City of Hendersonville, NC

Addendum # 1

Request for Proposal # _250057155002_

Manhole Rehabilitation

Date Issued: 4/29/25

There are two purposes to this addendum. The first purpose is to extend the proposal due date from the current Monday, May 5, 2025 at 2 PM EST. The proposal due date will now be Monday, May 12, 2025 at 2PM EST. The second purpose of this addendum is to provide pages missing from the RFP. Those pages are attached to this addendum.

FY2025 Manhole Rehabilitation

CITY OF HENDERSONVILLE

SECTION 01 01 00

SUMMARY OF WORK

PART 1 GENERAL

1.1. LOCATION OF WORK

A. The Project is located in Hendersonville, NC various locations within the City of Hendersonville Sewer Collection System.

B. Manholes are located within publicly maintained street rights of way or within utility-maintained easement areas.

1.2. WORK TO BE DONE

A. The Project will rehabilitate existing sanitary sewer manholes. Work shall generally proceed in the order of highest priority manholes to lowest priority manholes.

B. Provide all labor, materials, equipment, tools, services and incidentals necessary to complete all work to furnish and install all work as shown and specified herein.

C. Complete the Work, in place, tested, and ready for continuous service. Perform or provide repairs, replacements and restoration required as a result of damages resulting from construction operations.

D. Furnish and install all materials, equipment, and incidentals, which are reasonably and properly inferable and necessary for the proper completion of the Work, whether specifically indicated in the Contract Documents, or not.

1.3. ABBREVIATIONS AND REFERENCES

A. Whenever reference is made to the furnishing of materials or testing thereof to conform to the standards of any technical society, organization or body, it shall be construed to mean the latest standard, code, specification or tentative specification adopted and published at the date of advertisement for bids, even if reference has been made to an earlier standard. Where standards, specifications or codes of the various technical societies, organizations or bodies have been referred to throughout the Specifications, the referenced standard, specification or code is hereby made a part of the Contract the same as if herein repeated in full.

B. In the event of any conflict between any of these specifications, standards, codes or tentative specifications, and the Specifications, the latter shall govern.

C. Reference to a technical society, organization, or body may be made in the Specifications by abbreviations, in accordance with the following list:

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute

AISC	American Institute of Steel Construction
AGA	American Gas Association
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASME	American Society at Mechanical Engineers
ASTM	American Society of Testing Materials
AWS	American Welding Society
AWWA	American Water Works Association
DIPRA	Ductile Iron Pipe Research Association
EPA	Environmental Protection Agency
FED.SPEC.	Federal Specifications
IEEE	Institute of Electrical and Electronic Engineers
OSHA	Occupational Safety and Health Administration
NCDOT	North Carolina Department of Transportation
NEMA	National Electrical Manufacturers Association
NCDENR	North Carolina Department of Environment and Natural Resources

D. When no reference is made to a code, standard, or specification, the standard specifications of the ASTM, the ANSI, the ASME, the IEEE, or the NEMA shall govern.

1.4. WORK SCHEDULE

A. CONTRACTOR shall develop an overall project schedule estimating the dates for starting and completing the work in a progressing fashion. The project schedule shall meet all requirements specified herein, including working hours and sequence of work.

B. Work shall generally proceed in the order of highest priority manholes to lowest priority manholes.

C. 7am to 4pm Monday through Friday excluding Holidays unless otherwise approved by Owner.

1.5. TRAFFIC CONTROL

A. CONTRACTOR may utilize Owner's personnel for traffic control/flagging operations. A minimum 72-hour notice will be required for the Owner to properly schedule necessary personnel.

SECTION 01 02 50

MEASUREMENT AND

PAYMENT

PART 1 GENERAL

1.1. THE REQUIREMENT

A. All contract prices shall be full compensation for all labor, materials, tools, equipment, and incidentals necessary to complete the Work as described and specified.

B. The items listed below refer to and are the same pay items listed in the Bid Form. They constitute all the pay items for the completion of the Work. No direct or separate payment will be made for providing miscellaneous temporary or accessory work, services, job signs, sanitary requirements, testing, safety devices, surveying, field engineering, record drawings, water supplies, power, removal of waste, watchmen, exiting utility relocation, maintenance of sewer flow and all other requirements of the Contract Documents.

C. Each lump sum and unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR's overhead and profit for the Project.

D. Excavation, trenching, backfill, and compaction, if required, are not separate bid items but are an integral part of the work under the contract, and the Contract Bid Price shall include this work.

