

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**POND SEALING OR LINING - BENTONITE SEALANT, (NUMBER)**

**Code 521C**

**DEFINITION**

A liner for a pond or waste impoundment consisting of a compacted soil-bentonite mixture.

**PURPOSE**

To reduce seepage losses from ponds or waste impoundments for water conservation and environmental protection.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies where:

- Soils are suitable for treatment with bentonite.
- Ponds or waste impoundments require treatment to reduce seepage rates and to impede the migration of contaminants to within acceptable limits.

**CRITERIA**

**General Criteria Applicable to All Purposes**

Bentonite-treated soil liners shall be planned, designed, and installed to meet all federal, state, local and tribal laws and regulations.

Structures to be lined shall have been constructed to meet all applicable NRCS standards. All inlets, outlets, ramps, and other appurtenances may be installed before, during, or after the liner placement, but shall be done in a manner that does not damage or impair the proper operation of the liner.

Bentonite-treated soil liners shall be filter compatible with the natural foundation materials on which they are compacted according to the National Engineering Handbook, Part 633, Soil Engineering, Chapter 26, or an equivalent recognized industry standard.

The minimum thickness of the finished compacted liner shall be 6 inches. The liner material shall be placed in layers not over 9 inches thick before compaction. The final compacted thickness of each layer shall be no greater than 6 inches. Thicker liners shall be constructed in multiple layers with each layer compacted before the next layer is placed. Liner thickness is measured perpendicular to the finished surface.

The bentonite shall be a sodium bentonite with a free swell of at least 22 milliliters as measured by ASTM Standard Test Method D5890, unless laboratory tests using other bentonite types are used for design.

When laboratory permeability tests are required to determine application rates, the tests shall be performed using bentonite of the same quality and fineness as that proposed for use.

For protection against bentonite dust, personnel on site during bentonite application and mixing shall wear a mask and goggles.

**Criteria Applicable to Waste Impoundments**

**Design.** Design of the bentonite-treated soil liners for waste impoundments shall be in accordance with National Engineering Handbook Series, Part 651, Agricultural Waste Management Field Handbook,

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Chapter 10, Appendix 10D and/or state regul

The application rate of the bentonite shall produce a permeability of 1/16 inch/day or less with a compaction of 90 percent of the maximum density as determined by the Standard Proctor Test, ASTM-698.

**Liner Protection.** The liner shall be protected against desiccation cracking, the effects of water surface fluctuations, wave action, surface erosion, erosion from pipe inlets, agitation equipment, animals, or items installed through the liner. Protective measures shall be designed into the system to protect the liner for these cases. At least 12 inches of compacted soil cover shall be placed over the soil-bentonite liner.

### Criteria Applicable to Ponds

**Application Rate.** For ponds, in the absence of laboratory tests or field performance data on soils similar to those to be treated, the minimum application of finely ground bentonite per 1-inch thickness of constructed liner shall be:

Pervious Soil Description	Application rate (lb/ft <sup>2</sup> )
Silts (ML, CL-ML)	0.375
Silty Sands (SM, SC-SM, SP-SM)	0.5
Clean Sands (SP, SW)	0.625

**Liner Thickness.** In the absence of more detailed testing and analyses, liner thickness shall be according to the following table:

Water Depth (ft)	Liner Thickness (in)
8 or less	6
8.1 – 16	12
16.1 – 24	18
24.1 - 30	24

## CONSIDERATIONS

Flattening the slopes of ponds or waste impoundments to facilitate compactive efforts during construction should be considered. The stair-step method of construction as outlined in National Engineering Handbook Series, Part 651, Agricultural Waste Management Field Handbook, Chapter 10, Appendix 10D may be considered in lieu of slope flattening.

A protective compacted soil cover should be considered for protecting the soil-bentonite liner for ponds.

Consider using a flexible membrane liner for sites that have water depths greater than 24 feet.

### Quantity

1. Effects upon components of the water budget, especially effects on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
2. Variability of the practice's effects caused by seasonal or climatic changes.
3. Effects on downstream flows or aquifers that would affect other water uses.
4. Potential use for water management to conserve water.

### Quality

1. Effects on the movement of sediment, pathogens, and soluble material substances carried by seepage water.
2. Effects on the visual quality of downstream water resources.
3. Short-term and construction-related effects of this practice on the quality of the pool and downstream water.
4. Effects on the movement of dissolved substances below the pool area and toward ground water.

5. Effects on wetlands or water-related wildlife habitat.

### **PLANS AND SPECIFICATIONS**

Plans and specifications for bentonite treated soil liners for ponds and waste impoundments shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. Plans and specifications shall include such drawings, specifications, material requirements, quantities, construction requirements, equipment requirements, and other documents as are necessary to describe the work to be done.

The following list of Construction Specifications is intended as a guide to selecting the appropriate specifications for a specific project. The list includes most, but may not contain all, of the specifications that are needed for a specific project:

- IA-1 Site Preparation
- IA-3 Structural Removal
- IA-5 Pollution Control
- IA-11 Removal of Water
- IA-21 Excavation
- IA-23 Earthfill
- IA-24 Drainfill
- IA-27 Diversions
- IA-45 Plastic (PVC, PE) Pipe
- IA-92 Fences

### **OPERATION AND MAINTENANCE**

Maintenance activities required for this practice consist of those operations necessary to prevent damaging the treated soil liner. This includes, but is not limited to, excluding animals and equipment from the treated area, protection of the liner during initial filling, agitation, or pumping operations, and repair of disturbed or eroded areas.