

Pond Sealing or Lining – Bentonite Treatment (No.) 521C

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.

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.

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.

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.

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.

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, Chapter 10, Appendix 10D and/or state regulatory requirements.

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.

The application rate of the bentonite shall produce a permeability of 0.0028 ft/day (1×10^{-6} cm/sec) or less with a compaction of 90 percent of the maximum density as determined by the Standard Proctor Test, ASTM-698.

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.

All banks and fills within the area to be lined shall have side slopes 3H:1V or flatter.

Bentonite-treated soil liners shall be filter compatible with the natural foundation materials on which they

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

Liner thickness is measured perpendicular to the finished surface.

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.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

Support data documentation requirements are as follows:

- Inventory and evaluation records
 - Assistance notes or special report
- Survey notes, where applicable
 - Design survey
 - Construction layout survey
 - Construction check survey
- Design records
 - Physical data, functional requirements and site constraints, where applicable
 - Soils/subsurface investigation report, where applicable
- Design and quantity calculations
- Construction drawings/specifications with:
 - Location map
 - “Designed by” and “Checked by” names or initials
 - Approval signature
 - Job class designation
 - Initials from preconstruction conference
 - As-built notes
- Construction inspection records
 - Assistance notes or separate inspection records
 - Construction approval signature
- Record of any variances approved, where applicable
- Record of approvals of in-field changes affecting function and/or job class, where applicable

OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) plan shall be developed for this practice. The O&M plan shall be consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for the design.