SECTION 822

MANHOLE REHABILITATION

I. GENERAL

1.1 DESCRIPTION OF WORK

A. These specifications include requirements to provide a system for manhole rehabilitation that includes lining the manhole interiors, internal sealing of the frame-chimney joint area, and reconstructing manhole benches and channels. It is the Contractor's responsibility to stop all active leaks in association with the lining of the manhole interiors.

B. This Work shall include the furnishing of all materials, equipment, tools, and labor as required for the rehabilitation of the manholes.

C. Rehabilitation products shall be applied to the manhole from the cover seat to and including the benches. The rehabilitation system must provide a non-prorated warranty as herein described in manholes to stop infiltration, prohibit root intrusion, protect the existing structure from further deterioration, and provide a surface coating resistant to sewer gases and chemicals.

D. The Contractor shall perform all required permanent landscape restoration of disturbed areas on private property and within the locality or VDOT right-of-way upon completion of pipe rehabilitation, to the satisfaction of the Owner.

E. Materials and supplies provided shall be the standard products of the coating system manufacturer. Materials in each coating system shall be the products of a single coating system manufacturer.

F. Products shall conform to Section 200 or applicable Special Provisions.

1.2 SUBMITTALS

Submittals shall be made by the Contractor in accordance with the procedures set forth in Section 105 - Control of Work, and as described below.

A. After notification of award, the Contractor shall provide the following information for review and approval. These items may be submitted prior to the notice to proceed for review and approval. Once the notice to proceed is issued, working days will start being counted, regardless of the submittal status. The project shall not be initiated until all of the listed information has been reviewed and approved by the Owner.

1. A comprehensive construction sequencing plan. At minimum, the plan shall include the following.

a. A proposed schedule.

b. Identification of all proposed access routes.

c. Identification of set-up locations for lining installation.

d. Lining procedures.

e. Bypass Pumping Plan in accordance with Section 812 – Bypass Pumping.

f. Traffic Control Plan in accordance with the locality or VDOT requirements, as appropriate.

2. Letter identifying the crew members performing the Work. If any of the crew members are not identified on the original certification letter received during the pre-qualification process, then a new certification letter listing the crew member(s) must be received from the rehabilitation system supplier prior to initiation of the specific project.

3. Calculations (or letter from the manufacturer) supporting recommended liner thicknesses or wall coverage thicknesses.

B. Prior to initiation of a specific project, the Contractor shall submit the following information for review and approval.

1. Shop drawings and product data for the manhole rehabilitation method and materials, including a report outlining the process to be used in the rehabilitation of the sewer manholes. The report shall also include:

a. Information specific to the job, such as coordination issues, access, timing, manufacturer's installation instructions, equipment, and bypass pumping.

b. Information on the chemical grout and additives, cementitious compound, waterproofing, and corrosion control materials that will be used. For the materials that will be used, identify and furnish references for successful use of the materials in similar applications.

c. Method for sealing pipes at manholes.

2. All measurements made by the Contractor to verify manhole depths, elevations, and locations of penetrations prior to ordering of material.

C. The Contractor for the manhole rehabilitation must have a minimum of 3 years' experience using the proposed product in at least 50 manholes. All contractor employees and/or subcontractors performing Work on the manhole rehabilitation must be certified by the manhole rehabilitation system supplier as qualified to perform Work with the proposed product.

D. All manhole liner systems shall be warranted for materials and workmanship for a minimum of 2 years.

1.3 QUALITY CONTROL

The Contractor is responsible for the workmanship and quality of the coating system installation. Inspections by the Owner or the coating system manufacturer's technical representative will not relieve or limit the Contractor's responsibilities.

A. The Contractor's methods shall conform to requirements of this specification and the standards referenced in this Section 822 Manhole Rehabilitation and Section 200 Products and Materials. Changes in the coating system installation requirements will be allowed only with the written acceptance of the Owner before work commences.

B. Only personnel who are trained by the coating system manufacturer's technical representative specifically for this contract or who are approved by the coasting system manufacturer specifically for this contract shall be allowed to perform the coating system installation specified in this Section 822 Manhole Rehabilitation.

C. Contaminated, outdated, diluted materials, and/or materials from previously opened containers shall not be used.

D. For repairs, the Contractor shall provide the same products, or products recommended by the coating system manufacturer, as used for the original coating.

