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   (3) CEMENTITIOUS LINER INSTALLATION
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   (6) MANHOLE FRAME AND COVER REPLACEMENT

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   (2) DELIVERABLES
   (3) MEASUREMENT FOR PAYMENT
PART ONE: PROJECT-SPECIFIC CONDITIONS

SECTION 101 PROJECT DESCRIPTION

This Specification covers the work necessary to rehabilitate a series of manholes within the Madison Metropolitan Sewerage District collection system. The Contractor shall provide all materials, labor, equipment, and services necessary for performing the specified method of rehabilitation, preparing the surface prior to rehabilitation, and all other procedures necessary to complete the work specified herein.

SECTION 102 SCOPE OF WORK

The table below provides a summary of the manholes scheduled for rehabilitation, the approximate year installed, approximate depth, and anticipated rehabilitation method.

<table>
<thead>
<tr>
<th>Manhole</th>
<th>Year</th>
<th>MH Dia.</th>
<th>Pipe Dia.</th>
<th>VF (est.)</th>
<th>Anticipated Rehabilitation Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH11-171</td>
<td>1968</td>
<td>6'</td>
<td>42&quot;</td>
<td>7.7</td>
<td>substrate repair and corrosion barrier</td>
</tr>
<tr>
<td>MH11-170</td>
<td>1968</td>
<td>6'</td>
<td>42&quot;</td>
<td>10.4</td>
<td>substrate repair and corrosion barrier</td>
</tr>
<tr>
<td>MH12-177</td>
<td>1968</td>
<td>5'</td>
<td>33&quot;</td>
<td>18.0</td>
<td>corrosion barrier</td>
</tr>
<tr>
<td>MH02-547</td>
<td>1959</td>
<td>6'</td>
<td>24&quot;</td>
<td>11.3</td>
<td>substrate repair and corrosion barrier</td>
</tr>
<tr>
<td>MH07-955</td>
<td>2001</td>
<td>8'</td>
<td>48&quot;</td>
<td>17.7</td>
<td>substrate repair and corrosion barrier</td>
</tr>
<tr>
<td>MH07-946</td>
<td>2005</td>
<td>6'</td>
<td>42&quot;</td>
<td>14.0</td>
<td>substrate repair and corrosion barrier</td>
</tr>
<tr>
<td>MH07-943</td>
<td>2005</td>
<td>6'</td>
<td>36&quot;</td>
<td>14.1</td>
<td>substrate repair and corrosion barrier</td>
</tr>
<tr>
<td>MH07-938</td>
<td>2005</td>
<td>7'</td>
<td>54&quot;</td>
<td>14.0</td>
<td>substrate repair and corrosion barrier</td>
</tr>
<tr>
<td>MH07-937</td>
<td>2005</td>
<td>7'</td>
<td>54&quot;</td>
<td>11.4</td>
<td>substrate repair and corrosion barrier</td>
</tr>
<tr>
<td>MH07-936</td>
<td>2005</td>
<td>7'</td>
<td>54&quot;</td>
<td>11.0</td>
<td>substrate repair and corrosion barrier</td>
</tr>
<tr>
<td>MH07-934</td>
<td>2005</td>
<td>7'</td>
<td>54&quot;</td>
<td>14.5</td>
<td>substrate repair and corrosion barrier</td>
</tr>
<tr>
<td>MH13-137</td>
<td>1971</td>
<td>6'</td>
<td>48&quot;</td>
<td>6.3</td>
<td>substrate repair and corrosion barrier</td>
</tr>
</tbody>
</table>

Total Estimated vertical feet (VF) = 150.4 vertical feet of 5 to 8 foot diameter manhole substrate repair and corrosion barrier. VF is measured from bottom of manhole casting to the top of the bench.

The Contractor shall rehabilitate all manholes on this project from the bottom of the metal manhole casting to the top of, and including, the benches. This includes all adjusting rings, cone sections, decks, deck ceilings, intermediate decks, etc. The Contractor shall not be required to rehabilitate the flow channel. Bench rehabilitation shall be measured and paid separately from rehabilitation of vertical manhole surfaces.

The Project Drawings detail the location of these manholes. If necessary, District staff will assist in locating manholes. Also included with the Project Drawings is a standard manhole detail and shop drawings from when the manholes were installed. These are for reference only. Contractor shall field-verify all information shown on the drawings.

Access to MH02-547 will require a lane closure on University Avenue. University Avenue is a busy street, and the City of Madison has indicated that lane closures will only be allowed between the hours of 9am and 3pm. Contractor is responsible for traffic control in all project areas and must produce a traffic control plan per section 204 (9).