E. Pay Items

1) Mobilization

- Measurement
  - There shall be no measurement for Mobilization.
- Payment
  - The lump sum price bid for Mobilization to be paid for shall be full compensation related to preparing for work and associated operations, including but not limited to the necessary movement of personnel, equipment, supplies, and incidentals to or near the project site; for establishing offices and facilities as may be required for the work; and the subsequent removal of personnel, equipment, supplies, and incidentals from the work site at the completion of the work; and all other costs which the CONTRACTOR may incur for the work which are excluded from other bid items.

2) Rehabilitate Manholes Using Spray-Applied Cementitious Liner

- Measurement
  - The number of vertical feet to be paid for under this Item will be the actual number of vertical feet of manholes lined with cementitious liner according to

the Drawings, in place and accepted by OWNER. Measurement of depth shall be made from the invert out to the rim.

- Payment
  - The unit price for this Item will be full compensation for all labor, materials, tools, equipment, supervision, and incidentals to apply liner, and testing as specified herein.

3) Inject Pipe Connections, Individual Holes, Joints, or Leaks with Chemical Grout

- Measurement
  - The chemical grout to be paid for under this Item will be the actual number of gallons used to seal existing pipe connections, holes, leaks with chemical grout in place, tested, and accepted by the OWNER. CONTRACTOR to coordinate with OWNER to determine which pipe connections shall be sealed. This item covers grout used in pipe connections up to ½ gallon.
- Payment
  - The unit price for this Item will be full compensation for all labor, materials, tools, equipment, supervision, and all other incidentals required to inject chemical grout around existing pipe connections, holes, joints, or leaks in manholes as specified herein.

4) Reform Bench and Invert

- Measurement
  - The number of reformed benches and inverts to be paid for under this Item will be the actual number of benches and inverts reformed within existing manholes in place, tested, and accepted by the OWNER. CONTRACTOR to coordinate with OWNER to determine which manhole benches shall be reformed.
- Payment
  - The unit price for this Item will be full compensation for all labor, materials, tools, equipment, supervision, and all other incidentals required to reform existing manhole benches and inverts as specified herein.

5) Build Bench and Invert

- Measurement
  - The number of benches and inverts to be paid for under this Item will be the actual number of benches and inverts built within existing manholes in place, tested, and accepted by the OWNER. CONTRACTOR to coordinate with OWNER to determine which manholes shall have new benches constructed.
- Payment
  - The unit price for this Item will be full compensation for all labor, materials, tools, equipment, supervision, and all other incidentals required to build a new bench and invert within an existing manhole as specified herein.

SECTION 33 0561.50

MANHOLE

REHABILITATION

PART 1 - GENERAL

1.1 SUMMARY

A. Scope of Work:

1. Furnish all labor, equipment, materials, and incidentals necessary to perform manhole rehabilitation in accordance with the specifications herein. All materials, testing, and procedures shall be of the type specified herein.

B. Section Includes:

1. Cleaning of existing manholes.
2. Patching holes or voids in existing manholes and stopping active leaks and infiltration.
3. Lining manholes and testing for acceptance of Work.

1.2 REFERENCE STANDARDS:

A. ASTM International

1. ASTM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
2. ASTM C293 – Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading)
3. ASTM C457 – Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete
4. ASTM C596 – Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement
5. ASTM C642 – Standard Test Method for Density, Absorption, and Voids in Hardened Concrete
6. ASTM C666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
7. ASTM C882 – Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
8. ASTM C900 – Standard Test Method for Pullout Strength of Hardened Concrete'
9. ASTM C1193 – Standard Guide for Use of Joint Sealants
10. ASTM D412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension
11. ASTM D638 – Standard Descriptive Nomenclature of Constituents of Aggregates for Radiation-Shielding Concrete
12. ASTM D695 – Standard Test Method for Compressive Properties of Rigid Plastics
13. ASTM D903 – Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
14. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
15. ASTM D1004 – Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting

16. ASTM D2240 – Standard Test Method for Rubber Property – Durometer Hardness

B. NACE International

1. NACE No. 5/SSPC-SP 12 – Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating

1.3 COORDINATION

A. Coordinate Work of this Section with users connected to the system.

B. In the event that a connection will be out of service, provide notice, including a descriptionof the work to be performed and general time frame, to homeowners and businesses at least 72 hours in advance of expected disruption of sanitary service.

