

**CHAPTER 16.3
MANHOLE REHABILITATION**

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PART 1 - GENERAL

1.1 SCOPE

- A. This Section covers the cleaning, repair, structural restoration, and rehabilitation of existing manholes as required to eliminate leakage into the manholes and to restore structural integrity. The work includes but is not limited to: cleaning entire manhole interior, repair/reconstruction of the failed sections of the structure; stopping active leaks through manhole walls and joints; preparation of surfaces to receive the application of coatings designed to resist the affects of hydrogen sulfide gas or the affects of aging; and, application of those coatings to provide a monolithic liner on the inside walls of the manhole as specified.
- B. All ancillary work shall be constructed properly in accordance with the Drawings and Specifications. All defects shall be remedied to the Engineer's satisfaction prior to approval.

1.2 RELATED DOCUMENTS

- A. CHARLOTTE WATER Water and Sewer Design and Construction Standards and Standard Details.

1.3 DEFINITIONS AND ABBREVIATIONS

- A. See Sections iii and iv of the CHARLOTTE WATER Water and Sewer Design and Construction Standards for common abbreviations and definitions.

1.4 REFERENCE SPECIFICATION, CODES, AND STANDARDS

- A. Contractor shall ensure that the products and work comply with the reference specifications and all requirements of CHARLOTTE WATER's Water and Sewer Design and Construction Standards (latest version).
- B. Contractor shall ensure that the products and work comply with the current version of the following American Society for Testing and Materials (ASTM) standards:
 - 1. ASTM C78 Standard Test Method for Flexural Strength of Concrete
 - 2. ASTM C94 Standard Test for Ready Mix Concrete
 - 3. ASTM C109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
 - 4. ASTM C234 Standard Test Method for Comparing Concretes on the Basis of the Bond Developed with Reinforcing Steel
 - 5. ASTM C267 Standard Test Method for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing
 - 6. ASTM C321 Standard Test Method for Bond Strength of Chemical-Resistant Mortars
 - 7. ASTM C496 Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
 - 8. ASTM C596 Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement

- 1 9. ASTM C666 Standard Test Method for Resistance of Concrete to Rapid Freezing
- 2 and Thawing
- 3 10. ASTM C827 Standard Test Method for Change in Height at Early Ages of Cylindrical
- 4 Specimens from Cementitious Mixtures
- 5 11. ASTM C882 Test Method for Bond Strength of Epoxy-Resin Systems Used With
- 6 Concrete by Slant Shear
- 7 12. ASTM C952 Standard Test Method for Bond Strength of Mortar to Masonry Units
- 8 13. ASTM C1072 Test Method for Measurement of Masonry Flexural Bond Strength
- 9 14. ASTM C1244 Standard Test Method for Concrete Sewer Manholes by the Negative
- 10 Air Pressure (Vacuum) Test Prior to Backfill
- 11

12 **1.5 QUALIFICATIONS**

- 13
- 14 A. Contractor performing the work must have at least five years of experience coating
- 15 manholes with cementitious mortar, and shall have successfully installed a cementitious
- 16 mortar lining product in a minimum of 2,000 manholes as documented by verifiable
- 17 Owner references.
- 18
- 19 B. Contractor performing the work shall be fully qualified, experienced and equipped to
- 20 complete this work expeditiously and in a satisfactory manner and shall be an approved
- 21 installer as certified and licensed by the product manufacturer.
- 22
- 23 C. Contractor's proposed superintendent/foreman for the work should have successfully
- 24 installed a cementitious lining product in a minimum of 1,000 manholes as documented
- 25 by verifiable Owner references. Contractor shall submit information to demonstrate that
- 26 the experience requirements are met.
- 27
- 28 D. The cementitious product shall have been manufactured for installation specifically in
- 29 manholes for at least five years and shall have been installed in at least 10,000
- 30 manholes. References that are documented and that can be verified shall be submitted
- 31 to demonstrate that the cementitious products meet these requirements. Contact names
- 32 and numbers shall be included with the references.
- 33
- 34 E. Approved cementitious products are listed in these specifications. Even though the
- 35 product may be listed as approved, the product manufacturer and Contractor(s) shall still
- 36 meet the experience requirements specified above, or the products and Contractor will
- 37 not be approved for this work.
- 38