It is not anticipated that grouting will be required as a part of this project. However, the Contractor shall still be responsible for stopping any active infiltration found. If grouting is required, the Contractor shall use a commercially acceptable grouting product and shall adhere to section 207(2)(b). Costs for grouting shall be considered as incidental to the Contract.
The District shall retain the services of a coatings inspector to enforce the requirements contained and referenced in this specification. The costs of this inspector shall be borne by the District. As specified in section 207(4)(a), the epoxy or polyurethane coating shall be applied in 2 coats. The coatings inspector shall preform holiday testing only after both coats have been applied. Exceptions may be made for certain coating types at the discretion of the District’s Engineer. The Contractor is encouraged, but not required, to incorporate the inspection procedures contained within into their quality assurance program.

SECTION 103 ESTIMATED FLOWS

The table below provides a summary of the estimated peak and average daily flows in each section. The flow in the sewers varies greatly depending upon time of day. The estimated flows, as taken from the 2009 MMSD Collection System Evaluation, are detailed in the following table:

<table>
<thead>
<tr>
<th>ESTIMATED FLOWS (2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream MH</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td>07-955</td>
</tr>
<tr>
<td>PS16</td>
</tr>
<tr>
<td>PS12</td>
</tr>
<tr>
<td>TE05-22376</td>
</tr>
<tr>
<td>TE14-11057</td>
</tr>
</tbody>
</table>

Bypassing will not be required as a part of this project. It is anticipated that this work can be completed without bypassing flow. However, if bypassing is required by the coating/lining manufacturer and/or the Contractor believes that bypassing will be necessary, this shall be accounted for in their bid proposal.

SECTION 104 PROJECT SCHEDULE

Start of construction shall be Monday May 20, 2013. Final completion (rehabilitation complete, all deliverables received) shall be Friday, October 18, 2013. The delay between start of construction and final completion is to allow for flexibility of schedule. It is not anticipated that the work will take as long as this time span allows for.

SECTION 105 EASEMENT ACCESS

The following manholes are located on private properties and within easements:

<table>
<thead>
<tr>
<th>Manhole</th>
<th>Property Address</th>
<th>Property Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-137</td>
<td>5099 Comanche Way</td>
<td>Cherokee Townhouse Condo Homes</td>
</tr>
<tr>
<td>07-949</td>
<td>1919 S. Stoughton Rd.</td>
<td>Stoughton Properties LLC.</td>
</tr>
<tr>
<td>07-948</td>
<td>4702 Helgesen Dr.</td>
<td>Plestina Services INC.</td>
</tr>
</tbody>
</table>

The Contractor shall be responsible for providing these property owners with a notice of intent to access the manholes located in these easements a minimum of three (3) days prior to anticipated access as described in section 204(5).

SECTION 106 ACCEPTABLE PRODUCTS

The following is a generic list of products that the District has determined to be acceptable for specific rehabilitation applications. All products proposed by the Contractor are subject to approval by the District for use with a specific project. The Contractor must submit information about the product intended for use in the
project for approval prior to bidding. Products not on this list may be considered for approval, but the specified submittal data must first be received and approved by the District prior to submitting a bid for this work. The products proposed for use on this project by the Contractor must be submitted and approved as a part of the pre-qualification process.

a) Substrate Repair

   i. Sauerisen Sewerseal No. F-170
   ii. Quadex QM-1s Restore
   iii. Raven 755
   iv. Permacast MS-10,000
   v. CemTec Mortar

b) Corrosion Barrier- Epoxy or Polyurethane Corrosion Liner

   i. Sauerisen Sewergard No. 210 series Epoxy
   ii. Quadex Structure Guard Epoxy
   iii. Raven 405 Epoxy
   iv. CorCote Epoxy
   v. SherFlex Polyurethane

c) Composite Systems (Substrate Repair and Corrosion Barrier)

   i. SpectraShield
   ii. SprayWall
   iii. PPC Coating System

SECTION 107 SULFUR ANALYSIS

The following table is a summary of the results of sulfur monitoring in some sections of the Northeast Interceptor that was performed by district staff:

