NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

OREGON

POND SEALING OR LINING
BENTONITE TREATMENT

(No.)

CODE 521C

DEFINITION

A liner for a pond or waste storage 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 storage 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 comply with all federal, state, and local laws, rules, and regulations.

Bentonite treated soil liners shall be filter-compatible with the sub-grade on which they are compacted to prevent loss of the liner soil into larger openings in the sub-grade material. The National Engineering Handbook, Part 633, Chapter 26-Gradation Design of Sand and Gravel Filters, provides criteria on filter compatibility.

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 mask and goggles.

Criteria Applicable to Ponds

Design. Design of bentonite treated soil liners for ponds not storing animal waste shall be designed to reduce seepage to rates that will allow the pond to function suitably as intended.

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 a finely ground bentonite per 1-inch thickness of constructed liner shall be:

Pervious Soil Description	Application rate (lb/ft^2)
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 (feet)	Liner Thickness (inches)
≤ 8	6
8.1 – 16	12
16.1 – 24	18
24.1 - 30	24

Criteria Applicable to Waste Impoundments

Design. Design of the bentonite treated soil liners for waste storage impoundments shall be designed to reduce specific discharge (unit seepage) to rates recommended in the National Engineering Handbook Series, Part 651, Agricultural Waste Management Field Handbook (AWMFH), Chapter 10, Appendix 10D or rates mandated in state regulations if they are more restrictive. Lower specific discharge rates may be used at the discretion of the Designer.

Liner Thickness. The minimum thickness of the finished compacted treated liner shall be the greater of:

1. that required to achieve a specific discharge (unit seepage) design value selected by the designer,
2. that required by state regulations, or
3. that given in the following table. The water depth to be used in the table is the normal full pool storage depth in the impoundment.

Water Depth (feet)	Liner Thickness (inches)
≤ 16	12
16.1 – 24	18
> 24	24

Other Criteria

Liner Construction. Use methods described in Appendix 10D to the AWMFH for liner construction.

Liner Protection. Bentonite treated soil liners shall be protected against damage caused by the effects of water surface fluctuations, desiccation and cracking, wave action, rainfall during periods when the liner is exposed, water falling onto the liner from pipe outlets, agitation equipment, solids and sludge removal activity, animal activity, penetrations through the liner, and any other activity capable of causing physical damage to the liner.

Design should include measures to protect against damage to a bentonite treated soil liner due to uplift water pressures if a seasonal high water table occurs at a level above that of the lowest potential level of liquid in the impoundment. Examples of protective design measures are the use of perimeter drains to lower the water table, maintaining minimum liquid depth in the impoundment, and using liners thick enough to resist uplift water pressures.

Protection of the finished liner from the effects of desiccation during periods when the pond or impoundment is empty is advisable. A protective soil cover may be considered. The soil cover shall be of a soil type, thickness, and density that is resistant to erosion and desiccation.

Side Slopes. The side slopes of ponds or waste storage impoundments should be 3H: 1V or flatter to facilitate mixing of the bentonite when the bathtub method of construction as described in Appendix 10D, AWMFH, is used. Slopes as steep as 2H: 1V may be considered if the stair-step method of construction as described in Appendix 10D to the AWMFH is used for constructing the liner. Maintenance requirements should also be considered when selecting a side slope.

CONSIDERATIONS

Consider using a flexible geomembrane or geosyntheitic clay liner for sites that have water depths greater than 24 feet.

Alternatives to bentonite treated soil liners should be considered for poor foundation conditions such as karstic bedrock, joints or other discontinuities of the underlying bedrock.

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 necessary to describe the work to be done.

OPERATION AND MAINTENANCE

Maintenance activities required for this practice consist of those operations necessary to prevent and/or repair damage to the bentonite treated soil liner. This includes, but is not limited to; excluding animals and equipment from the treated area; repairing damage to the liner occurring from erosion during initial filling; erosion resulting from wave action after the impoundment fills, and erosion caused by agitation, pumping operations, as well as activities involved in removal of solids and sludge. Damage that might be caused by roots from trees and large shrubs should be prevented by removing such vegetation at first appearance. If the liner is damaged, any disturbed or eroded areas should be repaired to restore the liner to its original thickness and condition.