

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

POND SEALING OR LINING - BENTONITE

(No.)  
CODE 521-C

**DEFINITION**

Installing fixed lining of impervious material or treating the soil in a pond mechanically or chemically to impede or prevent excessive water loss.

**PURPOSE**

To reduce seepage losses in ponds or earthen waste impoundments to an acceptable level.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies where:

- (1) seepage losses from a pond or waste impoundment would prevent it from fulfilling its intended purpose.
- (2) seepage from a waste impoundment would contaminate ground or surface water, and/or
- (3) soils are suitable for treatment with bentonite or similar high-swell clay materials.

**CRITERIA**

Impoundment structures to be sealed shall have been constructed to meet all applicable NRCS Conservation Practice Standards, and may include any of the following as appropriate:

- Irrigation Storage Reservoir (Code 436)
- Pond (Code 378)
- Waste Treatment Lagoon (Code 359)
- Waste Storage Facility (Code 313)

Design of the treated soil liner shall be in accordance with National Engineering Handbook Series, Part 651, Agricultural Waste Management Field Handbook, Chapter 10, Appendix 10D.

**Soil Properties.** Sealing with bentonite or similar materials is more applicable on coarse-grained soils where more than half of the material is larger than the No. 200 sieve size. These soils are generally in Groups I and II as defined in Appendix 10D.

**Bentonite.** Unless otherwise specified, a Wyoming sodium type bentonite shall be used. Laboratory permeability tests to determine application rates shall be run using bentonite of the same quality and fineness as that proposed for use in the pond sealing.

**Rate of Application.** For treating waste impoundments, the rate of application and kind of bentonite used shall be based on laboratory tests.

For ponds, the rate of application and the kind of bentonite to use shall be based on laboratory tests unless sufficient data are available on the field performance of previously tested soils and their similarity texturally and chemically to the soil to be sealed.

For ponds, in the absence of laboratory tests on the soils to be sealed, the minimum application rate for each treated layer shall be as specified in Table 1.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

<b>Table 1</b>		
<b>Pervious Soil</b>	<b>Application Method</b>	<b>Application Rate <i>lb/ft<sup>2</sup></i></b>
Clay	Mixed Layer	1.0-1.5
Sandy silt	Mixed layer	1.0-1.5
Silty sand	Mixed layer	1.5-2.0
Clean sand	Mixed layer	2.0-2.5
Open rock or gravel	Clay or sand mixed layer	2.5-3.0

**Thickness of Treated Liner.** The finished treated liner shall be at least 6 inches thick for water depths up to 8 feet. For greater depths of water, the blanket thickness shall be 12 inches or greater as determined by procedures in Appendix 10D. The liner material shall be installed in multiple lifts of 6 inches compacted thickness. A minimum thickness of 12 inches is recommended for all areas in the vertical range of water surface fluctuation.

There shall be at least 2 feet of fine-grained soil over fractured rock outcrops or other highly permeable material in addition to the treated blanket.

A protective layer of untreated soil shall be placed over the treated liner in waste impoundments. The minimum thickness of the protective layer shall be 6 inches.

### **CONSIDERATIONS**

Compaction of thin layers on steep slopes is difficult to accomplish without leaving discontinuities in the liner. To preserve the integrity of the liner, consideration should be given to flattening the slopes of waste holding ponds or dug ponds. As an alternative, liners on steep slopes may be constructed using the stair step method as described in Appendix 10D. Consideration should be given to providing a protective layer of soil over the bentonite treated

liner in ponds where fluctuating water levels may contribute to erosion of slopes. The untreated soil cover will provide a sacrificial zone that can withstand some erosion while protecting the underlying treated liner.

Consideration should be given to fencing the impoundment structure for the safety of humans, livestock, wildlife, and pets and to protect the liner from damage.

### **PLANS AND SPECIFICATIONS**

Plans and specifications are to be prepared for each specific site based on this standard. They 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.