<table>
<thead>
<tr>
<th>Date</th>
<th>PS10</th>
<th>MH 07-954</th>
<th>MH 07-952</th>
<th>MH 07-947</th>
<th>MH 07-938</th>
<th>MH 07-936</th>
<th>MH 07-935</th>
<th>MH 07-310</th>
<th>MH 07-302</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>pH</td>
<td>SO4 (ppm)</td>
<td>pH</td>
<td>SO4 (ppm)</td>
<td>pH</td>
<td>SO4 (ppm)</td>
<td>pH</td>
<td>SO4 (ppm)</td>
<td>pH</td>
</tr>
<tr>
<td>4/18/2011</td>
<td>7.5</td>
<td>32.5</td>
<td>7.4</td>
<td>38.0</td>
<td>7.4</td>
<td>41.4</td>
<td>7.4</td>
<td>45.0</td>
<td>7.4</td>
</tr>
<tr>
<td>4/19/2011</td>
<td>7.3</td>
<td>34.2</td>
<td>7.4</td>
<td>39.3</td>
<td>7.2</td>
<td>58.0</td>
<td>7.3</td>
<td>33.2</td>
<td>7.4</td>
</tr>
<tr>
<td>4/20/2011</td>
<td>7.2</td>
<td>40.3</td>
<td>7.1</td>
<td>31.4</td>
<td>7.2</td>
<td>28.4</td>
<td>7.2</td>
<td>29.3</td>
<td>7.1</td>
</tr>
<tr>
<td>4/21/2011</td>
<td>7.4</td>
<td>40.4</td>
<td>7.2</td>
<td>33.2</td>
<td>7.3</td>
<td>31.0</td>
<td>7.3</td>
<td>33.1</td>
<td>7.4</td>
</tr>
<tr>
<td>4/22/2011</td>
<td>7.3</td>
<td>39.0</td>
<td>7.4</td>
<td>32.4</td>
<td>7.4</td>
<td>33.1</td>
<td>7.3</td>
<td>34.2</td>
<td>7.4</td>
</tr>
<tr>
<td>7/1/2011</td>
<td>7.2</td>
<td>37.2</td>
<td>7.2</td>
<td>29.8</td>
<td>7.2</td>
<td>67.2</td>
<td>7.3</td>
<td>30.7</td>
<td>7.3</td>
</tr>
<tr>
<td>7/5/2011</td>
<td>7.3</td>
<td>29.8</td>
<td>7.3</td>
<td>32.5</td>
<td>7.2</td>
<td>39.2</td>
<td>7.3</td>
<td>30.6</td>
<td>7.3</td>
</tr>
<tr>
<td>7/7/2011</td>
<td>7.2</td>
<td>40.0</td>
<td>7.1</td>
<td>31.9</td>
<td>7.0</td>
<td>104</td>
<td>7.2</td>
<td>40.0</td>
<td>7.2</td>
</tr>
<tr>
<td>7/8/2011</td>
<td>7.0</td>
<td>28.3</td>
<td>7.1</td>
<td>38.0</td>
<td>7.2</td>
<td>39.7</td>
<td>7.3</td>
<td>29.2</td>
<td>7.2</td>
</tr>
<tr>
<td>7/11/2011</td>
<td>7.4</td>
<td>40.5</td>
<td>7.0</td>
<td>438</td>
<td>7.3</td>
<td>35.0</td>
<td>7.4</td>
<td>32.8</td>
<td>7.4</td>
</tr>
<tr>
<td>7/15/2011</td>
<td>7.2</td>
<td>32.4</td>
<td>7.1</td>
<td>25.9</td>
<td>7.2</td>
<td>27.7</td>
<td>7.2</td>
<td>30.1</td>
<td>7.3</td>
</tr>
<tr>
<td>7/19/2011</td>
<td>7.2</td>
<td>31.8</td>
<td>6.7</td>
<td>124</td>
<td>7.2</td>
<td>35.8</td>
<td>7.2</td>
<td>28.7</td>
<td>7.2</td>
</tr>
<tr>
<td>7/20/2011</td>
<td>7.1</td>
<td>37.8</td>
<td>7.2</td>
<td>29.7</td>
<td>7.2</td>
<td>28.5</td>
<td>7.1</td>
<td>29.6</td>
<td>7.1</td>
</tr>
</tbody>
</table>
PART TWO: STANDARD MMSD MANHOLE REHABILITATION SPECIFICATIONS

SECTION 201 REFERENCED DOCUMENTS

This specification references standards from the American Society for Testing and Materials, the National Association of Corrosion Engineers (NACE), the Society for Protective Coatings (SSPC), such as: ASTM D4258, D4259, D4260, D4262, D4263, F1869, F2170, and C495; SSPC-SP 13/NACE No. 6, “Surface Preparation of Concrete”, SSPC-SP 13/NACE No. 5 “Recommended Practices for the Use of Manually Operated High Pressure Water Jetting Equipment”, NACE Standard RP0892, and IRCI Guideline No. 03732. which are made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.

SECTION 202 DESCRIPTION OF WORK

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 rehabilitation of manhole benches. If required, it is the Contractor’s responsibility to stop all active leaks in association with the lining of the manhole interiors. This will be considered as an extra to the Contract.

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

SECTION 203 PREQUALIFICATION OF BIDDERS

All Contractors seeking to become pre-qualified for this type of work must provide written documentation that their personnel have adequate experience and training in the installation of the proposed lining system and that the product to be used is commercially acceptable and meets all requirements of this specification. The installer must be certified by the product manufacturer in the installation of the product. For product acceptability, the product must have a minimum of 500 successful waste water collection system installations in the USA. For the installer to be qualified, they must have at least 5 years of active experience in applying industrial coatings and 3 years applying the proposed product. All prequalification documentation shall be submitted per the requirements in the Advertisement For Bids, the prequalification forms, and these specifications. It is the intent to disqualify any bidders not meeting the pre-qualification requirements before bids are accepted. MMSD reserves the right to reject the bid of any bidder who cannot meet the minimum requirements set forth in this section.

