SCOPE OF WORK

This specification shall govern all work, materials, and equipment required for manhole rehabilitation for the purpose of eliminating infiltration, providing corrosion protection, repair of voids, and restoration of the structural integrity of the manhole/wet well as a result of applying a monolithic fiber-reinforced cementitious liner to the wall and bench surfaces of brick, concrete, or any other masonry construction material.

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 to form a monolithic liner of a minimum 1/2 inch thickness, with machinery specially designed for application. All aspects of the installation shall be in accordance with the manufacturer's recommendation and approved by the manufacturer.

Approved lining materials are those manufactured by:
1. DINJER – Colorado Springs, CO
2. Engineer approved equal

LINER MIX

A Cementitious liner, shall be used to form a Structural/Structurally enhanced monolithic liner covering all interior manhole surfaces and shall have the following minimum requirements at 28 days.

A. Compressive Strength (ASTM C-109)  9,000psi
B. Tensile Strength (ASTM C-496)     900 psi
C. Flexural Strength (ASTM C-78)  1,000 psi

WATER

Shall be clean and potable. Questionable water shall be tested by a testing laboratory in accordance with ASTM C-94; Potable water need not be tested.
EQUIPMENT

A. Specially designed machines consisting of an optimized progressive cavity pump capable of producing a minimum of 250 psi pumping pressure, contra-blend mixer with twin ribbon paddle with end discharge, and an air system for spray application of product, shall be used for applying the Cementitious lining.

B. The Contractor will be responsible to ensure that application and installation of the Cementitious liner is made in accordance with, and approved by the manufacturer.

PREPARATION

A. Place covers 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.

C. Active leaks shall be stopped using quick setting specially formulated mixes, according to 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 mix prior to the final liner application. When severe infiltration is present, drilling may be required in order to pressure grout using a Cementitious grout. Manufacturer's recommendations shall be followed when pressure grouting is required.

INVERT REPAIR

A. After all preparation has been completed, remove all loose materials and wash wall again.

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

C. 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.

MIXING

A. For each bag of product, use the amount of water specified by the manufacturer and mix using the approved equipment and in accordance with the manufacturer's equipment.

B. Place the mix 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.

APPLICATION

A Commence pumping the mixed mortar and begin spray applying the material at the lowest point desired for the new wall and work upward to just under the manhole frame. The material may applied to the specified thickness in one or more passes.

B If additional thickness is desired at any level, simply recommence material application until that area is thickened. Additional layers may be applied at any time.

FINISHING

Trowel the surface of the liner to create a uniform finish. Caution shall be taken to prevent over working the material. Thickness may be verified at any point with a wet gage. Brushing is an optional procedure for texturing its finish for improved mechanical adhesion of epoxy.

WEATHER

Contractor will apply Cementitious lining in accordance with manufacturers requirements concerning weather conditions.
PRODUCT TESTING

Four - 2 inch cubes shall be cast each day or from every 50 bags of product used, and 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-109.

EPOXY LINING FOR CHEMICAL CORROSION PROTECTION

In cases of corrosion resulting from chemicals and at the Engineer’s direction, a protective epoxy coating shall be applied over the fresh Portland based liner to form a mortar/epoxy composite and to create an vapor barrier impervious to the chemical corrosion.

A. PREPARATION & PROCEDURE

The Portland based Liner shall be applied to the prepared interior as specified in the preceding sections, at the thickness necessary to restore the full cross-sectional thickness of the original wall. The Liner shall have successfully demonstrated its compatibility to mechanically interface permanently with the coating.

B. PROTECTIVE COATING

The protective coating shall be a 100% solids epoxy with no volatile organic compounds and gray or white in color to optimize visual inspection. Minimum physical properties shall be:

<table>
<thead>
<tr>
<th>Property</th>
<th>Standard</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>ASTM D-638</td>
<td>7,000 psi</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>ASTM D-790</td>
<td>13,000 psi</td>
</tr>
</tbody>
</table>

The epoxy shall be uniformly centrifugally cast or troweled onto the fresh mortar lining before re-exposure to the chemicals can contaminate the underlying mortar. If application is delayed beyond 24 hours, the mortar liner shall be rinsed to neutralize its surface and the epoxy shall then be applied. The epoxy shall have a minimum thickness of .125 inches (125 mils) and shall not run or sag during placement.
C. TESTING & VERIFICATION

The interior shall be visually inspected for thoroughness of coverage. When dry to the touch, the entire interior shall be tested with a holiday detector at the prescribed voltage to locate pinholes if any. Deficiencies shall be immediately corrected and retested.

SAFETY

If personnel are required to space during the application procedure, each and all OSHA requirements as well as those required by the manufacturer's material safety data sheets shall be complied with fully.

PAYMENT

Payment shall be made per vertical foot of manhole or per square foot of wet well rehabilitated. Payment shall include all materials, labor, equipment and related work items to rehabilitate the manhole. Cleaning of the manholes, patching, infiltration control and grouting shall be considered incidental to manhole/wetwell rehabilitation.