

DIVISION 03 – CONCRETE

03 10 00.02 - QUAKEWRAP SPiRe®+ PANEL SYSTEM

PART 1 – GENERAL

1.0 SUMMARY

- A. This specification is intended to define the minimum requirements and properties of manufactured fiber reinforced polymer (FRP) panels for the purposes of providing impervious corrosion protection barriers plus reinforcing of the existing structure. The patented Sheet Pile Repair (SPiRe®+) system described herein is developed by QuakeWrap, Inc. of Tucson Arizona, USA, and will be referred to as SPiRe®+ hereafter.
- B. The SPiRe®+ installation contractor shall provide all labor, materials, tools, and equipment required for the completion of the Work, as shown on the Contract Documents and specified herein:
 - 1. Prepare existing areas, as defined by these specifications and related Contract Drawings, designated to receive restoration, protection and/or strengthening.
 - 2. Furnish all panels and install all panels, shoring, bracing, and anchoring.
 - 3. Prepare installation and placement shop drawings.
 - 4. Prepare design drawings for shoring and bracing if required.
 - 5. Furnish all submittals required by this Section of the Specifications.
 - 6. Coordinate all work with other trades on site.
- C. Engineering and design of the SPiRe®+ system shall be provided by QuakeWrap, Inc. or approved licensed civil engineer (P.E.). Engineering design calculations and installation drawings will be provided with the SPiRe®+ panel system.
- D. The extent of the SPiRe®+ system covered herein is shown on the plans, elevations, sections and detailed in the Contract Documents and includes:
 - 1. Attachment to steel sheet piles
 - 2. Attachment to concrete walls
 - 3. Attachment to timber walls
 - 4. Attachment to concrete beams or columns
 - 5. Attachment of anchors through the SPiRe®+ system
 - 6. Attachment of shoring and bracing
- E. The SPiRe®+ Contractor shall cooperate and coordinate with all other trades in executing the work described in the Contract Documents.

1.1 REFERENCES

- A. The latest edition and addenda of the following publications in effect on the date of Contract Award are part of this Specification and, where referred to by title or basic designation only, are applicable to the extent indicated by the specific reference:

1. AMERICAN CONCRETE INSTITUTE (ACI)

ACI 116	Cement and Concrete Terminology
ACI 117	Specifications for Tolerances for Concrete Construction and Materials, and Commentary
ACI 224.1	Causes, Evaluation, and Repair of Cracks in Concrete Structures
ACI 224	Control of Cracking in Concrete Structures
ACI 440	State-of-the-Art Report on Fiber Reinforced Plastic Reinforcement for Concrete Structures
ACI 440.2	Guide for the Design and Construction of Extremely Bonded Systems for Strengthening of Concrete Structures
ACI 503	Use of Epoxy Compounds with Concrete
ACI 503.4	Standard Specifications for Repairing Concrete with Epoxy Mortars
ACI 503.5	Guide for the Use of Polymer Adhesives in Concrete
ACI 503.6	Guide for the Application of Epoxy and Latex Adhesives for Bonding Freshly Mixed and Hardened Concretes
ACI 546	Concrete Repair Guide

2. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 256	Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
ASTM D570	Standard Test Method for Water Absorption of Plastics
ASTM D 638	Standard Test Method for Tensile Properties of Plastics
ASTM D 790	Standard Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D2583	Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D2584	Standard Test Method for Ignition Loss of Cured Reinforced Resins
ASTM D3039	Test Method for Tensile Properties of Polymer Matrix

Composite Materials

ASTM D3418	Test Method for Transition Temperatures of Polymers by Differential Scanning Calorimetry
ASTM D4541	Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Tester
ASTM D5224	Standard Practice for Compression Molding Test Specimens of Thermosetting Molding Compounds
ASTM D5687	Guide for Preparation of Flat Composite Panels with Processing Guidelines for Specimen Preparation
ASTM 6153	Standard Specification for Materials for Bridge Deck Waterproofing Membrane System (500 hr. Accelerated Weathering by UV Twin Carbon Arc)
ASTM 7957	Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement
ASTM E 96	Standard Test Methods for Water Vapor Transmission of Materials

3. INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

AC125	Acceptance Criteria for Concrete and Reinforced and Unreinforced Masonry Strengthening Using Fiber-Reinforced Polymer (FRP) Composite Systems
AC178	Acceptance Criteria for Inspection and Verification of Concrete and Reinforced and Unreinforced Masonry Strengthening Using Fiber Reinforced Polymer (FRP) Composite Systems

4. INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

ICRI No. 03730	Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion
ICRI No. 03732	Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays
ICRI No. 03733	Guide for Selecting and Specifying Materials for Repairs of Concrete Surfaces

5. NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM (NCHRP)

NCHRP Report 514 Bonded Repair and Retrofit of Concrete Structures Using
FRP Composites (Recommended Construction
Specifications and Process Control Manual)

6. SOCIETY OF PROTECTIVE COATINGS (SSPC)

SSPC SP-2	Hand Tool Cleaning
SSPC-SP 6 NACE No. 3	Commercial Blast Cleaning
SSPC SP-12	WJ-2 Surface Preparation and Cleaning of Metals by Water Jetting
SSPC-SP 13/NACE No. 6	Surface Preparation of Concrete
SSPC-SP 15	Commercial Grade Power Tool Cleaning

1.2 SUBMITTALS

- A. Submit test results conducted per the ASTM standards as applicable to the project.
- B. Submit manufacturer's product data sheet indicating physical, mechanical, structural, and chemical characteristics of SPiRe®+ panel system.
- C. Submit product data sheets, ICC ESR reports (as required in Contract Documents) and other technical data for anchors used as defined in section 2.4.
- D. Design and Shop Drawings: The following information must be provided and sealed by a professional civil engineer:
 - 1. Details shall be carried out in accordance with the local building codes, and as shown on Contract Documents.
 - 2. Shop drawings detailing the SPiRe®+ panel installation and the installation of fill material to be placed in the annular space.
 - 3. Shop drawings and design calculations for any necessary shoring of the SPiRe®+ panel system to be used.
- E. Quality Assurance Documents
 - 1. Daily installation reports showing air and water temperatures during the placement of the fill material.
 - 2. Daily installation reports showing lot numbers of FRP laminates, fill materials, and resins used.

PART 2 – PRODUCTS

2.0 ACCEPTABLE MANUFACTURERS & COMPOSITE STRENGTHENING SYSTEM

- A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

SPiRe®+ System
QuakeWrap, Inc
6840 S. Tucson Blvd
Tucson, AZ 85756
Phone: (866) QuakeWrap (782-5397) or (520)791-7000
Fax: (520) 791-0600
www.QuakeWrap.com

- B. The FRP panel shall be the patented SPiRe®+ as trademarked by QuakeWrap, Inc. (Tucson, Arizona).
- C. This will be the only systems permitted, used in accordance with the manufacturer's recommendations, subject to the requirements of the plans and this specification. Alternate systems using FRP panels would violate US patent laws.
- D. Quality Control Testing and Certification: Manufacturer shall certify that the fiber reinforced panels conform to this specification and shall maintain records of testing. Each project consisting of greater than 5000 square feet of fiber reinforced panels shall have testing done for the following panel attributes:
1. Visual Inspection for:
 - a. Thickness
 - b. Panel imperfections
 - c. Dimensions
 - d. Color
 2. Ultimate Flexural Capacity, ksi - ASTM D 796
 3. Barcol Hardness - ASTM D2583
- E. Labeling, packaging, and storage shall include any health hazard warnings, precautions for handling and recommended first aid procedures in case of contact.
- F. All materials used shall conform to this specification and other specifications referenced within and subject to the approval of the Engineer.
- G. Design Loads: The SPiRe®+ system shall be designed for the following loads as they apply for the specific site conditions:
1. Hydrostatic pressure of grout (cementitious and/or epoxy) placement
 2. Anchorage/connection forces
 3. Any permanent or temporary bracing required

2.1 SPiRe®+ PANEL SYSTEM

- A. The FRP system shall be comprised of E-glass Fiberglass with a vinyl ester resin that provides strength in both longitudinal and transverse directions.
- B. The FRP panels are designed to serve as structural reinforcement for the repair system and must be properly bonded to the fill material to serve the intended purpose. This shall be achieved by the following:
 - a. The FRP panels must include T profile for mechanical locking to the fill material. The T profiles must be an integral part of the panels built monolithically during the manufacturing process. Epoxy bonding T profiles to flat panels is not permitted.
 - b. The T profiles must be spaced no more than 4 in. (100 mm) apart.
 - c. The flange of the T profiles shall be 1.5 in.(38mm) wide minimum to ensure adequate locking of the T profile within the filler material.
 - d. The inside surface of the FRP panels and T profiles must be coated with epoxy and grit to ensure full bonding of the panel to the fill material.
 - e. The T profile, being the reinforcing element for this system, its cross sectional area must be no less than 40% of the total cross sectional area of the panel.
- C. The FRP panels must include UV inhibitor in the resin matrix as an integral part of manufacturing to ensure longevity of the system. Products that are coated with a
- D. The SPiRe®+ system shall have the minimum properties listed in the table below.