SECTION 204 GENERAL REQUIREMENTS OF CONTRACTOR

(1) SUBMITTALS

The Contractor shall submit the following for review and approval to the MMSD Engineer prior to performing any work under this Contract.

a) Product Data

i. Submit manufacturer’s product literature and application, installation requirements, recommended repair requirements, and technical data sheet on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.
ii. Submit product information for all cementitious liner, epoxy liner, and/or polyurethane liner materials, patching mix, grouting compound, and information for all other materials associated with the rehabilitation system proposed for use on this project.

iii. Submit prepared concrete surface acceptance criteria as required by section 205(6).

iv. Material Safety Data Sheets (MSDS) for each product to be used.

v. Design details for any additional ancillary systems and equipment to be used in site and surface preparation, application and testing.

b) Installer Qualifications

i. Manufacturer certification that Installer has been trained and approved in the handling, mixing and application of the products to be used. Certification letter shall be dated within six months of bid date.

ii. The Installer shall provide a minimum of four (4) references which demonstrate previous successful projects completed for the proposed rehabilitation system or comparable system during the last four (4) years.

iii. Certification that the equipment to be used for applying the products has been manufactured or approved by the protective coating manufacturer and Installer personnel have been trained and certified for proper use of the equipment. Certification letter shall be dated within six months of bid date.

iv. Proof of any necessary federal, state or local permits or licenses necessary for the project.

c) Digital Photos/Videos

i. Submit digital videos and/or photos of manholes in pre-rehabilitation condition. Photograph and document the location any active infiltration locations pre-rehabilitation.

d) Traffic Control Plan

i. Submit Traffic Control Plan to MMSD Engineer a minimum of one (1) week prior to the start of work. All traffic control, including signing and barricading of the work areas, shall be the Contractor’s responsibility and shall conform with the Federal Highway Administration’s “Manual on Uniform Traffic Control Devices”.

ii. The Contractor shall be responsible for obtaining and paying all fees for any permits required by the local municipality in addition to this submittal to MMSD.

e) Construction Plan

i. Submit a proposed schedule of work, showing how the work will be completed by the required date.

ii. Submit Construction Plan detailing access routes and proposed storage areas as required by Section 204(4) of these Specifications. Submit construction plan to MMSD Engineer a minimum of one (1) week prior to the start of work.

iii. If bypassing is deemed necessary by the Contractor, submit a bypass pumping plan in accordance with Section 204(7), including: list of equipment, primary and backup pump
sizes, estimated length of time required for bypassing, and planned pump suction and discharge locations to MMSD Engineer a minimum of one (1) week prior to start of work.

(2) QUALITY ASSURANCE

a) Installer shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE and SSPC standards and the protective coating manufacturer’s recommendations.

b) The District shall retain the services of a coating Inspector. The Inspector will observe surface preparation, application and material handling procedures to ensure adherence to the specifications. The inspector shall submit detailed inspection reports for all manholes that are rehabilitated. This includes pre-application inspection, coating thicknesses, coating adhesion, and any other manufacturer quality assurance requirements. The Quality Assurance Inspector retained by the District shall be licensed to perform the work and shall be subject to Owner approval. All costs for these inspection services to be borne by the District.

c) Contractor shall give District’s representative and coating inspector timely notice of readiness of work for all inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

d) District representatives and the District’s inspector shall have access to the site and the work at a reasonable times for their observation, inspection, and testing. Contractor shall provide proper and safe conditions for such access and advise them of Contractor’s site safety procedures and programs so that they may comply therewith as applicable. The interpretation of this shall mean, but not be limited to mean, that the Contractor shall provide the District’s coating inspector with access and proper safety equipment to access (harness, winch, gas detection, etc.) the manholes at appropriate times to perform inspection and testing.

(3) DELIVERY, STORAGE, AND HANDLING

a) Materials are to be kept dry, protected from weather, and stored under cover.

b) Protective coating materials are to be stored between 50°F and 90°F. Do not store near flame, heat, or strong oxidants.

c) Protective coating materials are to be handled according to their material safety data sheets.

(4) USE OF SITE

a) Access Points: The Contractor is responsible for determining the suitability of access points to the manholes. The Contractor shall submit access routes and proposed storage areas. These access routes and any proposed storage areas must be approved by MMSD before beginning work.

b) Private Property: Operation of construction vehicles or equipment and storage of materials shall not be allowed on private properties unless Contractor obtains written permission from private property owner. Contractor shall notify MMSD of intent to contact private property owner for the purpose of obtaining written permission to use the property at least 3 days prior to anticipated contact with the property owner.

c) Easement Access: The District owns permanent limited easements for most of its facilities located on private property. The Contractor must limit their access to within 15 feet from the centerline of the pipe in these easement areas unless permission for further access is obtained from the property owner as described in section 204(5)(b). The Contractor shall notify property owners of intent to access easement areas for rehabilitation a minimum of three (3) days prior to anticipated access.

d) The Contractor shall conform to all local, state, and federal regulations including those set forth by OSHA, RCRA and the EPA and any other applicable authorities.
e) Typical allowable working hours are 7 am to 7 pm. MMSD shall apply for a variance from the City of Madison or other municipality to allow working hours before 7 am and after 7 pm if the Project Engineer determines that it is necessary. MMSD cannot guarantee that a variance will be granted or specify what the allowable working hours will be should a variance be granted.

f) Any damage done by the Contractor to any property shall be repaired to a condition equal to or better than what existed prior to the damage. Any damage repairs shall be considered as incidental to the Contract. See section 204(11) for further comment.

