

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

POND SEALING OR LINING  
COMPACTED CLAY TREATMENT

(No.)  
CODE 521D

**DEFINITION**

A liner for a pond or waste storage impoundment constructed using compacted soil without soil amendments.

**PURPOSE**

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

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies where:

- In-place soils at the site would exhibit seepage rates in excess of acceptable limits or would allow an unacceptable migration of contaminants from the impoundment.
- An adequate quantity of soil suitable for constructing a clay liner without amendments is available at an economical haul distance.

**CRITERIA**

**General Criteria Applicable to All Purposes**

Compacted soil liners as a part of a waste management system shall be planned, designed, and installed to meet all federal, state, local, and tribal laws, rules and regulations.

**Criteria for Limiting Seepage.** Compacted 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.

Compacted soil liners for waste storage impoundments shall be designed to reduce specific discharge rates (unit seepage) using the procedure in the NRCS National Engineering Handbook (NEH), Part 651,

Agricultural Waste Management Handbook (AWMFH), chapter 10, Appendix 10D. The maximum allowable specific discharge ( $v$ ) shall be  $0.0153 \text{ ft}^3/\text{ft}^2/\text{day}$  ( $5.411 \times 10^{-6} \text{ cm}^3/\text{cm}^2/\text{sec}$ ). Lower specific discharge rates may be used at the discretion of the designer.

**Liner Filter Compatibility.** Compacted 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 NRCS NEH, Part 633, Chapter 26-Gradation Design of Sand and Gravel Filters, provides criteria on filter compatibility.

**Liner Thickness.** The minimum thickness of the finished compacted liner on pond sides and bottom, measured perpendicular to the finished surface shall be the greater of:

1. That required to achieve a specific discharge (unit seepage) design value selected by the designer, or
2. 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 for waste storage impoundments is the maximum operating depth.

Water Depth (feet)	Liner Thickness (inches)
$\leq 16$	12
16.1 – 24	18
24.1 – 30	36

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

**Liner Protection.** The soil liner 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.

Where a water table exists, criteria in the Waste Storage Facility practice standard 313 shall be followed.

Protection of the finished liner from the effects of desiccation during periods when the pond or impoundment is low or empty is advisable.

When an earth cover is used the compacted earth liner shall be covered with not less than 1 foot of compacted soil material measured perpendicular to the finished surface. Earth cover material shall be a cohesive mineral soil. Cover soils shall be compacted in accordance with Construction Specification, MI-154, Earthfill. The soil cover shall have a thickness, and density that is resistant to erosion and desiccation. Under severe conditions, a protective soil cover may not adequately protect the liner from desiccation. For example a soil liner constructed with very high plasticity soils which are exposed to long periods of hot, low humidity conditions may constitute a severe condition. Additional design measures might be considered which includes installing a geomembrane in conjunction with a cover soil to protect the liner from desiccation adequately.

**Side Slopes.** The side slopes of ponds or waste storage impoundments should be 3H: 1V or flatter to facilitate compaction of soil on the slopes when the bathtub method of construction as described in Appendix 10D, AWMFH is used. Slopes as steep as 2H: 1V can be considered if the stair-step method of construction as described in Appendix 10D to the AWMFH is used. Maintenance requirements should also be considered when selecting side slopes.

## CONSIDERATIONS

Consider using a flexible geomembrane, non-reinforced concrete, geosynthetic clay or reinforced concrete liner for sites that have water or waste storage depths greater than 24 feet.

Alternatives to compacted clay liners should be considered for poor foundation conditions such as karstic bedrock, joints and other discontinuities of the underlying bedrock.

## 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
  - Conservation 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
  - Conservation Assistance notes or separate inspection records
  - Construction approval signature
- Record of any variances approved, where applicable
- For Waste Storage Ponds with a clay liner, include an evaluation report (soils lab or qualified specialist) documenting suitability of the liner material
- Liner construction documentation
  - *Documentation of soil liner density and moisture content during construction related to the design compaction test and permeability.*
  - *Documentation that soil liner material used during construction is the same as design soil liner material, and/or*
  - *Documentation of permeability of in place soil liner.*
- Well isolation distance documentation

- 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.

## **REFERENCES**

American Society for Testing and Materials (ASTM), 2000. D 5084, Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

American Society for Testing and Materials (ASTM), 2000. D 2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

American Society for Testing and Materials (ASTM), 2000. D 2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

American Society for Testing and Materials (ASTM), 2000. D 4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg limits).

USDA, NRCS National Engineering Handbook (NEH), Part 651, Agricultural Waste Management Field Handbook.

USDA, NRCS National Engineering Handbook (NEH), Part 633, Gradation Design of Sand and Gravel Filters.