

ENGINEERS
GENERAL BENTONITE INSTALLATION GUIDE

Private & Municipal Ponds
Sewage Treatment Lagoons
County Landfills

SECTION _____: BENTONITE SEAL (file ps4spec1)

1. SCOPE OF WORK

- 1.1 The work in this section consists of materials, storage and placement of bentonitesealant for the proposed area shown on the drawings. This work shall include the furnishing of all labor, materials, tools, equipment and other items necessary for the proper installation of the bentonite sealant per the layout, grades, cross sections and dimensions established on the drawings.

2 MATERIALS

- 2.1 The soil sealant material shall be free flowing, high swelling sodium PondSeal 4 bentoniteas distributed by H & H Environmental Inc., Grand Junction, CO. 1-800-952-0802 or approved equal.
- 2.2 The bentonite material shall conform to the following requirements.
- a. Dry Fineness: Corse-Granular Grade - "Pondseal4" 5% max retained on a 6 mesh, 15% max passing a 200 mesh
 - b. Free Swell: 22-24cc High swelling is defined as the ability of 2 grams of bentonite when mechanically reduced to minus 100 mesh to swell in water to a volume of 16 cc or more when added a little bit at a time to 100 cc of distilled water contained in a graduate.
 - a. Moisture content: 9% to 12%
 - b. pH 6.4 % Suspension: 9.6
 - c. Bulk Density: approx 65 lbs pcf Color: Tan to Brown
 - d. Packaging: 50# paper bags on pallets, 1-2 ton nylon jumbo bag or bulk.

3 EXECUTION

- 3.1 For bulk shipments, prior to delivery, storage site should be cleared and leveled. For paper bagged shipments, adequately protect bentonite until installation. Contractor shall schedule shipments to jobsite as close to installation time as possible to minimize storage time unless stockpiling of bentonite is required to expedite shipments and maintain construction schedule.
- 3.2 The surface area upon which the water barrier is to be constructed shall be graded as per the drawings or engineers instruction. No slope walls shall exceed a grade of 3:1 unless shown on the drawings or approved by the engineer.
- 3.3 Remove all vegetation, boulders and debris which would penetrate the area of the seal. Work on the slopes shall be performed first before the bottom to permit drainage in the event of rainfall.
- 3.4 Water should be added to the soil, or dried if too wet, before or after applying the sealant to result in an moisture content of optimum to plus 2% of optimum.

3. EXECUTION (con't)

- 3.5 The bentonite shall be spread uniformly across the base surface at the specified application rate, using an agricultural seed or lime spreader or other equipment as approved by the engineer. Pre-measured tarpaulin or drop clothes spread in different locations shall be weighed after spreading material over them to insure that the proper amount is being applied. Hand apply and hand compact a dry mixture of one part bentonite to four parts soil, by volume, blended dry up along the edges of a construction appurtenances.
- 3.6 The sealant should be thoroughly mixed into the soil to a depth specified by the engineer or shown on the drawings, typically 4-12 inches, in 6" lifts. An adjustable rot tiller is strongly recommended, however an agricultural disk drawn across the specified area in several different directions or other equipment may be used with engineer's approval.
- 3.7 The sealant-soil layer shall be compacted to 95% of Modified Proctor density, using a vibratory compactor, a flat steel wheel roller, or a sled type compactor. Compaction equipment must be approved by the engineer after a demonstration of its effectiveness.
- 3.8 The completed seal shall be covered with at least 4 inches of soil to control erosion or as shown on drawings.

4 RATE OF APPLICATION

- 4.1 The bentonite application rate shall be determined by consultation with the engineer, H & H Environmental and the soil testing lab. Permeability tests shall be performed with a representative soil sample from the jobsite and with the approved bentonite sample from the manufacture. Testing shall be done by the bentonite manufacture or by an independent lab as instructed by the engineer with the cost borne by the contractor. The soil sealant shall be applied at a rate to provide impermeability of 1×10^{-7} or less under the designed head pressure or as specified by the engineer. Contractor shall furnish 120% of the test result quantities of bentonite to adjust for field conditions.
- 4.2 Unless otherwise noted, for bidding purposes, the contractor shall use an application rate of 4 pounds per square foot and a cost per ton of bentonite installed. Exact amount of bentonite required shall be determined later by the soil permeability test and the engineer.

5 TESTING FOR WATER TIGHTNESS

- 5.1 The completed seal shall be hydrated with fresh water for the testing and protection. The adequacy of the completed seal for water tightness shall be tested prior to filling. Two (2) tests per lagoon or pond shall be made. The

5. TESTING FOR WATER TIGHTNESS (con't)

contractor shall furnish written certification from an independent soils lab that the seal was constructed in accordance with these specifications.

- 5.2 If excessive leakage greater than the allowable is found when the seal is tested, the contractor shall upgrade the soil-bentonite layer so as to produce the required water tightness. The soil sealant system shall be upgraded by adding more bentonite, re-mixing and re-compacting per the specifications. After upgrading the liner is complete, the contractor shall again test for water tightness as previously specified. All cost for this work shall be by the contractor.

6. WARRANTY

- 6.1 The soil sealant shall be covered by the manufacture's warranty against defects in the material and workmanship and have a useful life of 20 years under normal weathering and normal conditions.

7 MEASUREMENT AND PAYMENT

- 7.1 The quantities which constitute the complete and accepted work will be measured and paid for at the contract unit price(s) as indicated in the BID SCHEDULE. The payment for the bentonite soil sealant shall be based on the actual tonnage quantity installed times the cost per ton installed.