(5) CONTRACTOR’S INSURANCE

The contractor is required to obtain insurance as specified in Section 201 of the General Conditions.

(6) SAFETY

a) The contractor agrees to perform all work under this contract in accordance with local, state, and federal safety regulations. This includes, but is not limited to: (1) Continual evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen prior to entering the manholes and while performing work in manholes; and (2) Conformance with confined space procedures and requirements.

b) Disposal of contaminants, old coatings, acid from etching, and contaminated water and blasting media shall comply with all applicable facility, local, state, and federal regulations. The discharge of all waste products to the sanitary sewerage system shall be in accordance with the District’s Sewer Use Ordinance.

c) Handling of hazardous materials, machinery operations, worker protection, and control of airborne dust and fumes shall comply with all applicable facility, local, state, and federal health and safety regulations.

(7) BYPASSING PUMPING / DIVERSION

a) The Contractor shall determine if it is necessary to provide bypassing around a manhole specified for rehabilitation to comply with the manufacturer’s recommendations, safety requirements, or any other requirements of this specification. No additional compensation shall be made if the Contractor elects to use bypassing as part of the manhole rehabilitation process.

b) The bypass pumping system shall be in place and working before the sewer lining work begins. The sewer shall be returned to gravity flow at the end of each working day. Unattended bypass pumping is not allowed.

c) Bypass pumping shall be limited to those hours that the contractor is performing the work for this project unless necessitated by an emergency beyond the Contractor’s control. A representative of the Contractor must be on-site at all times that bypass pumping is in operation.

d) If the Contractor elects to use bypass pumping as a means of sewerage control, the methods, equipment, type of hose, etc., shall be subject to approval of MMSD. Hoses crossing streets, driveways, parking areas, etc., are to be ramped over to prevent damage to the hoses. Bypass pumps shall be sized to handle the peak flow with one pump out of service. Contractor must always have a backup pump ready in case a pump fails.

e) No spillage of wastewater to adjacent streets, lawns, etc., shall be tolerated. If any such spillage should occur, all construction operations shall cease and cleanup shall commence immediately and be completed to the satisfaction of the Engineer prior to the resumption of any construction operations.
f) If bypass pumping is necessary to complete the rehabilitation, prior to submitting a bid for this project the Contractor shall familiarize himself with the sanitary sewerage facilities in this area and develop an adequate bypassing plan. A written plan shall be submitted to MMSD for approval prior to the start of work.

g) Bypassing will not be permitted in the event of excessively wet weather. MMSD reserves the right to determine when any bypassing will or will not be allowed.

(8) WATER FOR CLEANING

The Contractor shall furnish water for cleaning existing manholes and for installing the manhole coating. The Contractor shall obtain permission from the City Water Utility to use any fire hydrants in the area to facilitate liner insertion. The Contractor shall notify the City prior to initiating cleaning operations, and shall coordinate his operations with the City Water Utility so as not to deplete the local water supply and pay for the water used.

(9) TRAFFIC CONTROL

The Contractor shall prepare and implement a Traffic Control Plan. The Contractor shall be responsible for obtaining and paying all fees for any permits required from the Cities and municipalities in which the work takes place. All traffic control, including signing and barricading of work areas, shall conform with the Federal Highway Administration's "Manual on Uniform Traffic Control Devices."

(10) CLEAN-UP

Upon acceptance of the installed work and testing, the Contractor shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work. Any grass areas disturbed shall be fine graded, seeded, and mulched. Clean up includes, but is not limited to removing rubbish, debris, dirt, equipment and excess material from the site. The Contractor shall clean adjacent surfaces soiled by and during the course of work.

(11) LIQUIDATED DAMAGES

Liquidated damages in the amount of $500.00 per calendar day shall be enforced by the District and shall be paid to the District by the Contractor for each day beyond either deadline stated in Part One of these specifications that the required work remains incomplete.

(12) MAINTENANCE RETAINER

The sum of five thousand dollars ($5,000.00) will be withheld from the Contractor by the Madison Metropolitan Sewerage District for a period of one year after completion and acceptance of all the Work as a guarantee that the Contractor shall provide all necessary maintenance, re-work, or repair related to rehabilitation work or other work which is determined by the Engineer to be defective.

