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SPECIFICATIONS - DETAILED PROVISIONS
Section 03604 - Casing Grouting-Annular Space

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SECTION 03604
CASING GROUTING-ANNULAR SPACE

PART 1 - GENERAL

1.01 DESCRIPTION

Provide grouting of the annular space between the carrier pipe and the casing pipe. The annular space (void between the carrier pipe and the casing pipe) shall be completely grouted to support the carrier pipe and provide long-term stability. The Contractor shall provide testing of materials and methods for compliance with the requirements which follow. All proposals shall be submitted to the Engineer.

PART 2 - PRODUCT

2.01 MATERIALS

- A. Grout. The grout materials shall consist of portland cement (portland cement and fly ash) and/or additives.
- B. Compressive Strength. The grout shall have a minimum penetration resistance of 100 psi in 24 hours when tested in accordance with ASTM C-403 and a minimum compressive strength of 300 psi in 28 days when tested in accordance with ASTM C-495 or C-109.
- C. Performance Requirements. The Contractor shall submit the proposed grout mixes, methods, plans, and criteria of the grouting operations. The grouting system shall have sufficient gauges, monitoring devices, and tests to determine the effectiveness of the grouting operation and to ensure compliance with the pipe specifications and design parameters.
- D. Mix Designs. One or more mixes shall be developed to completely fill the annular space based on the following requirements:
 - 1. Size of the annular void
 - 2. Sufficient strength and durability to prevent movement of the carrier pipe
 - 3. Provide adequate retardation, and
 - 4. Provide less than 1 percent shrinkage by volume

- E. Density. The Contractor shall design a grout mix with a density to meet the requirements to prevent floating of the pipe. The apparent viscosity shall not exceed 35 seconds in accordance with ASTM C-939.

PART 3 - EXECUTION

3.01 QUALIFICATIONS

The Contractor shall provide references of previous projects demonstrating to the Engineer its capabilities of filling the annular space and performing work in conformance with the Plans and the Specifications.

3.02 GROUTING EQUIPMENT

The materials shall be mixed in equipment of sufficient size and capacity to provide the desired amount of grout material for each stage in a single operation. The equipment shall be capable of mixing the grout at densities required for the approved procedure and shall also be capable of changing density as dictated by field conditions any time during the grouting operation.

3.03 INJECTION PROCEDURE AND PRESSURE

The gauged pumping pressure shall not exceed the liner pipe manufacturer's approved recommendations. Pumping equipment shall be of a size sufficient to inject grout at a velocity and pressure relative to the size of the annular space. Gauges to monitor grout pressure shall be attached immediately adjacent to each injection port. The gauge shall conform to an accuracy of no more than one-half percent error over the full range of the gauge. The range of the gauge shall not be more than 100 percent greater than the design grout pressure. Pressure gauges shall be instrument oil filled and attached to a saddle-type diaphragm seal (gauge saver) to prevent clogging with grout. All gauges shall be certified and calibrated in accordance with ANSI 840, Grade 2A.

3.04 ONSITE TEST EQUIPMENT

Density shall be verified by ASTM C 138 or by other methods as approved by the Engineer. Viscosities shall be checked with a flowcone provided by the Contractor and tested per ASTM C 939.

3.05 TEST SECTION

The Contractor may be required to perform an above ground test on each type of grout and grout system proposed to be used. The test Section to be grouted and the size of the annular space considered for each type of grout system shall be determined by the Contractor and approved by the District.

3.06 SUBMITTALS AND REQUIRED CALCULATIONS

The Contractor shall submit the following to the Engineer at least 20 working days prior to the start of the grouting operation.

- A. The proposed grouting mix
- B. The proposed densities and viscosities
- C. Initial set time of the grout
- D. The proposed grouting method
- E. The maximum injection pressures
- F. The 24-hour and 28-day minimum compressive strength
- G. Proposed grout volumes
- H. Bulkhead designs
- I. Buoyant force calculations
- J. Flow control
- K. Pressure gauge certification
- L. Vent location plans

These shall be submitted as a complete package for a single or sample section only. The Contractor shall notify the Engineer of any changes to be made in grouting.

END OF SECTION 03604