

ITEM 16X

MANHOLE LINING

1.0 DESCRIPTION. This work shall consist of providing all labor, materials and equipment necessary to line, prevent infiltration into, and provide corrosion protection for new and/or existing manholes, wet wells, vaults or other wastewater structures. Work shall include mobilization, demobilization, and maintenance of traffic during construction.

The equipment utilized shall be specialized equipment which shall reduce the amount of time the manhole, wet well, vault or other structure is out of service. It is the intent that whatever method of lining is approved, that the down time for a standard manhole is kept to a maximum of 3 hours.

2.0 SUBMITTALS. The Contractor shall submit the following in accordance with the conditions of this Contract.

A. Reference Standards. For each type of product indicated.

1. For all materials utilized in the lining preparation and final application shop drawings shall be supplied indicating showing conformance to project drawings and requirements and to applicable ASTM specifications listed in this specification. The Lining manufacturer/producer shall certify that such products will meet the ASTM specifications.
2. For any specific and/or unique materials necessary for proper preparation or installation of the lining product, if required by the Owner, the lining manufacturer shall supply shop drawings and/or informative literature. Supporting calculations and design details shall be available upon request. The lining manufacturer shall warrant that such products will perform the intended task.

B. Shop Drawings.

1. Shop drawings shall be furnished by the lining manufacturer/producer for approval by the Engineer. These drawings shall show complete design, installation, and construction information in such detail as to enable the Engineer to determine the adequacy of the proposed system for the intended purpose. The means of watertight pipe connection information shall be included indicating confirmation to this specification as well as to the Ohio EPA requirements.
2. The drawings shall include a schedule, which will list the size and type of structure to be lined, the location where they are to be used, orientation and lining of all items which are part of the structure such as sump pits, inverts etc.

3. As this specification requires graduated multiple coats, the shop drawings shall specify the proper number of coats and curing time between them, if any, as per the manufacturer's application requirements.
4. The shop drawing submittal shall include all work as indicated with the detail contact plan drawings.
5. The Contractor shall provide one (1) electronic copy of materials, equipment, equipment lists and spare parts data submittals in accordance with the provisions of the "General Conditions" and "Supplemental General Conditions" of this Contract.
6. Shop drawings shall indicate all principal dimensions, general construction and materials for the sewer system as specified herein.
7. Shop drawings shall:
 - a. Show relationship of all lining to structure components, connections, and support items.
 - b. Be complete in all details and include identified parts lists.
 - c. Be submitted for review and approval.
 - d. Not be Manufacturer's catalog or general web-site information. These types of submittals will NOT be sufficient to fulfill shop-drawing requirements and will be returned as "Not Approved."
8. After examination of such drawings by the Engineer and the return thereof, the Contractor shall make such correction to the drawings as have been indicated and shall furnish the Engineer with electronic corrections.
9. If requested by the Engineer, the Contractor must furnish additional hard copies.

3.0 MATERIALS. All materials required for the lining system shall be approved by a SCMSD representative. All lining systems and accessories shall comply with the following requirements. Equivalent materials of other manufacturers may be substituted on approval of the SCMSD representative reviewing all submittals.

A. Plugging Materials.

1. Chemical sealants or hydraulic grouts shall be used to plug and seal active manhole or wet well leaks. These materials shall be compatible with the approved lining system and approved by the Engineer, prior to usage.
2. The plugging materials shall:
 - a. Adhere to wet or dry surfaces.
 - b. Be 100% solids.
 - c. Be quick setting.
 - d. Have zero percent shrinkage per ASTM D2126.
 - e. Be ASTM, ANSI and NSF approved.
3. Recommended material manufacturers are Thoro Seal, Green Mountain Inc., Sika, Avanti International, or approved equal.