39 **1.6 SUBMITTALS**

- 40
- 41 A. Three hard copies (one to be returned to Contractor after review, one to remain with
- 42 Engineer and one to remain with Owner) and one pdf of all submittals specified herein
- 43 shall be submitted to the Engineer.
- 44
- 45 B. Contractor shall submit complete shop drawings of the manhole lining system to
- 46 demonstrate compliance with these specifications, to show materials of construction and
- 47 to detail installation procedures. Testing procedures and quality control procedures shall
- 48 also be submitted.
- 49

- 1 C. Certifications that the manhole lining was manufactured in accordance with these
2 specifications and the appropriate ASTM standards shall be submitted with each
3 shipment.
4
- 5 D. For all products to be used for manhole rehabilitation, Contractor shall submit
6 manufacturer documents containing product technical information, ASTM test results
7 and certification, application procedures and specifications for approval, and testing and
8 quality control procedures.
9
- 10 E. References for Contractor, superintendent and products shall be submitted to verify the
11 specified experience.
12
- 13 F. Submit a plan for bypassing sewage around the work area and facilities where sewage
14 flows must be interrupted to complete the work. The plan shall be reviewed by Engineer
15 and shall be acknowledged as acceptable before any work is started. The bypass
16 pumping plan, and requirements for bypass pumping, shall be in accordance with
17 Chapter 11 and/or Chapter 17 of CHARLOTTE WATER's Water and Sewer Design and
18 Construction Standards.
19

20 **1.7 WARRANTY**

- 21
- 22 A. The materials used for the project shall be certified by the manufacturer for the specified
23 purpose. The manufacturer shall warrant the cementitious liner material to be free from
24 defects in raw materials for two (2) years from the date of final acceptance by Owner.
25 Contractor shall warrant the liner installation for a period of two (2) years from final
26 acceptance.
27

28 **PART 2 - PRODUCTS**

29 **2.1 MATERIALS – CEMENTITIOUS MORTAR LINING SYSTEM**

- 30
- 31
- 32 A. Contractor shall line the interior of the manholes with a cementitious mortar lining system
33 where specified in accordance with the specifications of the manufacturer.
34
- 35 B. The cementitious manhole lining system for the interior of manholes shall be a
36 monolithic system suitable for use as a trowel - or spray-applied monolithic surfacing in
37 sewer manholes. The cementitious lining system shall be one of the following specified
38 products or approved equal:
39
- 40 - Strong Seal MS-2A, MS-2C, or High Performance by Strong Seal Systems
 - 41 - QM-1s Restore or Aluminaliner by Quadex
 - 42 - Cemtec Silatec MSM or CAM by A.W. Cook Cement
 - 43 - Sewpercoat PG by Kerneos, Inc.
 - 44 - Permacast MS-10,000 or CR-9000 by Action Products Marketing Corp.
 - 45 - PerpetuCrete MSC or CA by Protective Liner Systems
 - 46 - Mainstay ML-72, ML-CA or ML-PF by Madewell
 - 47 - Reliner MSP or Maximum CA Cement by Standard Cement Materials
- 48
- 49 C. Where additional hydrogen sulfide resistance is required and when specified by
50 Engineer (identified on the drawings as hydrogen sulfide resistant cementitious mortar),

1 the cementitious lining system shall be a 100% Calcium Aluminate Product (product
2 comprised of calcium aluminate cement and calcium aluminate aggregate). Partial
3 calcium aluminate products (or blended products) shall not be considered an equal and
4 shall not be approved. The 100% Calcium Aluminate Product shall be one of the
5 products listed below or approved equal. Any proposed equal product must have been
6 manufactured and successfully installed in high, hydrogen-sulfide manholes for at least
7 ten (10) years as documented by manufacturing records and detailed project references
8 (project names, owner contact name and number, project description, etc.). There will
9 be no exceptions to this requirement. The Engineer's decision on whether a product is
10 an "equal" shall be final.