### **OPERATION AND MAINTENANCE**

Maintenance activities required for this practice consist of those operations necessary to prevent breaching of the treated soil layer. This includes excluding cattle and equipment from the treated area, protection of the layer during initial filling, agitation, or pumping operations, and repair of disturbed or eroded areas.

### **REFERENCES**

National Engineering Handbook Series,  
Agricultural Waste Management Field  
Handbook, Chapter 10, Part 651, Appendix D

Kentucky NRCS Conservation Practice  
Standards:

- Code 436 - Irrigation Storage Reservoir
- Code 378 - Pond
- Code 359 - Waste Treatment Lagoon
- Code 313 - Waste Storage Facility

**CONSTRUCTION SPECIFICATION****POND SEALING OR LINING (Bentonite)  
521C****Scope**

This specification consists of the material requirements and construction procedures necessary for construction of a bentonite treated soil liner for sealing of ponds, including waste impoundments. Construction operations shall be carried out in such a manner that erosion, water, air, and noise pollution will be minimized and held within legal limits as established by state regulations.

**Materials**

Unless otherwise specified, bentonite shall be Wyoming type sodium bentonite. The fineness of the bentonite particles and application rate shall be specified for each job.

**Subgrade Preparation**

The area to be treated should be drained and cleared of all vegetation, trash, and all stones or other objects of a size which would interfere with the operation of mixing and compaction equipment.

If the treated liner is to be constructed in more than one layer, then adequate material shall be excavated and stockpiled for construction of the additional layers, unless other borrow material is to be obtained from outside the pond.

**Placing and Mixing Bentonite**

Soil on which bentonite is to be spread should be reasonably dry at the time of application to facilitate mixing of the soil and bentonite. If the soil is wet, it should be dried by disking or work should be delayed until the soil has dried.

Bentonite shall be distributed evenly over the surface to be treated with a drop type spreader by hand broadcasting or by other methods which provide a uniform distribution of the bentonite. Where bentonite has been obtained in bags and is to be spread by hand, the area should be marked in grids of sufficient size so that one bag of bentonite supplies the requirements for each grid space. The bags shall then be placed in each grid and the contents evenly raked over the grid area. The bentonite shall be incorporated into the soil immediately after spreading to avoid the possibility of it becoming wind blown.

The bentonite should be thoroughly mixed into each layer of soil being treated. Mixing should be with disk, rototiller, pulverizer, or similar equipment. At least two passes of the mixing equipment are required for thorough mixing. The second and subsequent passes should be in a direction perpendicular to the previous pass. The mixing equipment shall not be allowed to penetrate below the planned bottom of the layer being placed. As a guide, a 9 inch thick loose layer should compact to a thickness of about 6 inches.

After mixing of the bentonite is complete, sufficient water should be added to bring the soil to the specified moisture content. The water should be thoroughly mixed with the same equipment used to incorporate the bentonite into the soil.

**Compaction**

When a minimum dry density is specified, each treated layer of soil shall be compacted to the specified dry density with the soil at the specified moisture content. When a minimum dry density is not specified, each treated layer of soil shall be compacted by completely traversing the layer with not less than four passes of the compaction equipment. Each layer shall be mixed and compacted to the specified density before subsequent layers are placed.

Rubber tired or smooth wheeled steel rollers are suitable for compacting more granular soils while tamping type rollers are more suitable for fine grained soils. Sheepsfoot rollers which have long penetrating feet should be avoided. Care shall be exercised during compaction operations to avoid tearing or displacing the layer being compacted or previously compacted underlying layers. A direction of travel up and down slopes rather than along the slope may be required to avoid displacement of the treated layer.

Where the treated liner is to be covered with a layer of untreated soil, the untreated soil shall be spread in loose layers of approximately 9 inches thick. Each loose layer is to be compacted by at least 2 complete passes of the spreading equipment over the entire surface.