Contractor's CIPP liner installation process.

I. After inversion is complete, cure the tube.

1. Use:
    a. Hot water, or
    b. Steam, or
    c. Ultraviolet (UV) light.
2. Uniformly raise temperature to level required by resin manufacturer.
    a. Supply water recirculation equipment.
    b. Supply a suitable heat source.
        1) Fitted with monitors:
            a) Measure temperature of water supply or steam:
                (1) Outgoing.
                (2) Incoming.
            b) Locate second gauge at downstream manhole:
                (1) Between tube and host pipe.
                (2) To determine temperature during cure.
3. Ultraviolet curing lamps:
    a. Operate in a sufficient frequency range to ensure resin curing.
4. Locate a camera on ultraviolet light assembly:
    a. To enable video inspection of liner.
    b. To ensure that:
        1) Liner has been properly inflated.
        2) Any liner problems can be identified before curing begins.
5. Upon request, submit documented record to OWASA's Engineer of:
    a. Time.
    b. Ultraviolet light assembly's travel rate.
    c. Internal temperatures and pressures during curing.

J. Initial cure:

1. Use duration recommended by resin manufacturer.
    a. May require:
        1) Continuous water recirculation to maintain temperature, or
        2) Exposure to ultraviolet light.
2. Deemed complete when:
    a. Exposed portions of tube appear to be hard and sound, and
    b. Temperature sensors indicate temperature is of a magnitude to realize an exotherm.

K. Cool-down:

1. If accomplished by introducing cool water into an inversion standpipe to replace water being drained from a small hole made in downstream end,
    a. Before relieving static head in inversion standpipe:
        1) Cool down hardened liner:
            a) To whichever is lower:
                (1) 100 degrees F (38 degrees C).
                (2) Ambient temperature.
                (3) Timing as recommended by manufacturer.
        2) Avoid producing a vacuum:
            a) When static head is released.
            b) That could damage newly installed CIPP liner.

2. Follow a step cure approach:
    a. Or similar approach:
        1) Recommended by manufacturer.
        2) Approved by OWASA's Engineer.
    b. Hold at top step for adequate length of time to attain design physical properties.
3. Before releasing the hydrostatic head:
    a. Cool down circulation water:
        1) To at least 100 degrees F.
        2) For 1 hour.
    b. Control rate of temperature change:
        1) Rise during heating.
        2) Fall during cooling.
        3) Do not exceed 2 degrees F per minute.

L. Finish:

1. Cut off new pipe:
    a. In manhole.
    b. At a suitable location.
2. Where liner extends through a manhole:
    a. Cut off liner flush to existing bench.
3. Ensure finished product is:
    a. Continuous over length of reconstructed pipe.
    b. Free of:
        1) Dry spots.
        2) Delamination.
        3) Lifts.
4. Ensure pipe entries and exits are:
    a. Smooth.
    b. Free of irregularities.
    c. Watertight.
5. No visible leaks shall be present.

M. Reinstatement of active service laterals:

1. Take responsibility to accurately locate and reinstate all service connections.
2. After CIPP installation and curing is complete:
    a. Reinstate all existing service connections.
        1) Minimum 95% of original opening.
        2) Maximum 100% of original diameter, matching lateral's invert:
            a) Overcut connections not acceptable.
                (1) Repair any overcuts more than 105% with:
                    (a) Hydrophilic seal hat connection, or
                    (b) CIPP liner, or
                    (c) Other approved method by OWASA's Engineer.
        3) All openings:
            a) Clean and neatly cut.
            b) Buffed with wire brush:
                (1) To remove rough edges.

(2) To provide a smooth finish.

c) Bottom of openings:

(1) Flush with bottom of lateral pipe.

(2) Smooth edges, with no protruding material capable of:

(a) Hindering flow.

(b) Catching debris.

b. Initial reinstatement:

1) Use remote internal methods.

2) To allow continued service for all customers.

c. Where CIPP liner does not create dimples at service connections or in other ways indicate locations:

1) Determine exact location from internal inspection data.

3. Prior to CIPP lining acceptance:

a. Remove from reinstated service laterals all:

1) Coupons.

2) Excess resin.

4. Service lateral reconnections and/or renewals made by excavation methods:

a. InsertaTees:

1) May be used for solid wall pipes with 0.36-inch or greater wall thickness.