B. Structural Repairs.

1. Loose or protruding brick, mortar and concrete shall be removed using a mason hammer and chisel. All structural repairs necessary to complete the lining process shall be made with a non-shrink grout compatible with the lining system manufacturer's recommendations.
2. This material shall be applied to patch cracks, fill voids, make structural repairs, and build- up deteriorated structure surfaces back to original thickness.
3. All repair and/or patching materials shall be submitted to the Engineer for approval prior to material usage.

C. Cementitious Substrate Installation (RAVEN 405 Only).

1. An intermediate one (1") thick, uniform cementitious substrate/leveling course will be permitted for use on brick or masonry block type manholes and structures (not concrete or metal structures).
2. The cementitious product used shall be Reliner MSP Cement by Standard Cement Materials, Inc or SCSMSD approved equal.
3. Installation shall be in accordance with all Raven 405 manufacturer's installation instructions.

D. Lining Materials.

1. The lining materials shall be a self-priming monolithic system that eliminates infiltration, is designed and manufactured to provide chemical resistance to hydrogen sulfide and be third party tested and certified for a design life of no less than 50 years.
2. SCSMSD approved lining systems and manufacturers are as follows:
 - a. SprayWall by SprayRoq.
 - b. SpectraShield by CCI Spectrum Inc.
 - c. OBIC by OBIC LLC.
 - d. Raven 405 by Raven Industries Inc.
 - e. Engineer approved equivalent.

E. Qualifications. The Contractor shall be a certified applicator of the lining system, and provide the following documentation from the manufacturer.

1. All employees are trained and certified in the preparation and installation of the lining system.
2. Documentation from the Manufacturer that certifies they have performed similar work on at least 200 manholes, wet wells, vaults or other wastewater structures or a combination thereof.
3. Five (5) project references which include the following information:
4. Project Description and Scope of Services.
 - a. Project Owner.
 - b. Project Locations.
 - c. Quantity and types of Structures Lined.
 - d. Point of Contact (email or phone number).
 - e. Start and Completion dates.

F. Inflow Dish Inserts. (As Required).

1. Each lined manhole shall be provided with an inflow dish insert to prevent rainwater from entering the manhole through the manhole cover.
2. The inflow dish inserts and components shall be manufactured of materials resistant to corrosion from the atmospheres containing hydrogen sulfide and dilute sulfuric acid.
3. The inflow dish shall allow venting of sewer gases and vacuum release, be gasketed, and allow no more than 1 gallon per 24-hour period to inflow into the manhole.
4. The recommended manufacturers are:
 - a. V2P Manhole Inserts by Parson Environmental,
 - b. Rainstopper manhole insert by WBE Dorcas, Inc.,
 - c. Engineering approved equal.
5. Installation shall be in accordance with manufacturer's recommendations and shall not impede the proper seating of the manhole cover.
6. Each dish insert shall be spray-painted with an orange "X" to provide visible notification during nighttime that such a dish insert is installed. No holes shall be drilled into the dish inserts, except for those provided by during the manufacturing process

G. Internal Steps.

1. All cast or reinforced plastic steps within the structure shall be inspected for structural integrity.
2. If the steps are found to be in good condition than the contractor shall line around the steps.
3. If the steps are found to be defective then the contractor shall remove the steps. Removal of steps shall be cut flush with the manhole, wet well, vault or structure wall such that the removal shall not affect the structural integrity of the concrete, brick prior to lining of said structure.
4. The Contractor shall repair any surface deficiencies prior to lining the structure in accordance with the specification herein.

H. Manhole Castings and Lids.

1. Any loose casting shall be reset utilizing anchor bolts and Kent Seal bitumastic.
2. The contractor shall remove any chimney seals at all manholes and make any repairs necessary to stop ingress of water or assure the surface is properly prepped to receive the liner coating.
3. All internal and external casting and lid surfaces shall be thoroughly cleaned of all grit and rust via a wire brush, hand grinder and pressure washer. If the casting and lid cannot be properly cleaned it shall be replaced.
4. The Contractor shall reset the casting to the proper elevation in accordance with all Stark County Metropolitan Sewer District's requirements.
5. The contractor shall line to the top rim of the internal casting surface as part of the continuous lining system.
6. For wet well, vault or other structure hatches, the contractor shall thoroughly clean the internal frame systems and line to the frame where ever possible.

