



Pondlock™ Sodium Bentonite Clay Engineering Design Basis & Mixed-Method Application Specification

SECTION A – DESIGN BASIS (NRCS CPS 520 COMPLIANT)

This specification is based on USDA Natural Resources Conservation Service (NRCS) Conservation Practice Standard 520 – Pond Sealing or Lining (Compacted Soil Treatment), May 2016. The intent of this section is to translate NRCS performance criteria into explicit, constructible requirements suitable for engineered pond and basin projects.

The objective of a bentonite-treated compacted soil liner is to reduce seepage to an acceptable rate by creating a dense, continuous, low-permeability barrier that remains confined and stable over the life of the impoundment.

Seepage Control Objective:

The liner system shall be designed to reduce seepage to a rate that allows the pond or impoundment to function as intended. Where regulatory seepage thresholds apply, the most restrictive requirement shall govern.

Laboratory permeability testing may be used to refine application rates, but where testing is not performed, minimum NRCS-based rates shall apply.

Liner Thickness and Lift Control:

NRCS CPS 520 limits compacted lift thickness to a maximum of 6 inches. All bentonite application rates stated herein are explicitly defined per 6-inch thickness of compacted liner. Under no circumstances shall bentonite be applied assuming cumulative thickness without proportional increases in application rate.

Confinement Requirement:

Bentonite achieves low permeability only when fully confined. Design must ensure that the bentonite-soil matrix is restrained against volumetric expansion through:

- Adequate overburden pressure
- Proper compaction
- Protection from drying, cracking, erosion, and mechanical disturbance

Failure to maintain confinement is the most common cause of liner failure and is not a material defect.

Side Slopes:

Interior side slopes shall be no steeper than 3H:1V unless stair-step construction methods are explicitly detailed and approved. Slopes must allow effective compaction equipment access. Areas that cannot be mechanically compacted shall be regraded or redesigned.



SECTION B – MIXED METHOD APPLICATION

B.1 Method Overview

The Mixed Method consists of uniformly blending granular sodium bentonite into in-place soil followed by mechanical compaction to form a monolithic, low-permeability liner. This method is the preferred approach for engineered ponds where long-term performance, resistance to desiccation, and resistance to mechanical damage are required.

B.2 Subgrade Preparation

- Strip all vegetation, roots, topsoil, and organic matter to expose mineral soil.
- Remove all rocks greater than 1 inch diameter; larger particles create preferential seepage paths.
- Scarify the exposed subgrade to a uniform depth of 4 to 6 inches using a disc, ripper, or rotary tiller.
- Proof-roll the scarified surface; areas exhibiting pumping, rutting, or instability shall be removed and replaced.
- Shape subgrade to final grade prior to bentonite placement; do not rely on mixing to correct grade.

B.3 Bentonite Application Rates (Per 6-Inch Compacted Lift)

The following application rates are minimums per each 6-inch thickness of compacted liner:

- Silts and clayey silts: 2–3 lb/ft² per 6-inch lift
- Silty sands: 3–5 lb/ft² per 6-inch lift
- Clean sands and gravelly soils: 5–6+ lb/ft² per 6-inch lift

Where total liner thickness exceeds 6 inches, application rates shall be multiplied accordingly.

B.4 Distribution

- Bentonite shall be applied dry using mechanical spreaders, broadcast spreaders, or controlled bulk discharge.
- Hand spreading is not acceptable for large areas except for detail work.
- Application shall be visually uniform with no streaking or windrows.
- Placement shall not occur during heavy wind, rain, or when soil surface is saturated.

B.5 Mixing

- Mix bentonite and soil immediately after placement to the full scarified depth.
- Use disc harrows, rotary tillers, or equivalent equipment capable of full-depth mixing.
- Multiple passes are required; single-pass mixing is not acceptable.
- Uniform coloration and texture must be visually confirmed prior to compaction.
- Areas exhibiting layering, streaking, or dry pockets shall be re-mixed.

B.6 Moisture Conditioning

- Adjust moisture to near optimum compaction range prior to rolling.
- Add water uniformly using spray bars or water trucks; avoid localized flooding.



- Soil shall be moist but not pumping or slurry-like.
- Allow moisture to equilibrate before compaction where necessary.

B.7 Compaction – Final compaction shall be 95% Standard Proctor Density or greater

- Compact mixed soil in lifts not exceeding 6 inches.
- Use vibratory sheepsfoot rollers for fine-grained soils; smooth-drum rollers for sandy soils.
- Make sufficient passes to achieve a dense, firm condition with no visible laminations.
- Rework any areas showing cracking, laminations, or displacement.

B.8 Protection Prior to Hydration

- Protect completed liner from drying winds, rainfall, and construction traffic.
- Do not allow equipment traffic on finished liner.
- Repair any disturbed areas immediately using the same application rates and procedures.

B.9 Initial Filling & Performance Verification

- Fill pond gradually to prevent hydraulic uplift or localized erosion.
- Monitor water levels and embankments during initial filling.
- Isolated seepage areas may be spot-treated using localized mixed-method repair.