2) Requirements:

a) “Fatboy” type.

b) Hub manufactured of SDR 26 PVC material.

c) 360-degree integral stop on hub surface.

d) Exceed ASTM F1336 Section 10.3 Pipe Stop Load Support Test.

e) Or approved equal.

b. Romac-type saddles:

1) Shall be used for pipes with less than 0.36-inch wall thickness.

2) Requirements:

a) Seated and sealed to new CIPP using grout or resin compatible with CIPP.

N. Seal liner’s end points:

1. So that no fluid leakage may infiltrate between liner and existing pipe.

O. Lateral connection sealing system:

1. Apply:

a. After CIPP acceptance.

b. Where indicated on Drawings.

c. To completely seal area around liner opening and connection.

2. Installing connection seal shall not damage or adversely affect CIPP in any way.

a. If damage to CIPP liner does occur:

1) Repair or replace area at no additional cost to OWASA.

3. Loose or hanging/intruding pipe connection seals:

a. Trim to be flush with internal pipe wall.

b. Do not fold hanging/intruding material.

P. Inspect CIPP after installation.

3.6 FINISHED PRODUCT

A. Continuous over entire length of a manhole-to-manhole section of pipe.

B. Requirements for acceptable visual (CCTV) liner inspection:
    1. No significant:
        a. Wrinkles.
        b. Lifts.
        c. Ridges.
        d. Splits.
        e. Cracks.
        f. Delaminations.
        g. Flats.
        h. Dry spots.
        i. Pinholes.
        j. Shrinkage.
        k. Foreign inclusions.
        l. Crazing.
        m. Reverse curvatures.
        n. Other defects in CIPP lining.

C. Significant defects shall be defined as:
    1. Those listed in this specification, and/or
    2. Any defect that may create a maintenance issue in future:
        a. Inhibiting CCTV cameras
        b. Allowing solids to get caught on defect, and/or
        c. Any defect that appears to reduce long-term structural strength or stability of pipeline.

D. Defects affecting integrity or strength of CIPP, or adversely affecting pipe's hydraulic capacity:
    1. As determined by OWASA's Engineer.
    2. Such as:
        a. Foreign inclusions.
        b. Dry spots.
        c. Pinholes.
        d. Delamination.
        e. Lifts.
        f. Seam separation.
        g. Wrinkling beyond specification allowances.
    3. To be repaired or replaced at Contractor's expense.
        a. Propose repair methods for OWASA's Engineer review and approval.

E. Unacceptable wrinkles in finished CIPP:
    1. Those that:
        a. Cause a backwater of one-half inch (1/2") or more, or
        b. Reduce structural integrity of CIPP.
    2. Remove or repair at no additional cost to OWASA.
        a. If a void exists between wrinkle and pipe:
            1) Repair or replace that section of pipe at no additional cost to OWASA.
        b. Propose repair methods for OWASA's Engineer review and approval.

F. Separations of liner seams in finished liner pipe:
    1. Unacceptable.

2. Remove or repair at no additional cost to OWASA.
    a. If liner seam separation exists:
        1) Repair or replace that section of pipe at no additional cost to OWASA.
    b. Propose repair methods for OWASA's Engineer review and approval.

G. Longitudinal shrinkage of CIPP liner's length:

1. If more than three inches (3") from face of manhole:
    a. Repair using fiberglass reinforced CIPP spot repair:
        1) Per this Specification.
        2) At no cost to OWASA.

H. Circular shrinkage:

1. Measure via man entry.
2. Try to insert a 1/16" thick ruler or similar into any gap more than 8 inches past MH wall.
    a. Document with digital photos.
    b. Submit to OWASA's Engineer for approval.
3. Repair:
    a. Per manufacturer recommendations.
    b. At no cost to OWASA.

3.7 CIPP LINER SAMPLING

A. Prepare a sample of installed CIPP liner for subsequent testing of its physical properties.

1. First 5,000 linear feet of CIPP liner installed:
    a. Sample once every 1,000 linear feet.
        1) Perform sampling and testing to determine installed CIPP liner's:
            a) Flexural properties.
            b) Liner thickness.
2. After first five (5) test results have been collected and all have passed minimum standards per Specification:
    a. OWASA's Engineer may require collecting random samples for testing.
        1) Up to one per 5,000 linear feet.
    b. Testing frequency may be reduced:
        1) As approved by OWASA's Engineer.
        2) After sufficient tests are performed to verify CIPP liner's:
            a) Design.
            b) Production.
            c) Installation procedures.
    c. Likewise, testing frequency may be increased:
        1) By OWASA's Engineer.
        2) To be performed by Contractor:
            a) At no additional cost to OWASA.
        3) When required tests show that installed CIPP liner does not meet specifications.
    d. If a test is not passed:
        1) Re-evaluate liner thickness design to determine if installed physical properties meet minimum design requirements.
            a) If not, replace or reline liner:
                (1) With approval from OWASA's Engineer.
                (2) At no additional cost to OWASA.