4.0 EXECUTION. Lining installation procedures shall conform to all plans, drawings, and the manufacturer's specifications and requirements. Access to manholes, wet wells, vaults or other wastewater structures shall follow all OSHA confined space entry requirements.

A. Bypassing Sewage.

1. The Contractor shall bypass the sewage around existing manholes or wet wells that are to be lined; an existing upstream manhole shall be plugged and the sewage shall be pumped into a downstream manhole or adjacent system. Use of any invert "flow-through" device shall be limited to an as-needed basis, and only upon the written approval of the Engineer.
2. The bypass system shall be of adequate capacity and size to handle the existing peak flows (See Item 51). Under no circumstances will the dumping of raw sewage on private property or in streets be permitted.

B. Surface Preparation.

1. All manhole, wet well, vault or other structures surface preparation shall conform to the manufacturer's recommendations for the intended substrate - refer to the system specification listed at the end of this Item for the specific product requirements.
2. New precast concrete manholes, wet wells, vaults or structures shall not be lined prior to 28 days following their manufacture date. All water used shall be clean and potable.
3. No lining shall be made to any structure when ambient temperature is below 50° Fahrenheit or when the substrate surface temperature is below 55° Fahrenheit, unless approved by the manufacturer in writing that the temperature will not affect the integrity of the lining system.

C. Plugging Active Water.

1. The Contractor shall stop all active water infiltration in said manholes, wet wells, vaults or structures by troweling, injecting and/or pumping a quick setting non-shrinking Cementitious grout or polyurethane chemical grout into any dislodged section joints, pipe connections, cracks or spalled areas greater than 3/4".
2. This work shall include by not be limited to the removal of any chimney seals, repair to the structure surface or resetting of the casing then lining the structure and re-installation or replacement of the chimney seal.
3. This material and procedure shall be for the stopping of active water only. Any areas that require structural repair shall utilize the non-shrinking grout as specified above. All excess material shall be removed from internal wall surfaces.

D. Structural Repairs.

1. After all active infiltration has been stopped, the Contractor shall utilize a non-shrinking grout to structurally repair or build-up any deteriorated manhole or wet well surface back to the original surface thickness. The Contractor shall repair any

dislodged section joints, pipe connections, cracks or spalled areas greater than 3/4".

E. Application of the Lining System.

1. All pipe inverts shall be plugged with a removable plug to protect the pipes from lining over-spray. The Contractor shall apply the lining system per the manufacturer's recommendations.
2. The interior surface shall be considered to include the entire area from the inside top of the manhole, wet well, vault or other structure casting or lid to the bench/invert or floor elevation.
3. In cases where moisture or temperature is a concern, a propane-fired heater shall be utilized to assist in reduction of curing time.
4. Where existing concrete surface of the structure has eroded such that spray coating will not attain a smooth and uniform surface, it shall be built up to a smooth surface by the use of an approved filler material as specified above. Where the depth of the defect consistently exceeds 3/4", the area shall be trowel smooth prior to spray liner application
 - a. Lining thickness determination shall include the following considerations:
 - i. Vertical depth of lining product.
 - a) Manufacture shall consider hydraulic pressure based upon depth.
 - ii. Condition of manhole.
 - a) Structural repair and water inflow control.
 - b) Water inflow control.
 - iii. The lining thickness requirement indicated below shall be verified by the approved lining manufacturer and submitted to the engineer for pre-approval, as part of the shop drawing requirement prior to field installation.
 - iv. The minimum total lining thickness per manufacturer, as listed below per structure shall be:
 - a) Spray Wall - 250 mils.
 - b) SpectraShield - 500 mils.
 - c) OBIC - 500 mils.
 - d) Raven 405 - 250 mils.
 - v. Unless otherwise required by the lining manufacturer, for all structures, the Contractor shall apply the approved lining system as specified herein to the entire interior surface of the structure in four (4) graduated coats, each coat providing a minimum mil thickness as determined by the manufacturer to achieve the required total system thickness.
 - a) Structures up to 15 feet deep - The Contractor shall apply four (4) graduated coats at a minimum thickness in mils, as determined by the manufacturer, to achieve the minimum total system thickness requirement in mils. The requirement for multiple coats will be determined by the manufacturer's recommendation.
 - b) Structures 15 to 25 feet deep - The Contractor shall apply four (4) graduated coats at a minimum the manufacturer, to achieve the