C. Limit disruption of service to individual properties to a one-time occurrence for maximum of twohours. If a disruption more than two hours is necessary, include a detailed plan for managing flows in the bypass pumping plan.

D. Do not disrupt customer service between hours of 5:00 PM and 8:00 AM without prior writtenauthorization.

1.4 SUBMITTALS

A. Section 01 30 00 – Submittals/Electronic Submittals

B. Product Data:

1. Submit manufacturer information regarding patching material, chemical grout, cementitious liner, epoxy liner, polyurethane liner, and frame/cone seal.

C. Source Quality-Control Submittals: When requested, indicate results of factory tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record method of rehabilitation used at each manhole.

1.6 QUALITY ASSURANCE

A. All entries into or work within confined spaces shall be conducted in accordance with the National Institute for Occupational Safety and Health Publication No. 87-113 and Code of Federal Regulations 29 CFR1910.146.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section withminimum five years' documented experience. The cementitious and epoxy products shall have been installed in at least 5,000 manholes.

B. Installer: Contractor performing the work shall be fully qualified, experienced and equipped to complete this work expeditiously and in a satisfactory manner and shall be an approved installer as certified and licensed by the manufacturer. The Contractor shall have held such certification by the manufacturer to install the specific product being used for a minimum of one year prior to the bid date. The Contractor, as a company, must have at least three years of experience coating manholes with cementitious mortar and/or epoxy product (whichever product is being applied) or shall have successfully installed a cementitious lining and/or epoxy product (whichever product is being applied) in a minimum of 500 manholes as documented by verifiable Owner references. Further, the Contractor's proposed superintendent/foreman for the work under this Contract shall have successfully installed a cementitious lining product and/or epoxy product (whichever product is being applied) in a minimum of 100 manholes as documented by verifiable Owner references. The Contractor shall submit information to demonstrate that he meets the experience requirements.

1.8 DELIVERY, STORAGE, ANDHANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.
   3. Material shall be protected from sun exposure.

1.9 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements made by the CONTRACTOR to verify depth of manholes on Shop Drawings.

1.10 WARRANTY

A. Furnish a three-year manufacturer's non-prorated warranty for the materials used.

B. During the one-year warranty period, any defects that will affect the integrity or strength of the product or its ability to perform the task for which it was designed shall be repaired at the

installer'sexpense, in a manner mutually agreed by the OWNER and the installer.

PART 2 - PRODUCTS

2.1 Patching Material: Material used to patch, fill and repair non-leaking holes, cracks or voids shall bea quick setting (less than 30 minutes), non-shrink, fiber reinforced, corrosion resistant calcium aluminate or equivalent material that is compatible with the chosen liner system and shall be applied in accordance with the manufacturer's recommendation for basecoat materials. Patchmaterial must meet the following minimum requirements:

Compressive Strength	ASTM C109	>200 psi (1 Hour)
Ultimate Compressive Strength	ASTM C109	5000 psi
Bond Strength	ASTM C882	>1700 psi
Applied Density		105 pcf
Shrinkage	ASTM C596	0% at 90% R.H.

2.2 Infiltration Control Material (Chemical Grout): Active leaks and infiltration shall be stopped byinjecting a chemical grout through the source to the outside of the manhole. The grout used shall be an acrylamide, acrylic or urethane gel and might require the addition of a shrink control agent, gel reinforcing agent and accelerator. The chemical grout shall be volume stable and have a minimum 28 day compressive strength of 250 psi and a minimum one day strength of 50 psi.

2.3 Cementitious Liner: The material shall be a 100% calcium aluminate mortar designed to stop infiltration, restore structural integrity, and provide protection against microbiologically-inducedcorrosion. It shall be spray applied to form a structurally enhanced monolithic liner covering all interior substrate surfaces with the following minimum requirements:

Compressive Strength	ASTM C109	>8000 psi (28 Days)
Tensile Strength	ASTM C900	>800 psi
Flexural Strength	ASTM C293	>1200 psi (28 Days)
Shrinkage @ 90% R.H.	ASTM C596	<0.08% (28 Days)
Freeze/Thaw	ASTM C666	No Damage After 300 Cycles
Air Void Content	ASTM C457	2-4% (7 Days)
SpecificGravity/AbsorptionTest	ASTM C642	3-5% (7 Days)

The cementitious lining system shall be one of the following products or approved equal:

- Strong Seal MS-2A, MS-2C, or High Performance by Strong Seal Systems
- QM-1s Restore or Aluminaliner by Quadex
- Cemtec Silatec MSM or CAM by A.W. Cook Cement
- Sewpercoat PG by Kerneos, Inc.
- Permacast MS-10,000 or CR-5000 by Action Products Marketing Corp.
- PerpetuCrete MSC or CA by Protective Liner Systems
- Mainstay ML-72, ML-CA or ML-PF by Madewell
- Reliner MSP or Maximum CA Cement by Standard Cement Materials

Where hydrogen sulfide resistance is required and when specified by the Engineer, the cementitious lining system shall be a 100% calcium aluminate product (product comprised of calcium aluminate cement and calcium aluminate aggregate). Partial calcium aluminate products (or blended products) shall not be considered equal and shall not be approved. The 100% calcium aluminate products shall be one of the following products or approved equal:

- High Performance by Strong Seal Systems
- Sewpercoat PG by Kerneos, Inc.
- Mainstay ML-PF by Madewell
- Maximum CA Cement by Standard Cement Materials

The cementitious lining system shall be a pumpable cementitious mortar product specifically for manhole rehabilitation and shall be installed via low-pressure application only. The materials shall be suitable for all the specified design conditions. The materials used in the cementitious lining systems shall be mixed on site in accordance with the manufacturer's recommendations. Water shall only be added to the materials during the mixing process and prior to material pumping or spray application. No water shall be added at the nozzle. The cementitious lining shall provide a minimum service life of 25 years.

2.4 Epoxy Liner: The material shall be 100% solids, solvent-free two-component epoxy resin system with select fillers to minimize permeability and provide sag resistance acceptable to the following minimum requirements:

Hardness, Shore D	ASTM D2240	88
Tensile Strength	ASTM D638	>7000 psi
Flexural Strength	ASTM D790	>10000 psi

Epoxy liner shall be Raven 405, manufactured by Raven Lining Systems or approved equal.

2.5 Polyurethane Liner: The material shall be 100% solids, solvent-free two-component hybrid polyurethane coating system capable of being applied to the specified thickness in one application to the following minimum requirements:

Hardness, Shore D	ASTM D2240	55
Tensile Strength	ASTM D638	>2500 psi
Flexural Strength	ASTM D790	>10000 psi
Compressibility	ASTM D695	> 4200 psi

Polyurethane liner shall be Zebron 386, manufactured by Zebron Corporation or approved equal. Frame/Cone Seal: Applied seals shall be achieved by applying an aromatic urethane resin compound to the internal surface between the manhole frame and the cone section to stop inflowunder the manhole frame. Sufficient material shall be applied to achieve a minimum thickness of 120 mils. The material shall comply with the following requirements:

Hardness	ASTM D2240	75
Tensile Strength	ASTM D412	1150 psi
Elongation		800%
Adhesive Strength.	ASTM D903	175 lb/l.inch
Tear Resistance	ASTM D1004	155 lb/l.inch

The material shall be Flex-Seal Utility Sealant as manufactured by Sealing Systems, Inc. or approved equal.

2.6 Inflow Collector: The contractor shall supply and install, to the manufacturer's recommendations, manhole inflow collectors as specified hereafter. The completed manhole inflow collector and itsassociated valve body and components shall be manufactured from corrosion proof material suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with wastewater collection systems. The inflow collector shall be equipped with a gasrelief valve designed to relieve at a pressure of 1 psi and have a water leak down rate not to exceed5 gallons per 24 hours. The insert gasket shall be made of closed cell neoprene and have a pressure sensitive adhesive on one side and be placed under the insert body rim by the manufacturer. Theadhesive shall be compatible with the insert body material so as to form a long lasting bond in either wet or dry conditions of use. The inflow collector shall be equipped with a non-deteriorating lifting strap strong enough to lift a collector full to capacity with water out of themanhole. The lifting strap shall be fastened to the insert body with stainless steel rivets.

2.7 Water: All water used on this project shall be clean and potable.

PART 3 -EXECUTION

3.1 Covers shall be placed over the invert to prevent extraneous materials from entering the sewer lines before cleaning.

3.2 Patching Holes or Voids: All loose or disintegrated material shall be removed from the area to bepatched. Holes or voids around steps, joints or pipes, spalled areas, and cavities caused by missing or broken brick or mortar shall be repaired using patching material conforming to the requirementsof Part 2, Section 2.1. The patching material shall be mixed and applied in accordance with the manufacturer's requirements. Active leaks shall be stopped in accordance with Section 3.2 of this specification.