SECTION 205 CONCRETE SURFACE PREPARATION

(1) INSPECTION PROCEDURES PRIOR TO SURFACE PREPARATION

Inspection prior to surface preparation for concrete cure, concrete defects, physical damage, chemical damage, contamination, and moisture shall be performed in accordance with "SSPC-SP 13/NACE No. 6, Surface Preparation of Concrete". The Contractor shall not be responsible for performing this inspection, but is encouraged to incorporate such practices into their quality assurance. The District will retain the services of a coating inspector, the costs of which will be borne by the District. The Contractor shall cooperate as necessary with all inspections as per Section 204(3).
(2) SURFACE PREPARATION OBJECTIVES

a) Surface preparation shall be performed in accordance with “SSPC-SP 13/NACE No. 6, Surface Preparation of Concrete”. In instances where there are discrepancies between said referenced standard and this specification, this specification shall supersede.

b) The objective of surface preparation is to produce a concrete surface that is suitable for application and adhesion of the specified protective coating system.

c) Protrusions such as from burrs, sharp edges, fins, and concrete spatter shall be removed during surface preparation.

d) Voids and other defects that are at or near the surface shall be exposed during surface preparation.

e) All concrete that is not sound shall be removed so that only sound concrete remains.

f) Concrete damaged by exposure to chemicals shall be removed so that only sound concrete remains.

g) All contamination, form-release agents, efflorescence, curing compounds, and existing coatings determined to be incompatible with the coating to be applied shall be removed.

h) The surface preparation method, or combination of methods, should be chosen based on the condition of the concrete and the requirements of the coating system to be applied.

i) All prepared concrete surfaces shall be repaired to the level required by the coating system in the intended service condition.

j) Surface preparation debris shall not be allowed to flow downstream. Contractor shall use a method approved by the District Engineer and/or Inspector for controlling surface preparation debris. This method may consist of installing a cover over the flow channel of the manhole or something similar. The approved method will effectively block surface preparation debris from flowing downstream while allowing normal sewer flow when bypassing is not in place.

(3) SURFACE CLEANING METHODS

a) The surface cleaning methods described in 205(2) shall not be used as the sole surface preparation method of concrete to be coated as they do not remove laitance or contaminants or alter the surface profile of concrete. These methods shall be used as required, before and/or after the mechanical and chemical methods described in 205(4) and 205(5).

b) Vacuum cleaning, air blast cleaning, and water cleaning as described in ASTM D 4258 may be used to remove dirt, loose material, and/or dust from concrete.

c) Detergent water cleaning and steam cleaning as described in ASTM D 4258 may be used to remove oils and grease from concrete.

(4) MECHANICAL SURFACE PREPARATION METHODS

a) Dry abrasive blasting, wet abrasive blasting, vacuum-assisted abrasive blasting, and centrifugal shot blasting, as described in ASTM D 4259 may be used to remove contaminants, laitance, and weak concrete, to expose subsurface voids, and to produce a sound concrete surface with adequate profile and surface porosity.

b) High-pressure water cleaning or waterjetting methods as described in SSPC-SP 12/NACE No. 5, ASTM D 4259, or “Recommended Practices for the Use of Manually Operated High Pressure Water
Jetting Equipment," may be used to remove contaminants, laitance, and weak concrete, to expose subsurface voids, and to produce a sound concrete surface with adequate profile and surface porosity.

c) Impact-tool methods may be used to remove existing coatings, laitance, and weak concrete. These methods include scarifying, planing, scabbling, and rotary peening, as described in ASTM D 4259. Impact-tool methods may fracture concrete surfaces or cause microcracking and may need to be followed by one of the procedures in Section 205(4)(a) or 205(4)(b) to produce a sound concrete surface with adequate profile and surface porosity. The soundness of a concrete surface prepared using an impact method may be verified by one of the surface tensile strength tests described in Paragraph A1.6, Adhesion Testing, in NACE No. 6/SSPC-SP 13.

d) Power-tool methods, including circular grinding, sanding, and wire brushing as described in ASTM D 4259 may be used to remove existing coatings, laitance, weak concrete, and protrusions in concrete. These methods may not produce the required surface profile and may require one of the procedures described in Section 205(4)(a) or 205(4)(b) to produce a concrete surface with adequate profile and surface porosity.

(5) CHEMICAL SURFACE PREPARATION

Acid etching, as described in ASTM D 4260 and NACE Standard RP0892 may be used to remove laitance and weak concrete and to provide a surface profile on horizontal concrete surfaces. This method requires complete removal of all reaction products and pH testing to ensure neutralization of the acid. Acid etching is not recommended for vertical surfaces and areas where curing compounds or sealers have been used. Acid etching shall only be used where procedures for handling, containment, and disposal of the hazardous materials are in place. Acid etching with hydrochloric acid shall not be used where corrosion of metal in the concrete (rebar or metal fibers) is likely to occur.

(6) SURFACE CLEANLINESS

After the concrete surface has been prepared to the required soundness and surface profile, surfaces may still need to be cleaned by one of the methods described in 204(4) to remove the residue created by the surface preparation method or to remove spent media.