- 11 - High Performance by Strong Seal Systems
- 12 - Aluminaliner PF by Quadex
- 13 - Sewpercoat PG by Kerneos, Inc.
- 14 - Mainstay ML-PF by Madewell
- 15 - Cemtec HITECH 100 by A.W. Cook Cement
- 16 - Maximum CA Plus Cement by Standard Cement Materials

17
18
19 D. The cementitious lining system shall be a pumpable cement mixture. The lining shall be
20 installed via low-pressure application or trowel application. The materials shall be
21 suitable for all the specified design conditions.

22
23 E. The cementitious lining shall provide a minimum service life of twenty-five (25) years.
24 The cured cementitious lining shall be continuously bonded to all the brick, mortar,
25 concrete, chemical sealant, grout, pipe and other surfaces inside the sewer manhole.
26 Provide bond strength data on cured, cementitious lining based on ASTM test methods
27 referenced herein.

28
29 F. The cementitious liner when cured shall have the following minimum characteristics at
30 twenty-eight (28) days as measured by the applicable ASTM standards referenced
31 herein:

- 32
- 33 1. Minimum compressive strength of 6,000 psi
- 34 2. Minimum bond strength of 130 psi
- 35 3. Shrinkage of less than 0.05%
- 36

37 G. The cementitious lining shall be compatible with the thermal condition of the existing
38 sewer manhole surfaces. Surface temperatures will range from 20°F to 100°F. Provide
39 test data on shrinkage of the cementitious lining based on the ASTM standards
40 referenced herein.

41
42 H. Chemical sealants or grouts used to seal active manhole leaks, to patch cracks, to fill
43 voids and to otherwise prepare the manhole surfaces for the lining installation shall be
44 suitable for the intended purpose and shall be compatible with the lining as certified by
45 the manufacturer.

46
47 I. External Coating: Whenever the outside of exposed manholes walls are specified to be
48 coated with a special exterior cementitious mortar product, the exterior mortar shall be
49 HB2 Repair Mortar by ThoRoc, SikaTop 123 by Sika Corporation, or approved equal.
50
51

1 **2.2 MATERIALS – INJECTION GROUTING**

- 2
- 3 A. The grout used to completely stop identified leaks shall be a polyurethane grout and
- 4 shall be Hydro Active Cut by DeNeef Construction Chemicals, AV-202 Multigrout by
- 5 Avanti International, or approved equal.
- 6
- 7 B. The grout shall be suitable for injection and shall expand to seal identified leaks. The
- 8 grout shall be installed per the manufacturer’s recommendations. The material shall be
- 9 suitable for all the specified design conditions.
- 10
- 11 C. The grout shall provide a minimum service life of twenty-five (25) years. When cured,
- 12 the grout shall be suitable for sewer system service and chemically resistant to any
- 13 chemicals or vapors normally found in domestic sewage. The grout shall be compatible
- 14 with the thermal condition of the existing sewer manhole surfaces. Surface
- 15 temperatures will range from 20°F to 100°F.
- 16
- 17 D. The grout shall effectively seal the identified leak in the sewer manhole and prevent any
- 18 penetration or leakage of groundwater infiltration at this location or other nearby
- 19 locations or within the same pre-cast manhole joint as a direct result of the injected
- 20 grout. Any leaks from such migration shall be sealed at no additional cost to the Owner.
- 21

