

Soil Suitability and Testing for Earth Lined Slurry Lagoons

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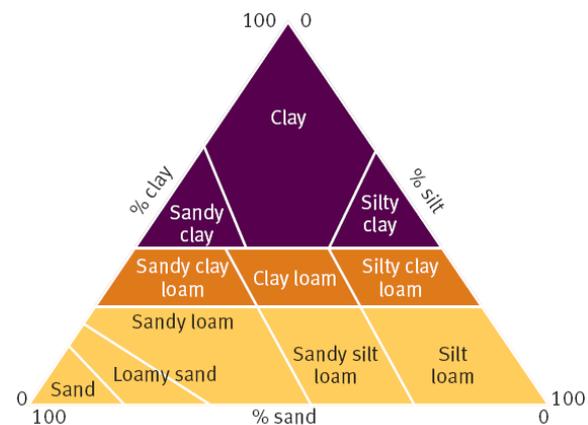
This is a summary sheet outlining the necessary soil characteristics and tests for constructing an unlined earth bank slurry lagoon. The importance of proper assessment cannot be overstressed.

Full details on soil suitability and testing can be found within [CIRIA C759](#) . The notes below are based on this report.

If the soil either in-situ or imported is not suitable for an unlined earth banked lagoon, the lagoon must be lined with a suitably engineered sheet liner. This would need to incorporate a single or a double skinned liner with or without leakage detection depending on the soil permeability and local factors. Guidance on selecting suitable synthetic liners can be found in CIRIA Report C759.

A site is only considered suitable for an unlined earth banked slurry lagoon if the final permeability of the compacted soil is less than 1×10^{-9} metres per second (0.000001 mm per second) and the impermeable soil is at least one metre thick. These criteria also apply where an imported clay lining is used in the construction.

The ideal mineral soil to use for embankments generally contains between 20-30% clay. These are the soil types shown in orange in the diagram to the right. A lower clay content may not meet the required permeability, whilst a higher one may be difficult to form into a stable embankment and could tend to shrink and crack on drying. It should however be suitable for the base.



Initial soil assessment should be taken from four perimeter points and one at the centre of the site, to identify any variability in clay content and depth of impermeable soil.

This can be done by digging trial pits that extend down to a metre beyond where you expect the final lagoon base to



be. You can check and record soil texture class below the top soil by hand texturing, and note the percentage stone content in each layer in the pit, and consider the soil that will be used for the base and the embankments. Where there is little variability across the site only samples from one pit need to be sent for detailed testing, otherwise send a range of samples. They need to be tested in an approved soils' laboratory to show whether the required level of impermeability can be achieved. As well as soil permeability, other soil characteristics should be tested for their suitability for embankment construction.

Testing should be to BS 1377 / BS EN 1997-2:2007 standard, and will commonly involve methods such as 'Triaxial' testing. Laboratory tests cost upwards from £100 per sample depending on the range of tests performed.

Material that is to be re-compacted, i.e. the subsoil excavated to form the banks, and any imported clay, should be tested to determine its natural moisture content, liquid and plastic limits, particle size distribution, compaction characteristics and permeability. Where in-situ material can be used without replacement, this only needs to be tested for permeability. As the testing involves compression, you may need to compact the in-situ material to obtain the same permeability as the test results.

An outline of suitable tests and the acceptance criteria are given in CIRIA report C759.

In considering embankment design it is useful to determine the specific gravity and shear properties of the soil. The use of naturally occurring soils in construction can involve significant variability in the soil profile. It is therefore recommended that the structural design is carried out by a suitably experienced and qualified engineer and that an engineer supervises the site works.

Investigations should also be carried out to determine the depth of the water table. The water table should be below the level of the proposed base level. This should preferably be done during the wettest time of the year.

You are advised however, to discuss your plans with your local Environment Agency office at the earliest possible opportunity. However, you must notify the Environment Agency at least 14 days prior to commencing construction of the facility, and should provide the results of soil testing along with site plans.

Once an agreed proposal has been constructed, we ask you to inform us a couple of weeks before you start using the facility.

Further advice on assessment of soil properties can be found in our 'Think Soils' document:

<http://www.ahdb.org.uk/projects/documents/ThinkSoils.pdf>

To search for a UKAS approved soil testing laboratory follow this link:

<http://www.ukas.org/testing/singlesearch.asp>