3.3 Stopping Active Leaks and Infiltration: All active leaks and infiltration shall be repaired using chemical grout conforming to the requirements of Section 2.2. Any areas that show evidence ofleakage either active or non-active during inspection shall be injected. At each point of leakage within the manhole structure a hole shall be carefully drilled through the wall to the exterior ofthe manhole. Grout ports or sealant injection devices shall be placed in these holes in a way as toprovide a watertight seal between the holes and the injection device. A hose or hoses shall beattached to the injection device from an injection pump. Chemical grout shall be pumped throughthe hole until material refusal is recorded on a pressure gauge mounted on the pumping unit. Care shall be taken during the pumping operation to insure that excessive pressures do not develop and cause damage to the manhole structure. Upon completion of the injection, the ports shall be removed, and the remaining holes filled with mortar and troweled flush with the surface of themanhole wall. The entire joint shall be sealed with patching material conforming to the requirements of Section 2.1 and smoothed flush with the surface of the manhole wall. To preventthe migration of infiltration leaks the Contractor shall comply with the following requirements forpoints of injection:

A. Joint Leaks: A minimum of 4 injection points shall be evenly spaced around the circumference of the manhole joint.

B. Pipe Connection Leaks: A minimum of 2 injection points shall be evenly spaced around pipeconnection. Note: Large diameter pipe may require more than 2 injection points.

C. Pipe Invert Leaks: A minimum of 2 injection points, one on each side of trough.

D. Lift Holes/Voids: A minimum of 1 injection point through the center of the lift hole/void.

3.4 Reform/Repair Existing Bench and Invert: Manhole inverts and benches shall be reformed or repaired as identified in the plans using the patching material identified in Section 2.1. The patch material shall be applied to the invert and bench at a minimum thickness of ½", extending sufficiently to the manhole wall to tie into the cementitious liner to be applied later. The finished invert and bench shall be troweled to a smooth finish free of ridges and burrs. The bench shall be sloped from the manhole wall toward the invert to prevent debris build-up on the bench. Repairs on the invert shall not compromise grade. The invert and bench shall be allowed to cure for a minimum of 30 minutes before being subject to active flow; flow shall be bypassed as specified.

3.4 Building Bench and Invert: Inverts and benches shall be constructed in manholes with no hard bottom or no defined invert (channel of flow) using the patching material identified in Section 2.1. The bench shall be constructed of brick and finished by troweling smooth with patching material. The patching material shall have a minimum thickness of 1". The finished invert and bench shall be troweled to a smooth finish free of ridges and burrs. The bench shall be sloped from the manhole wall toward the invert to prevent debris build-up on the bench. Repairs on the invert shall not compromise grade. The invert and bench shall be allowed to cure for a minimum of 30 minutes before being subject to active flow; flow shall be bypassed as specified.

3.5 Cementitious Liner Application:

A. Surface Preparation: All foreign material shall be removed from the manhole wall and bench using ahigh-pressure water spray (minimum 3500 psi). Loose or protruding brick, mortar and concrete shallbe removed using a mason's hammer and chisel or scraper. All concrete or mortar that is not soundor has been damaged by chemical exposure shall be removed to a sound concrete surface. Any holesor voids shall be filled in accordance with Section 3.1. The surface to be repaired must be clean and free of any loose materials. Active leaks and infiltration shall be stopped in accordance with Section3.2. Roots shall be removed by manually cutting the roots from inside the manhole.

B. Step Removal: Prior to application of the cementitious liner, all steps that are deemed defective or unsafe shall be cut off and ground flush with the manhole wall. The contractor shall be responsible for the removal and disposal of old steps.

C. Liner Application: The Contractor is responsible for ensuring proper preparation and installation conditions including temperature and moisture. For each bag of product, use the amount of water specified by the manufacturer and mix using equipment for the time per manufacturer's recommendation. The surface prior to spraying shall be damp without noticeable free water, but totally saturated. Materials shall be applied using low-pressure spray equipment from the bottom of the wall to the top, to a minimum uniform thickness to ensure that all cracks, crevices, and voids are filled and a relatively smooth surface remains after light troweling. The light troweling is performed to compact the material into voids and to set the bond.

1. The Contractor may request to hand trowel the cementitious liner instead of using a spray application method at the sole discretion and approval of the owner.