22 **PART 3 - EXECUTION**

23

24 **3.1 NOTIFICATIONS**

- 25
- 26 A. Contractor shall continuously notify the public of the work being performed. Owner will
- 27 define the specific notification requirements, and Contractor shall meet all of those
- 28 requirements. At a minimum, Contractor shall distribute door hangers to each property
- 29 owner affected by the work seventy-two (72) hours prior to performing any work.
- 30 Contractor shall submit a sample door hanger to Engineer and Owner for review and
- 31 approval. The door hangers shall include the specific work to be performed, start time
- 32 and estimated completion time for the work being conducted, impacts to the property
- 33 owner, contact names and local phone numbers for the Contractor’s project manager,
- 34 superintendent, and the Engineer’s on-site representative.
- 35
- 36 B. In the event of leakage, as a result of a water main or service leak, Contractor is
- 37 required to notify Engineer, Engineer’s representative, and 311.
- 38

39 **3.2 DELIVERY, STORAGE, AND SHIPPING**

- 40
- 41 A. Care shall be taken in shipping, handling and placing to avoid damaging the lining
- 42 products. Any lining product damaged in shipment, showing deterioration, or which has
- 43 been exposed to any other adverse storage condition that may have caused damage,
- 44 even though no such damage can be seen, shall be marked as rejected and removed
- 45 from the jobsite at once.
- 46
- 47 B. While stored, the lining products shall be adequately packaged and protected. The
- 48 lining products shall be stored in a manner as recommended by the manufacturer.
- 49
- 50

1 **3.3 INSTALLATION – CEMENTITIOUS LINING**
2

3 A. Contractor shall notify all affected property owners seventy-two (72) hours in advance,
4 giving the date, start time and estimated completion time for the work being conducted
5 and the impacts to the property owner.
6

7 B. Water for use in the installation of cementitious lining will be available from approved fire
8 hydrants owned and operated by CHARLOTTE WATER only. Use of fire hydrants other
9 than those approved by CHARLOTTE WATER will not be allowed. The Contractor shall
10 meet all Owner requirements for connecting to fire hydrants and **will be charged** for
11 water usage. Prior to connection to, and use of any hydrant, the Contractor must apply
12 for and successfully obtain a temporary fire hydrant use permit (Vehicle Mounted
13 “Tanker Truck” Permit). All instructions and requirements for obtaining the permit are
14 listed under the **Fire Hydrant Program for Temporary Service** section of CHARLOTTE
15 WATER’s website. The Contractor is responsible for meeting all requirements whether
16 listed herein or not.
17

18 The Contractor shall submit to the Engineer, a copy of the approved permit number for
19 each vehicle prior to connection to, and use of, any fire hydrant.
20

21 The Contractor shall be well versed in the proper operation of valves and hydrants and
22 will be responsible for any damage caused by improper operation or usage of hydrants.
23 All cure water must be discharged to the wastewater collection.
24

25 C. Contractor shall clean each sewer manhole to be surfaced and shall dispose of any
26 resulting material. The cleaning shall be performed using a high power jet wash at a
27 minimum of 3500 psi water pressure to remove all dust, biological growths, grease, oil,
28 paint or any other surface contaminants or coatings. The tip of the nozzle shall be a
29 maximum of 4 inches from the manhole wall during cleaning to ensure that 3,500 psi is
30 being applied to the walls.
31

32 D. Coatings that cannot be removed shall be sanded with coarse sandpaper to rough the
33 surface sufficient to obtain and ensure adequate bonding of the lining. Roots shall be
34 removed by manually cutting the roots from inside the manhole.
35

36 E. Contractor shall conduct a visual inspection of each manhole after it is cleaned. All
37 active, hydrostatic infiltration leaks shall be plugged or sealed with an appropriate grout
38 compatible with the cementitious lining. Injection grouting may be required to seal active
39 leaks, including leaks in existing invert channels and benches. All loose mortar and
40 rubble of existing walls, benches and inverts shall be removed.
41

42 F. Prior to installing the lining, Engineer and/or the Engineer’s representative, along with
43 Contractor must inspect and approve the surface preparation work. Contractor shall
44 notify Engineer when the manholes are ready for inspection. Contractor is responsible
45 for ensuring proper preparation and installation conditions including temperature and
46 moisture regardless of the findings by Engineer during the inspection. The manhole
47 lining shall be completed immediately after the inspection, or the manhole may need to
48 be re-cleaned prior to spraying to remove accumulated debris on the benches and walls.
49