SPiRe®+ System Properties		
Property	Standard	Value
Panel Width		36 in. (914 mm)
Wall Thickness		0.2 in. (5mm)
Minimum Ultimate Tensile Strength (Longitudinal Direction)	ASTM D 638	30 ksi 207 MPa
Minimum Tensile Modulus of Elasticity (Longitudinal Direction), ksi	ASTM D 638	2,490 ksi 17.2 GPa
Minimum Ultimate Tensile Strength (Transverse Direction), ksi	ASTM D 638	6.9 ksi 5.5 GPa
Minimum Tensile Modulus of Elasticity (Transverse Direction), ksi	ASTM D 638	797
Barcol Hardness	ASTM D 2583	30 min.
IZOD Impact (notched), ft-lbf./in	ASTM D 256	15
Maximum Water Absorption	ASTM D 570	< 1%
Ultraviolet (UV) Accelerated Weathering Test (500 hours Twin Carbon Arc)	ASTM 6153	Pass
Standard Color (options available)		Grey

2.2 ADHESIVE RESIN

- A. The adhesive resin shall be a two-component high-strength structural epoxy adhesive designed for underwater applications. It shall have an immediate high tack consistency both in air and water and shall trowel easily.
- B. The adhesive resin shall be a 100% solids formulation with low toxicity and low odor during cure.

2.3 FILL MATERIAL

- A. CAST-IN-PLACE CEMENTITIOUS AND EPOXY GROUT per QuakeWrap, Inc. Specification Section 03 30 12 for grouts permitted for use with the SPiRe®+ system.

2.4 ANCHORS

- A. Anchors are project specific and part of the Engineering Design and shall be identified on the Contract Documents. No substitutions are permitted without approval by the design engineer and product manufacturer.
- B. Anchors are used to support the panel system and shoring during construction and to create and maintain an annulus between panel and adjacent wall structure. Anchors must maintain annular space appropriate to the requirements of the fill material by using spacers additional nuts and washers appropriate for the application. Prior to installation in the field, all anchors shall be inspected to ensure the anchor is free of any damage.
 - 1. Threaded Steel Rod
 - a. Galvanized - ASTM A320, Grade 7, hot dipped galvanized per ASTM F2329, Fy=105 ksi (720 MPa)
 - b. Stainless Steel – ASTM A320, AISI SS 316, Fy=105 ksi (720 MPa)
 - c. Nuts and washers shall match threaded rod specifications.
 - d. Threaded steel rod set into existing concrete shall be set with an approved epoxy. See Contract Documents for additional information.
 - 2. Self-Tapping Steel Screws
 - a. Galvanized – ASTM A449, Grade 7, hot dipped galvanized per ASTM F2329, Fy=105 ksi (720 MPa)
 - b. Stainless Steel – Hex head, ASTM A193, 410 SS self-tapping screw.
 - c. Washers shall be made of FRP and matching the color of the FRP panels.
 - d. Nuts shall match steel screw specifications.
 - 3. Fiberglass Threaded Rod
 - a. Rod shall be manufactured by a licensed ISO certified facility.
 - b. Minimum properties:
 - i. Compressive Strength – 60,000 psi (410 MPa) per ASTM D695
 - ii. Flexural Strength – 50,000 psi (345 MPa) per ASTM D790
 - iii. Ultimate Tension – 4,500 lbs (20 kN)
 - iv. Minimum diameter – ¾ inch (19mm)
 - c. Nuts and washers shall match threaded rod specifications.

4. Concrete Screws

- a. Stainless Steel – Hex head, stainless steel Type 316
- b. Washers shall match concrete screw rod specifications.
- c. See Contract Documents for additional information.

2.5 REINFORCING MATERIAL

A. Fiber Reinforced Polymer (FRP) Reinforcing Bars

1. The reinforcing fibers shall be E-CR glass fibers (corrosion resistant).
2. The fiber content by weight shall be greater than or equal to 70% by weight per ASTM D2584.
3. The reinforcing matrix shall be vinyl ester resin.
4. Prior to installation in the field, all reinforcing bars shall be inspected to ensure the bar is free of any damage.