D. Curing: Caution should be taken to minimize exposure of applied product to sunlight and air movement. If application of second coat is to be longer than 15 minutes after completion of first coat, the manhole cover shall be set back in place. At no time should the finished product be exposed to sunlight or air movement for longer than 15 minutes before replacing the manhole cover. The application shall have a minimum cure time before being subjected to active flow in accordance with manufacturer's recommendation. Flow shall be bypassed as specified.

3.6 Epoxy Liner Application:

A. Surface Preparation: All concrete or mortar that is not sound or has been damaged by chemicalexposure shall be removed to a sound concrete surface. At a minimum, this shall be achieved with a low pressure water cleaning equipment using a 0 degree rotating nozzle at 5,000 psi and 4 gpm. Other methods such as high pressure water jetting (refer to NACE Standard No. 5/SSPC-SP12),abrasive blasting, shotblasting, grinding, scarifying and/or acid etching may also be used. The method(s) used shall be performed in a manner that provides a uniform, sound, clean, neutralized surface that is not excessively damaged. Any holes or voids shall be filled in accordance withSection 3.1. The surface to be repaired must be clean and free of any loose materials. Active leaksand infiltration shall be stopped in accordance with Section 3.2.

1. When required on the plans, the epoxy liner shall be applied over a back-build of cementitious surface. Exact minimum thicknesses of cementitious back-build will be determined after deteriorated concrete has been removed. The cementitious liner shall be applied accordance to Section 3.4 of this specification. The epoxy lining shall take place only after the cementitious liner has cured the appropriate length of time as recommendedby the manufacturer.

B. Liner Application: Surfaces shall be coated by spray application to a minimum wet film thicknessof 100 mils. If necessary, subsequent topcoating or additional coats should occur no later than the recoat window for the specified products. Additional surface preparation will be required if thisrecoat window is exceeded. The coating material must be applied by a Certified Applicator of the coating system manufacturer. Spray application equipment approved by the coating manufacturer shall be used.

C. Spark Test: The cured epoxy lining shall be spark tested for pinholes with a spark tester set at 15,000 volts minimum. All pinholes shall be marked off on surface areas containing pinholes to apoint 6 inches beyond all pinholes, primed with epoxy, and recoated with polyurethane to a minimum additional thickness of 30 mils. Blisters, uncured lining, and surface imperfections shall be completely removed and the areas recoated with epoxy primer and polyurethane lining to apoint 6 inches beyond the repair areas at a minimum thickness of 100 mils.

3.7 Polyurethane Liner Application:

A. Surface Preparation: All concrete or mortar that is not sound or has been damaged by chemicalexposure shall be removed to a sound concrete surface. At a minimum, this shall be achieved with a low pressure water cleaning equipment using a 0 degree rotating nozzle at 5,000 psi and 4 gpm. Other methods such as high pressure water jetting (refer to NACE Standard No. 5/SSPC-SP12),abrasive blasting, shotblasting, grinding, scarifying and/or acid etching may also be used. The method(s) used shall be performed in a manner that provides a uniform, sound, clean, neutralized surface that is not excessively damaged. Any holes or voids shall be filled in accordance withSection 3.1. The surface to be repaired must be clean

and free of any loose materials. Active leaksand infiltration shall be stopped in accordance with Section 3.2.

1. When required on the plans, the polyurethane liner shall be applied over a back-build ofcementitious surface. Exact minimum thicknesses of cementitious back-build will be determined after deteriorated concrete has been removed. The cementitious liner shall be applied in accordance with Section 3.4 of this specification.
2. Prior to applying the polyurethane liner, the cementitious surface shall be primed with a minimum of 3 mils of epoxy primer. Epoxy primer shall be Zebron Low Temperature Epoxy or approved equal. The polyurethane lining shall take place only after the cementitious liner has cured for a minimum of 6 hours.

B. Liner Application: Surfaces shall be coated by spray application to a minimum wet film thicknessof 100 mils directly after the application of the epoxy primer or within the 24-hour window. During the application, the contractor shall take wet gauge film thickness readings as required to ensure correct lining thickness. If necessary, subsequent topcoating or additional coats should occur no later than the recoat window for the specified products. The coating material must be applied by a Certified Applicator of the coating system manufacturer. High pressure airless spray application equipment approved by the coating manufacturer shall be used.

