

# Sealing Leaking Dams

If you have a leaking dam what can you do about it? Depending on the particular situation there are a number of alternatives that can be used to minimise dam leakage.

## Clay lining

If suitable clay can be found at or near the dam, clay lining can be a cost-effective way of sealing dams. The cost of clay lining depends on many factors, including the transport cost of the clay, the amount of clay to be moved, the cost of emptying the dam, access to the site, and potential crop and income loss caused by emptying the dam. If the dam still holds some water it should be pumped dry and all plants, loose sand and silt removed to expose a firm foundation on which to place the clay lining. There are a number of methods that can be used depending on the nature of the seepage problem but, in all cases, a minimum 300 mm depth of layered and compacted clay at the optimum soil moisture content is used.

## Bentonite

Bentonite is a naturally occurring clay and is used in dam building because it swells to many times its dry volume when wet. Bentonite may be used in three ways depending on the soil type, and whether it is practical to empty the dam. If the dam can be emptied, the area to be treated is cleared of loose rocks and vegetation and then lightly harrowed. On light or loam soils, the mixed blanket method is used where bentonite is broadcast over the prepared area at a rate of approximately 7 kg/m<sup>2</sup> and then mixed with the first 150–200 mm of soil by light harrowing. The treated soil is then compacted with a roller.

On heavy soils, the pure blanket method is used. In this method the bentonite is spread evenly over the area at a rate of approximately 10 kg/m<sup>2</sup>. The bentonite is then covered with at least 100 mm of site soil and compacted with a roller to prevent the blanket cracking as it dries out. A third option is the broadcast technique, which can have variable results and is not recommended, but may be the only option if the storage can't be emptied. In this method, the bentonite is spread over the water surface at a rate of 10 kg/m<sup>2</sup> and, as it settles to the bottom, it hopefully seals the storage.

## Commercial liners

There are at least five types of commercial liners available to seal leaking dams. They are all flexible membranes but offer different levels of strength, durability and resistance to UV breakdown. The liners have no structural strength and rely on a continuous backing for support, and must be anchored so they don't move. This means that the soil on which such a liner rests must be well compacted on an even and not too steep grade, have no vegetation growing in it, and be free from stones and branches which could damage the liner. A layer of fine soil or sand is required under thinner liners and the soil is sometimes sprayed with herbicide to prevent any plants growing through the liner. The simplest way to provide anchorage is to bury the liner in a trench dug along the perimeter of the storage.

Commercially available liners include woven polythene, black polythene, vinyl, high density polyethylene (HDPE), butyl rubber and composites of bentonite and polypropylene. Woven polythene, in blue or green, resists tearing but is very susceptible to UV degradation and will have a life of less than 5–7 years in the sun if it is not protected with a layer of soil. A grade no steeper than 3:1 must be used to keep the soil from slipping off the liner. Black polythene also has a short life due to UV degradation, and being generally being less than 0.4 mm, is susceptible to puncturing and must be covered with a layer of soil to prolong its life. The two grades of black polythene available use either reprocessed or prime resin. The prime resin liner lasts longer than the reprocessed liner and the thicker the liner, the longer it will last, because it is better able to withstand the UV degradation of its surface. Vinyl (or PVC) resists tearing and is more flexible than woven polythene but also needs to be covered with a layer of soil to minimise UV degradation.

Both HDPE and butyl rubber have the longest life and are tougher than vinyl or polythene products. These liners do not need to be protected from UV exposure but are more expensive than vinyl and woven or black polythene. Composite materials contain a thin layer of bentonite sandwiched between polypropylene materials. These products are not UV sensitive and, because of the bentonite material contained within the product, small holes in the liner are self-healing, but these liners must still be covered with soil to protect them from major punctures.

### **Chemical treatment of soil**

Gypsum, sodium tripolyphosphate (STPP) and polyacrylimides are chemicals that can be used to seal storages. Fine grained gypsum is used to stabilise dispersive soils so that both surface erosion and potential tunneling failures are reduced. The gypsum is mixed into the first 150–200 mm of damp surface soil at a rate of about 2 kg/m<sup>2</sup>, and the treated area is then compacted with a roller. STPP is a chemical which has the opposite effect to gypsum. It is used to disperse the clay particles in stable, but porous, clay soils as these soils are very hard to compact, and STPP is used to help the compaction process. Not all clay soils are suitable for STPP treatment and laboratory tests are needed to determine if the soil will react favorably. Treatment using STPP is the same as the bentonite mixed blanket method. STPP, in powder form, is broadcast over the area to be treated at a rate determined from the laboratory tests, usually 0.5 kg/m<sup>2</sup>.

With the soil near its optimum moisture content it is then mixed using a rotary hoe and compacted with a roller to give a compacted thickness of about 300 mm. Finally, the area must be covered with untreated soil to prevent the STPP/soil mix from drying out and cracking. STPP is ineffective in sandy soils or soils high in calcium carbonate and, in some cases, may increase seepage due to an increase in tunneling of the dam construction material. Polyacrylamide dam sealants are biodegradable polymers that use the same broadcast method as for bentonite. These chemicals are used at rates of 75-100g/m<sup>2</sup> with the recommendation that the dam contains water when treated as this forces the expanding gel into the leaking area to seal it.

### **Sprayed membranes**

Concrete and asphalt are examples of sprayed membranes. They are applied to the area to be treated to form a continuous skin of material that acts to seal the storage, but are rarely used to seal farm dams because of the high cost of the work involved. Sprayed concrete (known as gunite or shotcrete) requires specialised equipment and experienced applicators as its application involves spraying a mix of water, cement and aggregate onto a graded surface and steel reinforcement is usually required. Asphalt (bitumen) also requires a prepared, graded surface, experienced applicators and specialised equipment. The process can be messy but no steel reinforcement is required. Both methods require a depth of at least 75 mm to be effective and are prone to movement cracks and weathering.



There are a number of publications available on sealing leaking dams, but it is imperative that the services of a professional be sought to determine the best option available before any dam remediation works are commenced.

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