minimum total system thickness requirement, in mils. The requirement for multiple coat mined by the manufacturer's recommendation.

- c) Structures over 25 feet deep - The Contractor shall apply four (4) graduated coats at a minimum thickness in mils, as determined by the manufacturer, to achieve the minimum total system thickness requirement in mils. The requirement for multiple coats will be determined by the manufacturer's recommendation.
- vi. Each coat shall be sprayed via a pleural spray system to assure a uniform coating application.
- vii. Each coat shall be applied one after the other with an average cure time of two (2) to (3) hours between each coat or in accordance with material manufacturers requirements.
- viii. The entire interior surface shall include all area from the top of the structure or manhole casting to structure base or below the existing liquid flow line. This includes any internal piping located within said structure.
- ix. In manholes or wet well structures if flow is required to be bypassed, the entire manhole invert and wet well base shall also be coated.
- x. In cases where moisture or temperature is a concern a propane-fired heater shall be utilized to assist in reduction of curing time.
- xi. No solvents shall be used.

F. Lining Repair Procedure.

1. After the application of the lining system, it shall be visually inspected to identify any defects such as pinholes, lifts, etc. If any defects or deficiencies are found, they shall be repaired per the manufacturer's recommendations.

G. Clean Up.

1. Upon completion of the coating installation, all pipe inverts shall be inspected for any coating over-spray, debris, or deposits that may be present. The Contractor shall thoroughly clean all pipe inverts to remove any remaining material, whether it is the result of the coating installation or not. All material removed from the pipe inverts shall be hauled and properly disposed of offsite by the Contractor. Once the inverts have been inspected and cleaned, the temporary pipe plugs shall be removed.

5.0 ELECTRICAL. This section is not applicable.

6.0 QUALITY ASSURANCE.

A. Testing. The Contractor shall provide the following testing as part of this specification requirement.

1. Wet Gauge Testing or Ultrasonic Testing: The Contractor shall provide either Wet Gauge or Ultrasonic testing to verify the coating thickness requirement are met.

- a. Said tests shall be performed at random locations.
 - b. Three (3) tests shall be performed per every five (5) linear foot of depth of the structure. The Contractor shall provide the standard gauges required for testing.
 - c. Gauges and testing procedure shall be in accordance with ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings.
 - d. Test location shall be selected by the Stark County Metropolitan Sewer District Engineer or Resident Representative.
 - e. All results shall be made available to said SCMSD representative immediately after performing said test.
2. Ultrasonic testing: The Contractor shall provide verification of dry film thickness by means of ultrasonic testing
 - a. Said test shall be performed prior to the final coat application to determine the accumulated thickness of the previous coats. Three (3) tests shall be performed per every five (5) linear foot of depth of manhole.
 - b. All results are to be made available to the PCWR Representative immediately upon completion of said test.
 - c. The Contractor shall provide all testing equipment.
 3. Vacuum test: (Manholes Only) All vacuum testing shall be in accordance with the following requirements.
 - a. ASTM C 1244-93 (2000): "Standard Test Method for Concrete Sewer Manholes by Negative Air Pressure Vacuum) Test.
 4. Test Failures. In the event of any failures of the above-mentioned tests, the Contractor shall be responsible to:
 - a. Repair all deficiencies discovered by said testing.
 - b. Retest said manholes to assure all deficiencies have been properly repaired.
 5. All repairs and re-testing of said structures shall be made in accordance with these specifications and Manufacturer's requirements, at the Contractors expense.