50 G. Contractor shall prepare the manhole to receive cementitious lining as necessary by
51 reshaping and repairing benches, inverts, and walls where required including smoothing

1 out irregular shaped corbel and chimney sections prior to spray application. All interior
2 surfaces shall be prepared as recommended by the manufacturer. Minimum
3 requirements are as listed below.
4

- 5 1. All cracks and other voids must be repaired and filled with suitable non-shrinking
6 cements, sealants or grouts, including all voids between the existing sewer pipes and
7 manhole walls.
- 8 2. All patches shall be smooth and even with the manhole wall.
- 9 3. All existing manhole rungs/steps shall be removed, and voids filled.
- 10 4. All surfaces shall be suitably prepared for the required bonding of the cementitious
11 lining as recommended by the manufacturer.

12
13 H. A complete, watertight seal shall be provided at pipe and manhole wall connections
14 including filling in all voids around the connection and completely covering the
15 connection with an approved non-shrink grout. Contractor shall submit details of how
16 the watertight connections will be made to Engineer for review and approval. The invert
17 channel shall be coated with an appropriate quick-set grout product in complete
18 accordance with the manufacturer's instructions.

19
20 I. When CIPP is installed in the connecting sewer(s), the invert channel shall be coated
21 with an approved grout to build up the invert channel to the invert elevations of the new
22 CIPP; to fill all voids, cracks, holes, etc.; and to form a smooth flow channel. The entire
23 channel shall be coated. The coating shall be a minimum ¼-inch thick. The Contractor
24 shall submit details of the proposed grout for this application.

25
26 J. Contractor shall furnish and place the cementitious lining in each manhole as shown in
27 the standard details of CHARLOTTE WATER's Water and Sewer Design and
28 Construction Standards. The installation of the lining shall be in complete accordance
29 with the applicable provisions of ASTM and the manufacturers' specifications.

30
31 K. Contractor shall bypass pump sewage flows around the lining work while it is being
32 performed. Contractor is responsible for handling and accommodating all existing
33 wastewater flows during the work. Prior to performing the work, Contractor shall submit,
34 for approval by Engineer, a detailed plan of the method Contractor proposes in order to
35 maintain the existing flow during construction. The plan must include a provision for
36 handling the existing peak flow by pumping. The peak flow shall be considered the
37 existing pipe flowing full, which is highly possible during rain events. When pumping is
38 used, an identical standby pump(s) shall be on site in the event of failure of the primary
39 pump(s). Lateral flows will not require bypass pumping. Contractor shall coordinate with
40 the homeowner/business in advance of all work to ensure the lateral will be inactive at
41 the time of the manhole rehabilitation. All bypass pumping work shall be performed as
42 specified in Chapter 11 and/or Chapter 17 of CHARLOTTE WATER's Water and Sewer
43 Design and Construction.

44
45 L. The walls and benches shall be coated to the required minimum 1-inch thickness by
46 spray-on or trowel-applied methods. Invert channels shall also be coated as specified
47 herein. Cementitious mortar lining shall be monolithically applied in one pass or
48 application and shall be troweled smooth after application. The manhole lining shall not
49 be installed until all required main sewer rehabilitation and other manhole rehabilitation
50 work are complete.
51