E. The Contractor shall identify the points of access for inspection by the Owner. The Contractor shall provide ventilation, ingress and egress, and other means necessary for the Owner's personnel to access safely the work areas.

F. The Contractor shall conduct the work so that the coating system is installed as specified and shall inspect the work continually to ensure that the coating system is installed as specified. Coating system work that does not conform to the specifications or is otherwise not acceptable shall be corrected as specified.

G. The Contractor shall provide written daily reports that present, in summary form, test data, work progress, surfaces covered, ambient conditions, quality control inspection test findings, and other information pertinent to the coating system installation.

1.4 Delivery and Storage

A. Materials shall be delivered to the job site in their original, unopened containers. Each container shall be properly labeled. Materials shall be handled and stored to prevent damage to or loss of label.

B. Labels on material containers shall show the following information:

1. Name or title of product.
2. Coating system manufacturer's batch number.
3. Coating system manufacturer's name.
4. Generic type of material.
5. Application and mixing instructions.
6. Hazardous material identification label.
7. Shelf life expiration date.

C. Materials shall be stored in enclosed structures and shall be protected from weather and excessive heat or cold in accordance with the coating system manufacturer's recommendations. Flammable materials shall be stored in accordance with state and local requirements.

D. Containers shall be clearly marked indicating personnel safety hazards associated with the use of or exposure to the materials.

E. Material Safety Data Sheets (MSDS) for each material shall be provided to the Owner. The Contractor shall store and dispose of hazardous waste according to federal, state and local requirements. This requirement specifically addresses waste solvents and coatings.

II. EXECUTION

2.1 GENERAL

A. Prior to performance of the actual Work carefully inspect the entire site and locate those manholes designated to be rehabilitated.

B. Cleaning: Cleaning of sewer lines and manholes shall be performed as specified in Section 810 - Sewer Line Cleaning.

C. Bypass Pumping: When required for acceptable completion of the rehabilitation process, the Contractor shall provide for adequate flow control including but not limited to required pumping and bypassing as stipulated in Section 812 - Bypass Pumping.

D. Site conditions may preclude the Contractor from mobilizing the sealing, coating and/or lining equipment near the manhole. If the manhole is inaccessible, as determined by the Contractor and the Owner, the Contractor shall hand apply the coatings and/or liners per the manufacturer’s instructions and recommendations. Hand application shall be completed at no additional cost to the Owner.

2.2 REHABILITATION PROCEDURES

A. Place cover over invert to prevent extraneous material from entering the sewer lines.

B. All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (minimum 1200 psi). Loose and protruding brick, mortar, and concrete shall be removed using a mason's hammer and chisel and/or scraper. Fill any large voids with quick-setting patching mix in accordance with Section 200 - Products and Materials. The surface to be repaired must be clean and free of any loose materials with walls totally saturated with water.

C. Minor leaks shall be stopped using the quick-setting specially formulated infiltration control mix and shall be mixed and applied per manufacturer's recommendations. Some leaks may require weep holes to localize the infiltration during the application, after which the weep holes shall be plugged with the quick-setting infiltration control mix prior to the final liner application. When severe infiltration is present, drilling may be required in order to pressure grout using a cementitious or chemical grout. Manufacturer's recommendations shall be followed when pressure grouting is required.

D. After all preparation Work has been completed, remove all loose material and wash wall again.

E. Any bench, invert, or service line repairs shall be made at this time using the quick-setting patching mix per manufacturer's recommendations.

F. Invert Repair:

Invert repair shall be performed on all inverts with visible damage or infiltration. After blocking flow through the manhole and thoroughly cleaning invert, the quick-setting patch mix

shall be applied to the invert in an expeditious manner. The mix shall be troweled uniformly onto the damaged invert extending out onto the base of the manhole sufficiently to tie into the structural/structurally enhanced monolithic liner to be applied. The finished invert surfaces shall be smooth and free of ridges. The flow may be re-established in the manhole within 30 minutes after placement of the mix. Upon completion of the invert repair and lining, there shall be a smooth transition from the invert to all of the lined and unlined incoming and outgoing connections.