3. Testing laboratory:
    a. Independent.
    b. Certified by American Association for Laboratory Accreditation (A2LA).
    c. Submit to OWASA's Engineer:
        1) Name and location of laboratory.
        2) Certified statement from laboratory indicating they are independent from and not associated with Contractor in any way.
        3) A2LA certification.
4. Sampling and testing responsibilities:
    a. Installed liner:
        1) All expenses paid for by OWASA.
            a) Chain of custody for test samples to be through OWASA's representative.
    b. Manufacturer's testing to qualify products furnished to project site:
        1) Contractor responsible for all costs.
5. Minimum wall thickness:
    a. Measured per ASTM D 5813.
    b. Determined:
        1) At minimum of three locations.
        2) On a cut section of CIPP lining.
        3) Using a measurement method accurate to nearest 0.005 inch.
6. Sample preparation:
    a. Per ASTM F1216, using
        1) Flat plate sampling method, or
        2) Restrained method.
    b. Flat plate sample:
        1) Large enough to provide five (5) sample specimens each for short-term flexural (bending) properties.
            a) Per ASTM D790.
        2) Clamped in a mold and placed in downtube during CIPP tube curing.
7. Sample processing:
    a. Remove sample after all water is removed from cured pipe tube.
    b. Identify samples by:
        1) Date.
        2) Project Name.
        3) Size.
        4) Thickness.
        5) Location.
        6) Resin.
        7) Catalyst.
    c. Test cured sample:
        1) By independent testing laboratory:
            a) As recommended by CIPP liner manufacturer.
            b) As approved by OWASA's Engineer.
        2) For:
            a) Short-term flexural (bending) properties per ASTM D790.
            b) Tensile properties per ASTM D638.

d. Double-bag and seal the sample.

8. Provide liner test results for long-term properties per ASTM D2990.
9. Take responsibility for any deviation from specified physical properties.
    a. Failure to meet specified physical properties:
        1) CIPP liner will be considered defective work and be rejected.
    b. Correct any CIPP lining that does not meet new calculated thickness requirements:
        1) In a manner approved by OWASA's Engineer.
        2) At no additional cost to OWASA.
    c. OWASA's Engineer's decision on how to correct deficient CIPP liner installations shall be final.
    d. OWASA's Engineer will consider the following options for correcting deficient CIPP liner:
        1) Removing existing CIPP liner and re-lining sewer.
        2) Open-cut replacement of sewer from manhole to manhole.
        3) Re-lining sewer with existing CIPP liner in place.
10. The Contractor shall be responsible for all costs associated with testing liner physical properties.

3.8 ACCEPTANCE

A. Perform internal inspection of CIPP-lined pipe:

1. Per Section 33 01 16.
2. After all liner end and connection sealing is completed.
3. Before removing sewage flow diversion.
4. To be reviewed by OWASA's Engineer.

3.9 CLEAN-UP

A. Following inspection, clean up entire project area.

1. Dispose of all excess material and debris not incorporated into permanent installation:
    a. Off-site.
    b. At a site approved by OWASA's Engineer.

3.10 FIELD QUALITY CONTROL

A. After delivery:

1. OWASA's Engineer or other OWASA representative may inspect CIPP lining.
2. CIPP lining that fails to meet any specified requirement:
    a. Subject to rejection at any time, even though sample may have been accepted as satisfactory at place of manufacture.
3. CIPP lining rejected after delivery:
    a. Mark for identification.
    b. Remove from job site.

B. If an installation is rejected based on review of post-rehabilitation CCTV inspection:

1. Repair the sewer segment:
    a. To satisfaction of OWASA's Engineer.
    b. At no additional cost to OWASA.

C. Provide to OWASA's Engineer:

1. Physical properties testing results.
2. Post installation CCTV survey.

3. Certified copy of curing report output from temperature monitoring system used to control pipe curing process.
    a. Or provide OWASA's Engineer with access to website where secure report can be obtained.

END OF SECTION