- 1 M. The cementitious lining shall cover the complete interior of the existing sewer manhole
2 including the benches (shelves). The lining shall effectively seal the interior surfaces of
3 the sewer manhole and prevent any penetration or leakage of groundwater infiltration.
4 When cured, the lining shall form a continuous, tight-fitting, hard, impermeable surfacing
5 which is suitable for sewer system service and chemically resistant to any chemicals or
6 vapors normally found in domestic sewage.
7
- 8 N. Contractor shall plug off and/or protect the connecting pipes while coating the manhole
9 walls to prevent any material from washing down the sewers. If material enters the
10 sewer pipes, Contractor will be required to clean the sewers from manhole to manhole to
11 remove all material and then televise the sewer to demonstrate that all material is
12 removed at no cost to Owner.
13
- 14 O. Contractor shall take precautions to avoid damage or flooding to public or private
15 property being served by the manhole being rehabilitated. Contractor shall be
16 responsible for all flooding and pay for cleanup from flooding to the satisfaction of the
17 property owner. Contractor shall document all backups and submit documentation to
18 Engineer including the reason for the backup, the time and date of the backup, the
19 property owner's name, address and phone number, the resolution to problem, the time
20 and date the problem was resolved, and any special cleanup work that had to be
21 performed. This required documentation shall be submitted for all backups regardless of
22 when they occur. All cleanup shall be completed within four (4) hours of the backup.
23
- 24 P. External Coating: The existing surface shall be completely cleaned, and all loose
25 material removed prior to applying the cementitious material. Installation shall be in
26 strict accordance with the manufacturer's recommendations including utilizing any
27 required bonding agents and providing proper curing conditions. The installed thickness
28 shall be at least two (2) inches, troweled smooth after application.
29

30 **3.4 INSTALLATION – INJECTION GROUTING**

- 31
- 32 A. Contractor shall inject grout to seal the specified leaks. The grout shall be injected in
33 accordance with the manufacturer's instructions. Grout shall continue to be pumped
34 until the leak is completely sealed. The hole drilled to inject the grout shall be covered
35 with non-shrink grout.
36

37 **3.5 ACCEPTANCE TESTS - CEMENTITIOUS MORTAR LINING SYSTEM**

- 38
- 39 A. Field acceptance of the cementitious lining shall be based on Engineer and/or
40 Engineer's representative's field inspections and evaluation of the appropriate
41 installation and curing test data. The cementitious lining shall provide a continuous
42 monolithic surfacing with uniform thickness throughout the manhole interior. If the
43 thickness of the lining is not uniform or is less than specified, it shall be repaired or
44 replaced at no additional cost to the Owner.
45
- 46 B. If Engineer and/or Engineer's representative has to enter the manholes to inspect the
47 work, Contractor shall provide forced air ventilation, gas monitors and detectors,
48 harnesses, lights, confined space entry permits, etc. for Engineer and/or Engineer's
49 representative to enter the manhole and perform the inspection in complete accordance
50 with OSHA requirements at no additional cost to Owner.
51

1 C. Samples shall be taken of the installed liner each day that cementitious lining is installed
2 as follows: one (1) sample if one (1) to five (5) manholes were coated that day, two (2)
3 samples if six (6) to ten (10) manholes were coated that day, three (3) samples if eleven
4 (11) to fifteen (15) manholes were coated that day, and four (4) samples if sixteen (16)
5 or more manholes were coated that day. Samples shall be taken at equally spaced
6 intervals throughout the day. The frequency of tests may be increased by Engineer and
7 performed by Contractor at no additional cost to Owner when the required tests show
8 that the installed lining does not meet the specifications.
9

10 D. Samples shall be cube samples. At least six (6) cubes shall be taken for each sample
11 for testing. All cube samples shall be taken in the field from the material being sprayed.
12 Contractor shall show the samples to Engineer and/or Engineer's representative each
13 day and they shall initial the samples for delivery to the testing laboratory. Contractor
14 shall properly take and store the samples and shall deliver the samples to the testing
15 laboratory. The laboratory shall document that they received the initialed samples. The
16 tests shall be performed by an independent testing laboratory. All costs associated with
17 the tests shall be paid for by Contractor. The test results shall be submitted to Engineer
18 immediately when available, no later than thirty (30) days after the lining is installed, or
19 final acceptance will be withheld.
20