G. Watertight Seal between Pipe Liner and Manhole Liner: Where a manhole has been lined through with a pipeline liner, the Contractor shall prepare a watertight seal and smooth transition between the pipe liner and manhole liner system. No leakage or gaps will be allowed. The method of sealing and preparing a smooth transition shall be approved by the Owner

H. Cementitious Liner Installation:

Described are procedures for manhole preparation, cleaning, application and testing. The applicator, approved and trained by the manufacturer, shall furnish all labor, equipment and materials for applying a cementitious mix with machinery specially designed for the application. All aspects of the installation shall be in accordance with the manufacturer's recommendations and with the following specifications which include:

- Elimination of active infiltration prior to the application.
- Removal of loose and unsound material and cleaning surfaces in accordance with Section 810 - Sewer Line Cleaning and per manufacturer's recommendations.
- Repair and sealing of the invert and benches.
- Spray application of a cementitious mix to form a liner.

1. Liner Application:

Prior to liner application onto walls, manhole bench area shall be covered with plywood sections, which conform to the internal dimensions of the manhole, to prevent accumulation of liner material on bench.

No application shall be made to frozen surfaces or if freezing is expected to occur inside the manhole within 24 hours after application. If ambient temperatures are in excess of 95º F, precautions shall be taken to keep the mix temperature at time of application below 90º F. Mix water temperature shall not exceed 85º F. Chill with ice if necessary.

2. Mixing:

For each bag of product, use the amount of water specified by the manufacturer and mix for 30 seconds to 1 minute after all materials have been placed in the mixer, using equipment per manufacturer's recommendation.

Empty the mixed material into the holding hopper and prepare another batch with timing such that the nozzleman can spray in a continuous manner without interruption until each application is complete.

3. Spraying:

a. First Application: The surface prior to spraying shall be damp without noticeable free water droplets or running water, but totally saturated. Materials shall be spray applied 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.

b. Second Application (as necessary per manufacturer's recommendations): A second application is to be applied after the first application has begun to take an initial set (disappearance of surface sheen which could be 15 minutes to 1 hour depending upon ambient conditions) to assure a minimum total finished thickness of ½ inch. Again application shall be from the bottom up. The surface is then troweled to a smooth finish being careful not to over trowel so as to bring additional water to the surface and weaken it. Manufacturer's recommendations shall be followed when more than 24 hours have elapsed between applications.

c. Bench Application: The plywood covers shall be removed and the bench sprayed such that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than ½ inch. The wall bench intersection shall be rounded to a uniform radius equal to the full circumference of the intersection.

d. The Contractor shall take precautions to keep overspray or excess material from entering the newly installed liner pipe and any other pipes in the manhole.

4. 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 application 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 final application shall have a minimum of 4 hours cure time before being subjected to active flow.

Traffic shall not be allowed over manholes for 6 hours after rehabilitation is complete.

I. Cured in Place Manhole Liner (CIPM) Installation:

1. Cured-in-place manhole liner systems shall be suitable for use as a monolithic surfacing in sewer manholes. The cured in place liner system shall be Poly-Triplex Liner System, Terre-Hill, or pre-approved equal.

2. The cured in place liner shall be installed on the benches, walls, channels, and inverts of existing manholes. The cured surface shall be smooth and continuous with proper sealing connections to all unsurfaced areas. The cured in place liner shall begin below

the frame and the frame/liner interface shall be sealed using an epoxy.

3. The cured in place liner shall be continuously bonded to all the brick, mortar, concrete, chemical sealant, grout, pipe and other surfaces inside the sewer manhole. The cured in place liner shall form a continuous, tight-fitting, hard, impermeable surfacing which is suitable for sewer system service and chemically resistant to any chemicals or vapors normally found in domestic sewage. The liner shall effectively seal the interior surfaces of the sewer manhole and prevent any penetration or leakage of groundwater infiltration.

4. The finished liner must be repairable at any time during the life of the structure. The liner shall be flexible, and have an elongation sufficient to bridge up to a ¼-inch settling crack, without damaged to the liner. The liner shall be able to bridge expansion cracks that may occur.

5. Field acceptance of CIPM shall be based on the Owner's evaluation of the proper monolithic lining of the manhole. Field acceptance shall also be based on the Owner's evaluation of the appropriate installation and curing test data along with review of the manhole inspections.