B. Reinforcing Steel

1. The reinforcing material shall be Grade 60 steel conforming to ASTM A615
2. The reinforcing steel shall be epoxy coated and conform to ASTM A775
3. Prior to installation in the field, all reinforcing steel shall be inspected to ensure the epoxy coating is free of any damage.
4. Epoxy coat the ends of rebar that have been cut in the field.

PART 3 – EXECUTION

3.0 GENERAL PROCEDURES

- A. QuakeWrap, Inc. shall design the SPiRe®+ panel to meet the structural performance requirements indicated in Contract Documents. The design of the SPiRe®+ panel shall follow basic mechanics of materials principals.

3.1 SURFACE PREPARATION – GENERAL

- A. The Contractor shall expose and inspect surfaces to be protected with the SPiRe®+ system. Inspection shall check the location and inspect for corrosion, deterioration, cracking and general condition of the steel, concrete, and/or wood surfaces.
- B. The Contractor shall examine the existing conditions to identify potential obstructions and constraints; shall verify dimensions, geometry and access locations; and shall map all visible items of concern.
- C. Where an adhesive bond is required, the surface preparation shall also promote continuous intimate contact between SPiRe®+ and base material by providing a clean, and smooth surface.
- D. Contractor shall notify project engineer of existing structural deterioration, apparent distress, or compromised sheet piles that exceed the scope of the repair.

3.2 SURFACE PREPARATION – MATERIAL SPECIFIC

A. Concrete Surface Preparation

1. Contractor shall remove any marine growth or any soft surface layer that has accumulated on the concrete wall as stated below.
 - a. All loose and deteriorated concrete shall be removed using hydraulic or air pressurized hand tools.
 - b. The concrete surface to which SPiRe®+ panel system is to be applied should be exposed and free of loose or unsound materials.
 - c. All loose deleterious material and marine growth shall be removed to a profile no greater than 1/4- inch shell base.
 - d. All concrete surfaces where SPiRe®+ panels are directly epoxy bonded to the concrete, must be prepared to Concrete Surface Profile (CSP) 2 or higher.
 - e. For applications where new concrete or grout will be placed in direct contact with existing concrete, AND the SPiRe®+ panels are contributing to the structural capacity of the system, the existing concrete must be prepared to a CSP-6 or higher.

B. Steel Surface Preparation

1. Contractor shall remove any marine growth or any soft surface layer that has accumulated on the steel sheet piles as stated below.
 - a. All loose and rusted steel shall be removed using hydraulic or air pressurized hand tools.
 - b. All loose deleterious material and marine growth shall be removed to a profile no greater than 1/4- inch shell base.
 - c. All steel surfaces receiving SPiRe®+ panel system shall be cleaned using pressure water jetting conforming to SP WJ-4 as described in SSPC-SP 12/NACE No. 5.
 - d. For applications where epoxy grout will be placed in direct contact with existing steel, AND the SPiRe®+ panels are contributing to the structural capacity of the system, the steel surface shall be cleaned to SP WJ-2.

C. Wood Surface Preparation

1. Contractor shall remove any marine growth or any soft surface layer that has accumulated on the wood timber wall.
 - a. All timber scheduled to receive SPiRe®+ panel system shall be cleaned using low pressure washing or other mechanical means to remove marine growth, any soft layer that has accumulated and other contaminants.
 - b. Precautions must be taken to not remove any intact timber during the surface preparation.

3.3 ELAPSED TIME AFTER CLEANING

- A. The elapsed time between cleaning of the surface and the installation of the SPiRe®+ panels and fill material shall not exceed 7 days unless approved by EOR or product manufacturer.
- B. Contractor shall remove any marine growth that has accumulated on the surface prior to placement of fill material.

3.4 DEBRIS AND DUST CONTAINMENT

- A. Proper care shall be taken to contain and remove dust and debris. Such containment and extraction shall be dictated by the specific requirements of the site. Consideration should be made for enclosed areas, areas where falling debris is possible, and areas where dust and debris may inhibit the function of adjacent equipment, processes, and/or daily practices. All areas are to be properly ventilated. Walkways and paths of ingress and egress shall be kept free of dust and debris.