C. Spark Test: The cured polyurethane lining shall be spark tested for pinholes with a spark tester set at 15,000 volts minimum. All pinholes in the protective lining shall be marked. The area 6-inches around the pinhole shall be abraded with a 60-grit paper, cleaned, primed, and topcoated with 30 mils of polyurethane handmix. Blisters, uncured lining, and surface imperfections shall be completely removed, and the areas recoated with epoxy primer and polyurethane lining 6-inchesbeyond all borders of the repair areas to a minimum thickness of 100 mils with polyurethane handmix. Defect areas exceeding one square foot in area shall be repaired as stated above by using spray appliedpolyurethane.

3.8 Frame/Chimney Seal Installation: All foreign material, bituminous coating, rust or scale build-up, etc. shall be removed from the area to be coated by sandblasting in accordance with the manufacturer's requirements. After the area is cleaned, it must be completely dried prior to application of the seal material. The urethane resin compound shall then be applied from the bottom 3 inches of the frame to the top three inches of the cone, including the grade adjustmentarea, to a minimum thickness of 120 mils. Application shall be in accordance with the manufacturer's instructions.

3.9 Cleaning Manhole: Any rocks, pieces of broken pipe or any other debris not desired in the manholeor invert shall be removed and disposed of by methods deemed appropriate by the OWNER. The bench and invert shall be pressure washed to remove organic material and return undisturbed wastewater flow to the invert.

3.10 Plugging Abandoned Line: Abandoned lines shall be filled with non-shrink grout conforming to therequirements of Section 2.1. Grout plug shall extend at least 1.5 times the thickness

of the manhole wall. Plugging abandoned lines shall be performed prior to cementitious lining.

3.11 Grouting Bench/Barrel Joint: Bench/Barrel joints shall be repaired with patching material conforming to the requirements of Section 2.1. Adequate patching material shall be applied to fill the void between the bench/barrel joint to assure no leakage. The patching material shall be applied and smoothed to an even thickness around the entire circumference of the joint. All active leaks shall be injected with chemical grout conforming to the requirements of Section 2.2 prior to applying the patching material. Active leaks shall be injected in accordance with Section 3.2 of this specification. A minimum of 4 injection points shall be evenly spaced around the circumference of the bench/barrel joint.

3.12 Grouting Section Joints: Section joints shall be repaired with patching material conforming to the requirements of Section 2.1. Patching material shall be applied to fill any holes, voids, or cracks at the section joint. The patching material shall be applied at an even thickness around the entire circumference of the joint and smoothed flush to the surface of the manhole wall. All active leaks shall be injected with chemical grout conforming to the requirements of Section 2.2 prior to applying the patching material. Active leaks shall be injected in accordance with Section 3.2 of this specification. A minimum of 4 injection points shall be evenly spaced around the circumference of the joint.

3.13 Grouting Chimney: Manhole chimneys shall be repaired with patching material conforming to the requirements of Section 2.1. Sufficient patching material shall be used to assure no leakage. The patching material shall be applied and smoothed to an even thickness around the entire circumference of the chimney.

PART 4 - ACCEPTANCE

4.1 After the various types of rehabilitation and repair have been completed, the work shall be visually inspected by the Contractor in the presence of the Owner for compliance with these specifications and the manufacturer's recommendations. The Owner shall also inspect the work during the warranty period. Any leakage or defects in the work shall be corrected by the Contractor at no additional cost to the Owner.

4.2 If the manhole fails a visual inspection or the initial test, necessary repairs shall be made with an approved non-shrink grout. Retesting shall continue until the manhole satisfactorily passes the test. All tests shall be performed in the presence of the Owner. The Contractor will furnish all personnel, facilities, and equipment necessary to conduct the testing. Testing of the manholes shall not be paid for directly, but shall be included in the contract unit price for Manhole Rehabilitation.

4.3 Manholes that are completely rehabilitated using epoxy or polyurethane liner shall be spark

tested in accordance to Section 3.5 for epoxy lining and Section 3.6 for polyurethane lining. If the manhole fails the initial test, necessary repairs shall be made in accordance to Section 3.5 E for epoxy lining and Section 3.6 for polyurethane lining. Retesting shall continue until the manhole satisfactorily passes the test. All tests shall be performed in the presence of the Owner. The Contractor will furnish all personnel, facilities, and equipment necessary to conductthe testing. Testing of the manholes shall not be paid for directly, but shall be included in the contract unit price for Manhole Rehabilitation.