6. The CIPM shall provide a continuous monolithic lining with uniform thickness throughout the manhole interior. If the thickness of the CIPM is not uniform or is less than specified, it shall be repaired or replaced at no additional cost to the Owner.

   a. The Owner will measure the CIPM cured thickness by physically cutting through the lining (by drilling or coring) and making a direct measurement. There will be up to two thickness measurement locations in each CIPM manhole. A suitable non-destructive type of thickness measurement may also be used.

   b. All CIPM thickness measurement locations shall be repaired by the Contractor in accordance with the manufacturer's recommendations. These repairs shall be included in the two-year guarantee.

   c. The Contractor shall also perform in-place testing in each manhole to verify the adhesion of the CIPM to the existing manhole substrate. Adhesion strength tests shall be in accordance with ASTM D7234 and the test area shall be isolated from the remaining portion of the manhole by coring through the liner into the substrate. Two tests shall be performed in each manhole at locations directed by the Owner. Testing shall consist of a calibrated pull off test. All equipment shall be provided by the contractor. Samples must meet a minimum pressure resistance of 400 psi.

7. There shall be no cracks, voids, pinholes, uncured spots, dry spots, lifts, delaminations or other type defects in the liner.

J. Epoxy Manhole Monolithic Lining System (EMMLS) Installation:

1. Field acceptance of EMMLS shall be based on the Owner's evaluation of the proper monolithic lining of the manhole. Field acceptance shall also be based on the Owner's evaluation of the appropriate installation and curing test data along with review of the

manhole inspections.

2. The EMMLS shall provide a continuous monolithic lining with uniform thickness throughout the manhole interior. If the thickness of the EMMLS is not uniform or is less than specified, it shall be repaired or replaced at no additional cost to the Owner.

   a. The Owner will measure the EMMLS cured thickness by physically cutting through the lining (by drilling or coring) and making a direct measurement. There will be up to two thickness measurement locations in each EMMLS manhole. A suitable non-destructive type of thickness measurement may also be used.

   b. All the EMMLS thickness measurement locations shall be repaired by the Contractor in accordance with the manufacturer's recommendations. These repairs shall be included in the two year EMMLS guarantee.

   c. The Contractor shall also perform in-place testing in each manhole to verify the adhesion of the EMMLS to the existing manhole substrate. Adhesion strength tests shall be in accordance with ASTM D7234 and the test area shall be isolated from the remaining portion of the manhole by coring through the liner into the substrate. Two tests shall be performed in each manhole at locations directed by the Owner. Testing shall consist of a calibrated pull test. All equipment shall be provided by the contractor. Samples must meet a minimum pressure resistance of 400 psi.

3. There shall be no cracks, voids, pinholes, uncured spots, dry spots, lifts, delaminations or other type defects in the EMMLS.

K. Enhanced Cementitious Liner

1. The monolithic cementitious lining shall cover the complete interior of the existing sewer manhole including the benches (shelves). The lining shall effectively seal the interior surfaces of the sewer manhole and prevent any penetration or leakage of groundwater infiltration.

2. The lining shall be compatible with the thermal condition of the existing sewer manhole surfaces. Surface temperatures will range from 20°F to 100°F. Provide test data on shrinkage of the cementitious lining based on ASTM C596.

3. If an internal flexible chimney seal is called for in the Contract Documents, then the lining shall be installed 1-inch below the bottom of the manhole frame. If no internal flexible chimney seal is called for in the Contract Documents, then the lining shall be installed to 2 to 3 inches above the bottom of the manhole frame.

4. The termination of and surface of the lining shall be suitable for proper installation of the manhole frame-chimney seal specified.

5. The cured system shall be continuously bonded to all brick, mortar, concrete, chemical sealant, grout, pipe and other surfaces inside the sewer manhole.

6. Chemical sealants, grouts or patching materials used to seal active manhole leaks, to patch cracks, to fill voids and to otherwise prepare the manhole surface prior to

application of the system shall be fully compatible with the system.

2.3 LINER AND COATING ACCEPTANCE AND TESTING

A. The Owner may enter the manholes to inspect the benching, invert channels, manhole wall/pipe connections, surface preparation, and other parts of the Work. The Contractor shall provide forced air ventilation, gas monitors and detectors, harnesses, lights, etc. for the Owner to enter the manhole and perform the inspection in complete accordance with OSHA requirements at no additional cost to the Owner.