(7) MOISTURE CONTENT

If the moisture level in the concrete is higher than the specified limit tolerable by the coating, the concrete shall be dried or allowed to dry to the level specified in the procurement documents before inspection and application of the coating. This drying may be accomplished with taking advantage of ambient conditions if the ambient conditions allow rehabilitation in accordance with the product manufacturer’s specifications. The use of dehumidifiers and/or portable heaters may be required in order to achieve a proper condition.

(8) PATCHING AND REPAIRS

a) Prior to proceeding with patching and repairs, the prepared concrete surface shall be inspected according to Section 205. After the patching and repairs of the concrete surface are completed, the repaired areas shall be reinspected according to Section 205.

b) All gouges, surface air voids, and other surface anomalies shall be repaired to a level required by the coating system as specified in the procurement documents.

c) All repair materials, both cementitious and polymeric, should be approved or recommended by the coating manufacturer as being compatible with the coating to be applied. Repair materials not recommended or approved by the coating manufacturer shall be tested for compatibility prior to their application.
d) The repair material shall be cured according to the manufacturer’s published instructions.

e) The repaired section may require additional surface preparation prior to coating application.

f) All patching and repair shall be considered as incidental to the Contract.

SECTION 206 INSPECTION AND CLASSIFICATION OF PREPARED CONCRETE SURFACES

The Contractor may perform the tests and evaluations described in this section at their own discretion and cost. The District shall obtain the services of a coating inspector to preform said tests and evaluations. Contractor shall provide for and allow the District’s coating inspector access to the work as per Section 204(3) of these specifications.

(1) COATING ADHESION

a) If specified in part one of these specifications, a test patch shall be applied to determine the compatibility of and adhesion between the prepared surface and the coating system.

b) Coating adhesion should be tested using one of the methods agreed upon by all parties. (See NACE No. 6/SSPC-SP 13, “Surface Preparation of Concrete”, Paragraph A1.6 for commentary on these methods.)

(2) SURFACE PROFILE

a) If a specific surface profile is required for the performance of the coating system to be applied, the profile shall be specified in the product submittal data.

b) The surface profile of prepared concrete surfaces should be evaluated after cleaning and drying but prior to repairs or application of the coating.

c) The surface profile may be evaluated by comparing the profile of the prepared concrete surface with the profile of graded abrasive paper, as described in ANSI B 74.18 by comparing the profile with the ICRI Guideline No. 03732 (surface profile chips), or by another agreed-upon visual comparison.

(3) SURFACE CLEANLINESS

a) All prepared concrete surfaces shall be inspected for surface cleanliness after cleaning and drying but prior to making repairs or applying the coating. If the concrete surfaces are repaired, they shall be reinspected for surface cleanliness prior to applying the coating.

b) Prepared concrete surfaces may be inspected for surface cleanliness by lightly rubbing the surface with a dark cloth or pressing a translucent adhesive tape on the surface. The test method and acceptable level of residual dust shall be agreed on by all parties.

c) The method used to verify compatibility of the coating to be applied over a contaminated surface or over contaminated surfaces that have been cleaned and prepared should be approved by the coating manufacturer and specified in the product submittal data.

(4) pH

a) If a specific pH range is required for proper performance of the coating system to be applied, the pH of the concrete shall be specified in the product submittal data.

b) The pH of concrete surfaces prepared by acid etching should be tested after etching and rinsing but before the prepared surface has dried.
c) ASTM D 4262 should be used to determine pH.

(5) MOISTURE CONTENT

a) If a specific moisture content is required for proper performance of the coating system to be applied, the moisture content of the concrete shall be specified in the product submittal data.

b) Prepared concrete surfaces should be tested for residual moisture after cleaning and drying but prior to the application of the coating.

c) ASTM D 4263, ASTM F 1869, or ASTM F2170 should be used to determine the residual moisture content in concrete.

(6) ACCEPTANCE CRITERIA

a) The acceptance criteria for prepared concrete surfaces shall be specified in the product submittal data. The criteria should include acceptable value ranges for surface tensile strength, surface profile, surface cleanliness, residual contaminants, pH, and moisture content. The criteria should specify the testing methods to be used to determine values.

b) The acceptance criteria as stated in NACE No. 6/SSPC-SP 13, “Surface Preparation of Concrete”, Section 6, Table 1 may be used in lieu of the criteria submitted with the product data as specified in Section 206(6)(a).

SECTION 207 EXECUTION OF REHABILITATION

(1) EXAMINATION

a) When required for acceptable completion of the rehabilitation process, any active flows shall be dammed, plugged or diverted as required to ensure that the liquid flow is maintained below the surfaces to be coated. All extraneous flows into the manhole or vaults at or above the area coated shall be plugged and/or diverted until the coating has set hard to the touch. As an option, hot air may be added to the manhole to accelerate set time of the coating.

b) Installation of the protective coating shall not commence until the surface has been properly prepared in accordance with these specifications.

c) Temperature of the surface to be coated should be maintained according to the product manufacturer’s recommendations. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the structure being coated.