B. Observation.

1. SCMSD designated representative will visually observe the work performed. The representative will notify the Engineer of any discrepancies with the contract documents in the course of the contractor performing the work. The progress observations by the SCMSD do not waive any rights or remedies, nor divest the Contractor of any responsibility for contract compliance or liability for damage.

C. Warranty. The contractor shall provide the following warranty and inspection on all structures lined under this specification.

1. Lining system warranty. The Contractor/Manufacturer shall provide the following warranty on all structures lined under this specification/contract;
 - a. Manufacturers Standard Warranty. The Manufacturer shall provide the manufacturers standard warranty for the lining system.

- b. Ten (10) Year Extended Warranty. In addition to the standard manufacturer's warranty the contractor/manufacturer shall provide a ten (10) year extended warranty on each structure lined under this specification against material delamination and all other defects in workmanship and materials, as described below for a period of ten (10) years after the completion and acceptance of the lining system.
 - c. Any defect or failure shall be repaired within four (4) weeks from the date of notification, at no additional cost to the County.
 - d. Two (2) year maintenance bond upon completed and acceptance of all work in accordance with the General Conditions of the Contract Documents.
2. Contractor's warranty inspection: At the Contractor's expense, on or near the first (1st), fifth (5th), and ninth (9th) anniversary dates of final project acceptance, the Contractor shall perform a complete inspection of each lined manhole, wet well, vault or structure lined, as indicated on all detail plans.
 - a. The Contractor/Manufacturer performing the first (1st), fifth (5th), and ninth (9th) year inspections shall provide:
 - i. A comprehensive inspection report for each structure lined and inspected. The report shall include but not be limited to:
 - a) Structure type.
 - b) Structure location.
 - c) Date of liner installation.
 - d) Description of liner condition.
 - e) Test result.
 - f) Complete digital photographic documentation of the liner condition of the inspected structure.
 - ii. Said report and photographs shall be provide electronically on a USB drive.
 - a) USB drive shall be labeled and provided with a table of contents indicating the structures inspected with the report.
 - iii. Provided to the SCMSD Engineer within 10 working days of said inspection.
3. All inspections shall be arranged through the SCMSD office. SCMSD reserves the right to require county representatives being present during all inspections.
4. The contractor shall be responsible, at their expense, to re-inspect any structures if:
 - a. The inspections were not arranged through the SCMSD Engineer.
 - b. Any inspections performed without a SCMSD Representative, when required
5. Any defects found during said inspections shall be promptly repaired in accordance with the fore mentioned specifications and all manufacturers specifications. **In no case shall the contractors/manufacturers liability for repairs exceed the total contract price per structure lined.**
6. Failure will be deemed to have occurred if the protective lining:
 - a. Shows signs of surface delamination.
 - b. Fails to prevent the internal deterioration or corrosion of the structure.
 - c. Fails to protect the substrate and environment from contamination by effluent.
 - d. Fails to prevent groundwater infiltration.

7. Repaired manholes shall be re-inspected at no cost to the County.

7.0 MEASUREMENT. The number of manholes to be paid for under Item 16X, shall be the number of manholes lined.

8.0 PAYMENT. The unit pricing stipulated for the provision of all labor, equipment and materials necessary for Item 16X as specified above and located on all detail drawings, shall be as follows:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
16X	EA	Manhole Lining
16X	EA	Wet Well Lining
16X	EA	Vault Lining
16X	EA	Structure Lining

END OF SECTION