21 The samples shall be tested in accordance with the applicable ASTM standards to verify
22 that the installed liner meets the compressive strength requirements specified herein and
23 the lining manufacturer's published data on the product. Tests shall include 7-day and
24 28-day strength tests (3 tests/cubes for each time period for each sample). Shrinkage
25 and bond strength tests shall be performed on each batch or lot of material shipped to
26 the Contractor.
27

28 E. Engineer will direct which manholes shall be tested via vacuum testing when all manhole
29 rehabilitation work to that manhole is complete. Manholes shall not be vacuum tested
30 until at least seven (7) days after the cementitious lining was installed. Vacuum testing
31 shall be performed in accordance with ASTM C-1244 except that the minimum test time
32 shall be one (1) minute. Engineer and/or Engineer's representative shall be present for
33 all testing. Contractor shall notify Engineer forty-eight (48) hours prior to testing.
34

35 Contractor shall submit test reports of the testing which include the project name,
36 manhole tested, data on testing (vacuum pressure, test duration, etc.), and whether the
37 manholes passed or failed the test. Test reports must be submitted for failed tests with
38 the reason for failure noted on the report. Engineer and/or Engineer's representative
39 shall sign all test reports to document that Engineer and/or Engineer's representative
40 was present for the testing. Any manhole that fails the vacuum test shall be repaired
41 and retested immediately by Contractor at no additional cost.
42

43 F. There shall be no groundwater infiltration or other leakage (active or previously active)
44 through the manhole walls, benches, inverts or pipe connections at the manholes after it
45 has been lined. If leakage is found, it shall be eliminated with an appropriate cement
46 mortar, grout or sealant as recommended by the manufacturer and approved by
47 Engineer at no additional cost to Owner. Injection grouting may be required to stop
48 leaks around the pipe connections or in the invert channel or benches. Engineer's
49 decision on how defective lining is repaired shall be final. If any defective lining is
50 discovered after it has been installed or during the warranty period, it shall be repaired or
51 replaced in a satisfactory manner at no additional cost to Owner. Repaired manholes

1 including those repaired during the warranty period shall be vacuum tested at no
2 additional cost to Owner. In the event of leakage, as a result of a water main or service
3 leak, Contractor is required to notify Engineer, Engineer's representative, and 311.
4

- 5 G. Final acceptance shall not be granted for the installed cementitious lining until (1) the
6 manhole passes the vacuum test, (2) all material tests are submitted, and (3) the final
7 CCTV inspection of the CIPP liner (if applicable) is submitted as specified in Chapter 16,
8 CIPP for Main Sewers (when CIPP is installed; final CCTV performed after manhole
9 rehabilitation is completed).

10
11 **3.6 ACCEPTANCE TESTS – INJECTION GROUTING**
12

- 13 A. Field acceptance of the grout shall be based on Engineer and/or Engineer's
14 representative's visual inspections, their evaluation of the appropriate installation, and
15 the absence of any visible active leaks in the general area of the original leak location or
16 within the same pre-cast manhole joint.
17
- 18 B. If Engineer and/or Engineer's representative has to enter the manholes to inspect the
19 work, Contractor shall provide forced air ventilation, gas monitors and detectors,
20 harnesses, lights, confined space entry permits, etc. for Engineer and/or Engineer's
21 representative to enter the manhole and perform the inspection in complete accordance
22 with OSHA requirements at no additional cost to Owner.
23
- 24 C. There shall be no groundwater infiltration or other leakage (active or previously active) at
25 or near the original leak location or within the same the pre-cast manhole joint after it
26 has been repaired. If leakage is found and deemed to be a direct result of the original
27 repair as determined by Engineer and/or Engineer's representative, it shall be eliminated
28 as approved by Engineer at no additional cost to Owner. The Engineer's decision on
29 how additional leak(s) are repaired shall be final. If any additional leaks are discovered
30 after it has been installed or during the warranty period, they shall be repaired in a
31 satisfactory manner at no additional cost to Owner. In event of leakage as a result of
32 water main or service leak, Contractor is required to notify Engineer, Engineer's
33 representative, and 311.
34
35
36

END OF SECTION

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