

SEALING PONDS AND LAKES WITH BENTONITE

C. Wayne Keese*

Some Texas subsoils allow rapid loss of water by seepage from ponds, lakes or reservoirs. Ponds and lakes on such soils often may be improved by use of bentonite to reduce seepage losses. Bentonite is a natural clay which has the characteristic of swelling 10 to 12 times its dry size when it becomes wet. When bentonite is applied in a layer over porous soil, or mixed with a porous soil, and then moistened with water, it forms an impermeable layer. Bentonite does not affect the water. In addition, it is easy to apply with ordinary farm equipment, or with hand tools.

APPLICATION METHODS

You can apply bentonite directly to the soil in the bottom of the pond, or sprinkle it on the water surface and then allow it to settle to the bottom. Treatment usually is more effective if the bentonite is applied directly to the soil by the "blanket method" or the "mixed blanket method." The "sprinkle method" is recommended only when it is impractical to drain the water from the area to be treated.

The Blanket Method

The blanket method of applying bentonite, figure 1, usually results in the most efficient seepage control, but more care is required during application. Use the fine or pulverized grade of bentonite for this method.

Carefully prepare the area to be treated. Remove the top 4 to 6 inches of soil from the pond, lake or reservoir. Fill deep holes or crevices with a mixture of 1 part bentonite to 5 parts soil. Smooth the surface with a roller or drag. Cover the area with a layer of bentonite. (See page 6 for amount.) After spreading the bentonite evenly, replace the 4 to 6 inches of soil carefully to avoid disturbing the layer of bentonite.

To achieve best results, spread the bentonite evenly. Mark the area in squares 10 feet by 10 feet as shown in figure 2. Place the required number of bags of bentonite in each space. Treatment at the rate of 1 pound per square foot will require one bag in each square (each square contains 100 square feet). Spread the bentonite evenly over the square. Bare spots may allow seepage to continue. Use care in covering the bentonite layer to avoid leaving holes in the impermeable layer.

Compact the top soil by rolling or tamping. If possible, control the flow of water when filling the pond to prevent damage to the treated surface. Several days may be required for the bentonite to become saturated and fill the permeable voids in the soil. If livestock are expected to walk in the pond, the cover coat must be thicker than 4 inches. A top layer of gravel is an ideal finish to protect the bentonite layer.

The Mixed Blanket Method

The first step in applying bentonite by the mixed blanket method, shown in figure 3, is to remove all surface rocks and vegetation. For best results, have the soil just moist enough to be plowed or disked easily. Plow or disk the pond bottom and then drag the surface until it is smooth. This preparation makes the top 4 to 6 inches of soil uniform so that the bentonite can be mixed evenly with the soil. Mark the area in squares 10 feet by 10 feet and spread the required amount of bentonite as described for the "blanket method." Mix the bentonite with the top 4 to 6 inches of soil with a disk harrow, spike-tooth harrow or by hand raking. Compact the surface by rolling or tamping. No cover coat is needed.

The mixed blanket method may be less effective than the blanket method because of uneven mixing of the bentonite. The disking operation sometimes leaves strips or spots where the bentonite concentration is too low. Increase the amount of bentonite to minimize this possibility.

The Sprinkle Method

Coarse particles of bentonite are scattered on the surface of the water, figure 4. The particles sink to the bottom where they swell. The gel is drawn into porous areas reducing the seepage rate. Use the crushed or granular grade of bentonite. These particles are large enough to sink to the bottom before they complete their swelling, while finer particles will float.

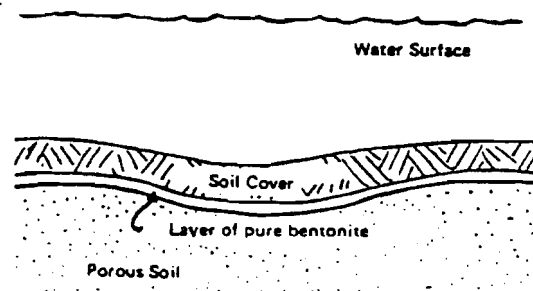


Figure 1. Blanket Method

*Extension Agricultural Engineer, Texas Agricultural Extension Service, The Texas A&M University System, College Station, Texas 77843.