3.5 STORAGE, HANDLING, AND DISPOSAL

A. Storage Requirements

- 1. All components of the SPiRe®+ system must be delivered and stored in the original factory-sealed, unopened packaging or in containers on pallets with proper labels identifying the manufacturer, brand name, system identification number, and date. All components must be protected from dust, moisture, chemicals, direct sunlight, physical damage, fire, and temperatures outside the range specified in the system data sheets. Any component that has been stored in a condition different from that stated above must be disposed of, as specified in Section 3.5 G.

B. Shelf Life

- 1. All resins and adhesives, that have been stored longer than the shelf life specified on the system data sheet shall not be used and must be disposed of, as specified in Section 3.5 G. All other components of the SPiRe®+ system, such as the panels, fasteners, do not have an expiration date or shelf life.

C. Handling

- 1. All components of the SPiRe®+ system, especially FRP panels, must be handled with care according to the manufacturer recommendations to protect them from damage, breakage of the panels by pulling, separating, or stacking. Panels shall be stacked dry to prevent damage. Items shall not be stacked on panels that could create bowing, cracking, indentation, damage of finish or puncture of panels.

D. Safety Hazards

1. All components of the SPiRe®+ system, especially resins and adhesives, must be handled with care to avoid safety hazards, including but not limited to skin irritation and sensitization and breathing vapors and dusts. Mixing resins shall be monitored to avoid firming and flammable vapors, fire hazards, or violent boiling. The Contractor is responsible for ensuring that all components of the SPiRe®+ system at all stages of work conform to the local, state, and federal environmental and worker's safety laws and regulations. The Contractor is advised that a forced ventilator system may be required inside enclosed sections and that provision for ventilation, if any, shall be included in the cost of the work.

E. Safety Data Sheets

1. The SDS for all components of the SPiRe®+ system shall be accessible to all at the project site. Specific handling hazards and disposal instructions shall be specified in the SDS. The Contractor is responsible for providing the proper means of protection for safety of the personnel and the workplace. The Contractor shall inform the personnel of the dangers of inhaling fumes of primer, putty, or resin and shall take all necessary precautions against injury to personnel. The resin mixing area shall be well vented to the outside.

F. Clean-Up

1. The Contractor is responsible for the cleanup of the equipment and the project site from hazardous and aesthetically undesirable SPiRe®+ components using appropriate solvents, as recommended in the system data sheet.

G. Disposal

1. Any component of the SPiRe®+ system that has exceeded its shelf life or pot life or has not been properly stored, as specified in Section 3.5 A, and any unused or excess material that is deemed waste shall be disposed of in a manner amiable to the protection of the environment and consistent with the SDS and local ordinances.

3.6 INSTALLATION OF SPiRe®+ SYSTEM

Surface preparation for installation of SPiRe®+ flat and formed panels shall follow the procedure outlined in Sections 3.1 and 3.2.

A. Environmental Conditions

1. Environmental conditions for installation shall be examined before and during installation of the SPiRe®+ system to ensure conformity to the Contract Documents and manufacturer's recommendations.

B. Equipment

1. The Contractor shall provide all necessary equipment in sufficient quantities and in clean operating conditions for continuous uninterrupted SPiRe®+ installation.

C. Attaching SPiRe®+ System

1. The system may be affixed to the surface by means of mechanical anchoring concrete screws, “J”-bolts, soil screws, or other mechanical fasteners, as indicated on the Contract Drawings and Engineering Design.
2. If necessary, spacers can be installed against the base material surface to maintain the desired annular space between the surface and the SPiRe®+ panel.

D. Sealing SPiRe®+ System Prior to Grout Installation

1. The SPiRe®+ system shall be sealed where required to ensure no leaks and loss of grout during grout placement and curing. Methods to seal the bottom shall be as indicated on the Contract Documents or may be an approved alternate proposed by the contractor, such as backer rod, soil embedment, or other systems. The contractor is responsible to ensure that leakage and blowout does not occur.
2. A bottom plug shall be part of the sealing of the base of the SPiRe®+ system, with a minimum of six (6) inches (150mm) of epoxy grout or as detailed in the Contract Documents. The bottom plug shall be cured enough to support the weight of the concrete placed during the grouting sequence.

E. Shoring

1. Proper shoring should be used to resist the force of the hydrostatic pressure from the grout (140 pcf (2240 kg/m³) for normal weight grout) during placement. Strong backs should be designed to allow for a hydraulic head pressure to facilitate the placement of the grout in lifts not to exceed four (4) feet (1.2m) in height or as designated on the Contract Drawings. Shoring may be removed after the grout has reached the required design strength or in seven (7) days.
2. Shoring may not be required for light-weight fill material, such as light-weight grout, or injected foams. The Contract Documents or delegated shoring design shall account for specific fill material selected.
3. Other shoring designs provided by the Contractor or Engineer of Record shall be approved by the product manufacturer for the intended use and panel design properties.