B. The finished manhole surface shall be continuous and as free as commercially practicable from significant defects. Any defects which will affect, in the foreseeable future, or warranty period, the integrity or strength of the manhole shall be repaired at the Contractor's expense, in a manner mutually agreed upon by the Owner and the Contractor.

C. There shall be no cracks, voids, pinholes, uncured spots, dry spots, lifts, delaminations or other type defects in the liner. If any defects are discovered after liner has been installed, it shall be repaired or replaced in a satisfactory manner within 72 hours and at no additional cost to the Owner. This requirement shall apply for the entire guarantee period.

D. Active infiltration through the lining system be zero.

E. The Contractor is responsible for coordinating testing times with the Engineer schedule as the field representative may be involved in other tasks for scope on this project.

F. All rehabilitated manholes shall be tested. The Contractor shall submit proposed method for testing. One or more of the following tests shall be performed by the Contractor as directed by the Owner.

1. Cementitious and Enhanced Cementitious

a. Visually verify the absence of leaks or physical defects.

b. Cementitious manholes rehabilitation thickness shall be tested by inserting a measurement device at 8 defined locations in the manhole, as directed by Owner.

c. Four 3-inches by 6-inch test cylinders or six 2-inch cubes shall be cast each Day or from every 50 bags of product used. The test specimen shall be properly labeled and sent in for testing in accordance with the manufacturer's directions for compression strength testing as described in ASTM C 495. The frequency may be reduced by the Owner at their discretion if the samples pass the required strengths.

d. Pull off test in accordance with ASTM D4541 with a minimum acceptable pull strength of 250psi. The failure point of the pull must located within the substrate not within the coating thickness.

2. Cured in Place Manhole Liner (CIPM)

a. Visually verify the absence of leaks or physical defects.

b. Vacuum Test or Hydrostatic Test: Either a vacuum test conforming to the requirements of ASTM C1244 or the Exfiltration Test shall be performed for every lined manhole or circular structure where practical. The Exfiltration Test shall consist of plugging incoming and outgoing sewer lines (or performing prior to reinstating the holes) and filling the manhole with water up to the rim. After initial absorption (15 minutes), if the water loss exceeds one inch in depth in five minutes, the manhole shall have failed the test. Each manhole which fails the test shall be carefully inspected to determine the problem and then resealed and retested until the water loss is less than one inch in 15 minutes.

3. Epoxy Manhole Monolithic Lining System (EMMLS)

a. Visually verify the absence of leaks.

b. Holiday detection test: A holiday detection test shall be performed in accordance with subsection 2.4.C.2 of Section 802 – Sanitary Gravity Sewer Systems.

c. Pull off test in accordance with ASTM D4541 with a minimum acceptable pull strength of 250psi. The failure point of the pull must located within the substrate not within the coating thickness.

2.4 MANHOLE STEP REMOVAL

The Contractor shall remove all steps. Removal shall consist of neatly cutting steps flush with the wall prior to any lining installation. The Contractor shall be responsible for proper disposal of steps.

2.5 MANHOLE FRAME AND COVER REPLACEMENT

A. Excavation and site restoration in paved and unpaved areas shall be in accordance with Divisions 3, 5, and 6 of these *Regional Construction Standards* to a minimum of established pre-construction conditions.

B. The Contractor shall remove and dispose of the existing manhole frames and covers, as specified in the Contract Documents. It shall be the responsibility of the Contractor, at no additional cost to the Owner, to repair any damage to the chimney or corbel caused by the removal of the existing manhole frame.

C. New replacement frames and covers shall be as specified in Sections 200 – Products and Materials, Section 802 – Sanitary Gravity Sewer Systems, and the *Regional Construction Standards* Standard Details.