(2) GENERAL REHABILITATION PROCEDURES

a) 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. The surface to be repaired must be clean and free of any loose materials with walls totally saturated with water. The surface must be prepared in accordance with section 205 of these specifications and “SSPC-SP 13/NACE No. 6, Surface Preparation of Concrete”

b) Minor leaks shall be stopped using quick-setting specially formulated infiltration control mix or grouting compound 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 quick-setting infiltration control mix or grouting compound 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.

c) After all preparation work has been completed, remove all loose material and wash wall again.

(3) CEMENTITIOUS LINER INSTALLATION

The Contractor, 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:

i. Elimination of active infiltration prior to the application.

ii. Removal of loose and unsound material and cleaning surfaces in accordance with Section 205.

iii. Repair and sealing of the invert and benches (when specified).

iv. Spray or trowel application of a cementitious mix to form a liner.

1. Liner Application:

i. Prior to liner application onto walls and top of the bench, the flowline shall be covered to prevent accumulation of liner material in the flowline.

ii. No application shall be made to frozen surfaces or if freezing is expected to occur inside the manhole within 24 hours after application. Contractor shall apply the cementitious liner within the manufacturer’s recommended range of application temperatures.

2. Mixing:

i. 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.

ii. 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. Application:

i. The Contractor shall follow the manufacturer’s recommendations for either spray or trowel application of the liner.

ii. Bench Application: The bench shall be 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 1/4 inch. The wall bench intersection shall be rounded to a uniform radius equal to the full circumference of the intersection.

iii. 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:
i. The Contractor shall allow the liner to cure in accordance with the manufacturer’s recommendations for sunlight and air exposure, multiple coats, curing time, traffic flow, and all other recommendations.

(4) EPOXY OR POLYURETHANE COATING INSTALLATION

The installation of the approved epoxy or polyurethane coating system shall be in strict accordance with the manufacturer’s written instructions. This shall include re-grouting all inlet and outlet lines and benches as needed, plus the preparation, installation, curing, and finish operation, for the completion of the rehabilitation process.

a) Coating Installation: The coating shall be uniformly applied onto the prepared mortar lining before re-exposure to chemicals can contaminate the underlying mortar. Two coats shall be applied to reduce pinholes. The second coat will act to repair the pinholes that develop in the first coat due to filling imperfections in the substrate. The coating shall be applied at a minimum thickness of .100" (100 mils) to provide a complete and uniform vapor barrier.

b) Damaged coating: Repair damaged coating, pinholes, and holidays. Feather edges and repair in accordance with manufacturer’s recommendations. Repair defects in accordance with manufacturer’s written recommendations.

(5) LINER AND COATING ACCEPTANCE

At the direction and option of the Owner, all rehabilitated manholes may be tested as follows.

a) Visually verify the absence of leaks.

b) Performance of a vacuum test.

c) High voltage spark testing for detection of pinholes.

d) Passing inspection in accordance with these specifications by District representative or coating inspector. Repair defects in accordance with manufacturer’s written recommendations. The Contractor shall provide the District’s coating inspector access to the work for performing testing and inspection as per Section 204(3) of these specifications.

(6) MANHOLE FRAME AND COVER REPLACEMENT

Where specified in the contract documents and/or called out in the project plans, the Contractor shall remove and replace the manhole frame and cover. The frames and covers shall be supplied by the District at no cost to the Contractor. The Contractor shall be responsible for providing the labor, equipment, and all other costs associated with the replacement.

208 ACCEPTANCE AND PAYMENT

(1) FINAL ACCEPTANCE

After the various types of rehabilitation work have been completed and suitable inspection reports have been submitted (and approved) from the Quality Assurance Inspector, the work shall be visually inspected for compliance by the District. The Owner reserves the right to inspect the rehabilitated manholes during the warranty period of one year. 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.

(2) DELIVERABLES
The Contractor shall submit digital photos and/or videos of the manholes in post-rehabilitation condition. Locations where infiltration was stopped shall be noted.

(3) MEASUREMENT FOR PAYMENT

a) Measurement will be made after completion of the work in accordance with the Contract Documents and this Section. Measurement of quantities will be made by the Contractor in the presence of a District representative.

b) Measurement for payment for manhole rehabilitation will be the actual vertical distance of manhole that is rehabilitated, measured at the center of the manhole from the frame seat to the top of the bench.

c) Measurement for payment for bench rehabilitation shall be per bench rehabilitated.

d) Payment shall include all labor, materials, equipment, tools and incidentals for cleaning, surface preparation, bypass pumping, root removal, repairing, and sealing of all surfaces including walls, chimney, inverts and benches, liner application, removal of steps, testing, traffic control, deliverables and all other work necessary to complete rehabilitation in accordance with these specifications.