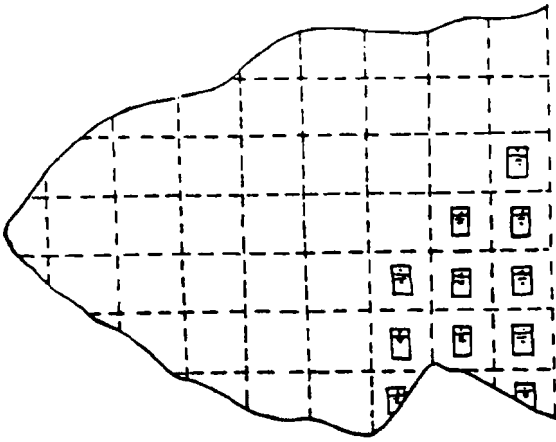


Figure 2. Reservoir Layout

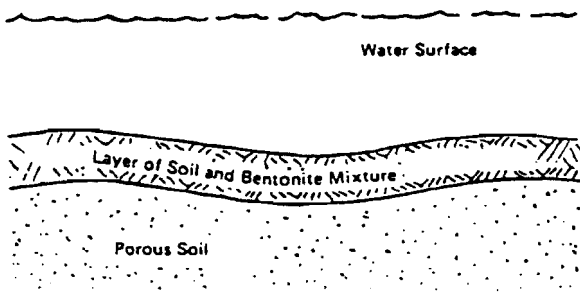


Figure 3. Mixed Blanket Method



Figure 4. Sprinkle Method

The sprinkle method is less effective than other methods. Accurate, uniform placement of bentonite is difficult to accomplish. This method is not recommended for ponds where livestock may wade in the water and disturb the bentonite layer. The sprinkle method is useful in emergencies when isolated leaks need to be stopped. Spots known to be especially porous should be treated first. Spot treatment may reduce water loss enough that the entire bottom will not require covering.

Sprinkling bentonite in the water will cause a slight temporary cloudiness; however, it is not harmful for drinking purposes.

AMOUNT OF BENTONITE TO USE

The amount of bentonite required to effectively reduce seepage losses from a pond or lake varies from $\frac{1}{2}$ to 2 pounds per square foot of soil surface. One-half pound of bentonite per square foot of soil usually is satisfactory when the bottom of the pond is fine sand or sandy loam and the maximum water depth is less than 6 feet. With the same type of soil and a water depth of 6 to 20 feet, increase the rate to 1 pound per square foot. In general, coarse soils require more bentonite. Greater water depths increase the pressure on the bottom of the pond and require more bentonite.

HOW TO DETERMINE THE REQUIRED AMOUNT OF BENTONITE

Perforate the bottom of a bucket, can or small oil drum and place 1 or 2 inches of gravel in the bottom. Cover the gravel with 6 or 8 inches of typical soil from the area you intend to treat. Tamp the soil, fill the container with water and observe the rate of water seepage.

Repeat the procedure described above using the bentonite application method you are considering. If you plan to use the blanket method, apply a blanket of bentonite over the soil sample in the can, cover with 3 or 4 inches of soil and fill the can with water. If you plan to use the sprinkle method, apply the bentonite by sprinkling it on the water surface after you have filled the can with water. Observe the seepage rate through treated soil.

Try an application rate of $\frac{1}{2}$ pound of bentonite per square foot. Repeat the procedure until you find the minimum amount of bentonite required to prevent or reduce water seepage to an acceptable rate.

Use the same application procedure in the test that you plan to use in the pond. After determining the minimum amount of bentonite needed, add 25 to 50 percent more to allow for greater water depths in the pond or reservoir and the inefficiency of large-scale application.