D. Repair of Manhole Chimney and Corbel, Requiring Excavation (when directed by the Owner):

1. In Paved Areas:

a. The removal of the manhole frame shall be accomplished by making a square cut of sufficient size in the pavement.

b. Material in the exposed area shall be dug out to a sufficient depth to permit the required repairs. All excess material, including pavement, shall be

disposed of as surplus material in accordance with Section 303 - Earthwork.

c. Backfill materials shall be in accordance with VDOT *Road and Bridge Standards.*

d. Backfill shall be replaced and compacted to prevent settlement and to restore the setting to a condition equal to or better than that found in accordance with Section 303 - Earthwork. Backfill shall not cover the manhole.

e. The surfacing needed to cover the exposed area (concrete or asphalt) shall conform to the existing pavement. It shall be placed to the same elevation and grade and have a thickness equal to or greater than the existing pavement.

f. Replacement of pavement not satisfactorily performed by the Contractor shall be reworked at no expense to the Owner.

2. In Unpaved Areas:

a. Only necessary excavation around manhole shall be performed.

b. Backfill shall be replaced and compacted to prevent settlement and to restore the setting to a condition equal to or better than that found in accordance with Section 303 - Earthwork. Backfill shall not cover the manhole.

c. Any private property element or structure that is removed for access to the manhole shall be replaced by the Contractor to existing or better condition to the satisfaction of the property owner.

3. The Contractor shall take all necessary precautions to prevent falling debris from damaging the manhole trough and/or entering the sewer. The damaged or deteriorated portions of the existing manhole chimney and corbel shall be removed and property disposed of by the Contractor.

4. The chimney and corbel shall be repaired or rebuilt with new brick or precast concrete grade rings as appropriate to reconstruct the chimney to the height needed for the frame and cover to meet the required grade. The manhole frame shall be sealed using either a manufactured or applied sealing method.

2.6 INTERIOR FLEXIBLE CHIMNEY SEALANTS

Interior Flexible Chimney Sealants shall provide corrosion protection and prevent infiltration through the interior of the manhole frame and chimney area of the manhole. Interior flexible chimney sealants shall be installed according to the manufacturer's recommendations. Interior flexible chimney sealants shall prevent leakage of water into the manhole though the frame joint area and the area above the manhole cone including all extensions to the chimney area. The sealant shall remain flexible allowing for repeated vertical or horizontal movements of the frame due to frost lift, ground movement, or the thermal movement of pavement. The final liner material shall be made of no less than 170 mils of corrosion resistant flexible urethane resin coating to be applied to the inside wall of the entire chimney area as described above. The product shall have a minimum elongation of 800% and a Durometer hardness of 75. Final liner shall have a minimum tensile and adhesion strengths of 1150 psi and 175 lb. l/in. respectively. The manhole sealant shall conform to the physical requirements of ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and

Thermoplastic Elastomers-Tension.

Sealant shall equal or exceed “Flex-Seal” as manufactured by Sealing Systems, Inc., Loretto, MN.

2.7 FINAL ACCEPTANCE

After the various types of rehabilitation work have been completed, the Work shall be visually inspected for compliance and tested for water tightness by the Contractor in the presence of the Owner. If a water tightness test cannot be conducted on the proposed product and/or rehabilitated manhole, the Contractor shall note that with the manhole rehabilitation product shop drawing submittals and shall provide an alternate test method for review and approval by the Owner, at no additional expense to the Owner. If a post-rehabilitation water tightness test is not provided, the Contractor will not receive full compensation for the manhole rehabilitation tasks. The Owner reserves the right to inspect the rehabilitated manholes during the warranty period. Any leakage or defects in the Work found by this inspection shall be corrected by the Contractor within 30 days from notice, at no additional cost to the Owner.

III. MEASUREMENT FOR PAYMENT

A. Measurement for payment for manhole rehabilitation will be the actual vertical distance measured along the center of the manhole from bottom of the frame to centerline of invert.

Payment under this item shall include all:

1. Chimney seal,
2. Equipment,
3. Flow Control/Bypass Pumping (Less than 2 MGD),
4. Incidentals for cleaning,
5. Labor,
6. Liner application,
7. Materials,
8. Removal of steps,
9. Repairing,
10. Root removal,
11. Sealing of all surfaces including walls, chimney, inverts and benches,
12. Site restoration and other incidental work,
13. Surface preparation,
14. Testing,
15. Tools, and
16. Traffic Control.

B. Measurement for payment for manhole frame sealing will be measured on a unit price basis for each internal manhole frame sealed and approved. Payment will include:

1. All labor, materials, equipment, tools, and incidentals for preparing the internal frame and cone area,
2. Sealant application,
3. Testing and,
4. Traffic control.

End of Section