F. Epoxy Grout

1. CAST-IN-PLACE CEMENTITIOUS AND EPOXY GROUT per QuakeWrap, Inc. Specification Section 03 30 12 for grouts permitted for use with the SPiRe®+ system. Epoxy grout shall be placed in lifts not to exceed twelve (12) inches (300 mm) or as specified in the Contract Documents.
2. Any mixed epoxy grout that exceeds its pot life shall be disposed of according to Section 3.5 G.

3. Epoxy grout should be poured in lifts to ensure full encapsulation, with consideration to the alignment and flatness tolerances of the SPiRe®+ system and capacity of the sealing system. The epoxy grout shall be allowed to cure per the manufacturer's material data sheet.

G. Grout

1. CAST-IN-PLACE CEMENTITIOUS AND EPOXY GROUT per QuakeWrap, Inc. Specification Section 03 30 12 for grouts are permitted for use with the SPiRe®+ system. Grout shall be placed in lifts not to exceed four (4) feet (1.2 m) or as specified in the Contract Documents.

H. Damaged Panels and Products

1. Panels or products damaged during the installation may not be installed. Handle products in a manner to protect the finishes, edges, protruding T profiles and structural integrity of the panel.

3.7 INSPECTION & QUALITY ASSURANCE (QA)

- A. A project specific QA plan shall be developed from the tests identified in this section. All inspections and tests in this section will be performed by a trained inspector acting on behalf of the project owner/manager for QA of the project in the presence of the Contractor and the Engineer. The Contractor may have its own inspector for Quality Control.
 1. Inspection of Materials
 - a. The manufacturer's certifications for all delivered and stored FRP components will be inspected for conformity to the contract documents before starting the project.
 2. Daily Inspection
 - a. Daily inspection reports shall include date and time of installation; ambient temperature; relative humidity; general weather conditions; qualitative description of surface cleanliness; batch numbers of adhesives.
 3. Testing of the fill material materials as specified for conformance to Contract Documents.
 4. It is recommended that a manufacturer representative be retained to provide periodic site visits for the inspection of the installation for conformance to the manufacturer's specifications.

3.8 REPAIR OF DEFECTS

- A. Contact the Engineer of Record and/or product manufacturer for defects that occur during installation to review specific conditions and repair options. Modifications, repairs or alterations to the products by the contractor or other persons is strictly prohibited and nullifies any warranties and/or guarantees.

3.9 PROJECT CLOSE-OUT AND MAINTENANCE

A. Documentation of the Work

1. The Owner may provide specification language requiring documentation of the work be prepared and submitted by the Contractor on completion of the work. The documentation shall include the following:
 - a. Information on the products and installation method used
 - b. Pre- and post-inspection results
 - c. Test results
 - d. Any changes or deviations from the contract documents and possible corrective work
2. Owner's Inspector may also prepare documentation of the project and include the following:
 - a. Purchaser's/Inspector's tests and reports
 - b. Material test reports
 - c. Field test reports
 - d. As-built drawings of the renewed or strengthened segments

B. Verification/Basis for Rejection

1. Materials not complying with the requirements of this specification shall be rejected. Repairs, replacements, and retesting shall be accomplished in accordance with the Owner's documents.

C. Certificate of Compliance

1. The Owner may require an affidavit from the Manufacturer or Contractor, as applicable, that the material provided, or the installation performed complies with the applicable requirements of the specifications provided herein.

PART 4 - WARRANTY

The SPiRe®+ system shall provide a two-year material warranty against defects. Extended material warranties may be available upon request provided separately by the product manufacturer for additional fees that may require periodic site inspection and/or maintenance.

The Contractor shall provide a one-year warranty on the labor used for installation of the SPiRe®+ system. Any defects affecting structural and hydraulic performance of the SPiRe®+ system shall be repaired by the Contractor at no cost to the Owner.

Cosmetic defects such as discoloration and minor undulations do not need to be repaired and are excluded from the warranty. Any damage caused by direct impact or loads that are substantially higher than the normal operation is not covered by the warranty. The Owner will provide all required access to the area to be repaired under this warranty.

END OF SECTION