PROTOCOL
COMPACTED LINING FOR SMALL WASTEWATER LAGOON

Purpose: Guidelines for lagoon construction where soils do not have extremely slow drainage and where it is shallow to bedrock (bottom of lagoon is less than a foot above or into rock).

Suitable Soil: Determine subsoil is at least 30 percent clay, either by determining soil texture or testing the soil to determine percent clay.

Construction Procedure:

1) Remove topsoil and stockpile it near the site for later use. Vegetation should be permanently removed and not used to construct the berm because it will eventually decay and cause soil settling.

2) Test to determine if soil is at or slightly above the plastic limit by rolling out a small clump of soil into a wire shape, 1/8-inch diameter or smaller, without breaking apart. If it breaks, it is either not wet enough or does not contain enough clay. Add water and test again. If repeated attempts are not successful, there may not be enough clay and the choice of a lagoon for this site should be reconsidered.

3) Remove the subsoil 12 to 18 inches below the bottom and sides of the lagoon and stockpile for reuse. When the bottom is shaped, measure the bottom area and, using a level, determine elevations near the inner corners and center. Measure horizontal distances from permanent reference points to the corners to verify thickness of the constructed lining.

4) Compact the bottom and side layer using at least four passes.

    a) A sheepsfoot or other full-coverage roller is preferred.

    b) If a sheepsfoot roller is not available, use a heavily weighted wheel tractor, making passes so there is complete coverage of the surface to equal one pass with a full-coverage roller. Given the small percent of tire to machine width, to get full coverage of the surface may require a total of 16 to 20 passes for each width of the tractor.

5) Add a layer of loose subsoil (clay) material and compact. If the amount of material removed is not adequate, a similar subsoil material must be imported to the site.

    a) If a sheepsfoot roller is used, add 9 inches of loose material and compact to a 5- to 6-inch thickness, or add 6 inches of loose material and compact to 3.5 to 4 inches.

    b) If a tractor is used for compaction, add 6 inches of loose material and compact to 3.5 to 4 inches.

6) Repeat step (5) until a 1.5-foot-thick compacted layer is constructed.

7) After the compacted liner is complete, finish final grade of the compacted bottom and sides of the lagoon to maintain the proper side slope. The interior slopes should be no steeper than 3:1; 3.5:1 is better.

8) Place the topsoil over the outside, top, and top-third of the inside of the berm.

9) Using field tests, verify that compaction has been achieved.

   a) Compaction makes the soil firm and it should be very difficult to insert a hand probe more than a few inches. This gives a good indication of compaction. KDHE recommends an electronic soil compaction meter (Field Scout or equivalent) to test compaction.

   b) To evaluate compaction of the entire liner thickness, use a 4-pound hammer to drive an 18- to 24-inch-long number 3 rebar 1½ to 2 feet into the lagoon lining. Count the number of blows to drive it for each 6-inch interval. The number of blows should increase with depth. The bar will be quite difficult to remove, so if removal is important, plan how to do this before you go to the field. If a shorter bar is used and left flush or slightly below the surface, removal is not essential.

Resource: Kansas Department of Health and Environment & Pollution Prevention Institute Environmental Health Handbook, 3rd Edition, 2020, Chapter IX, Pages 36-37