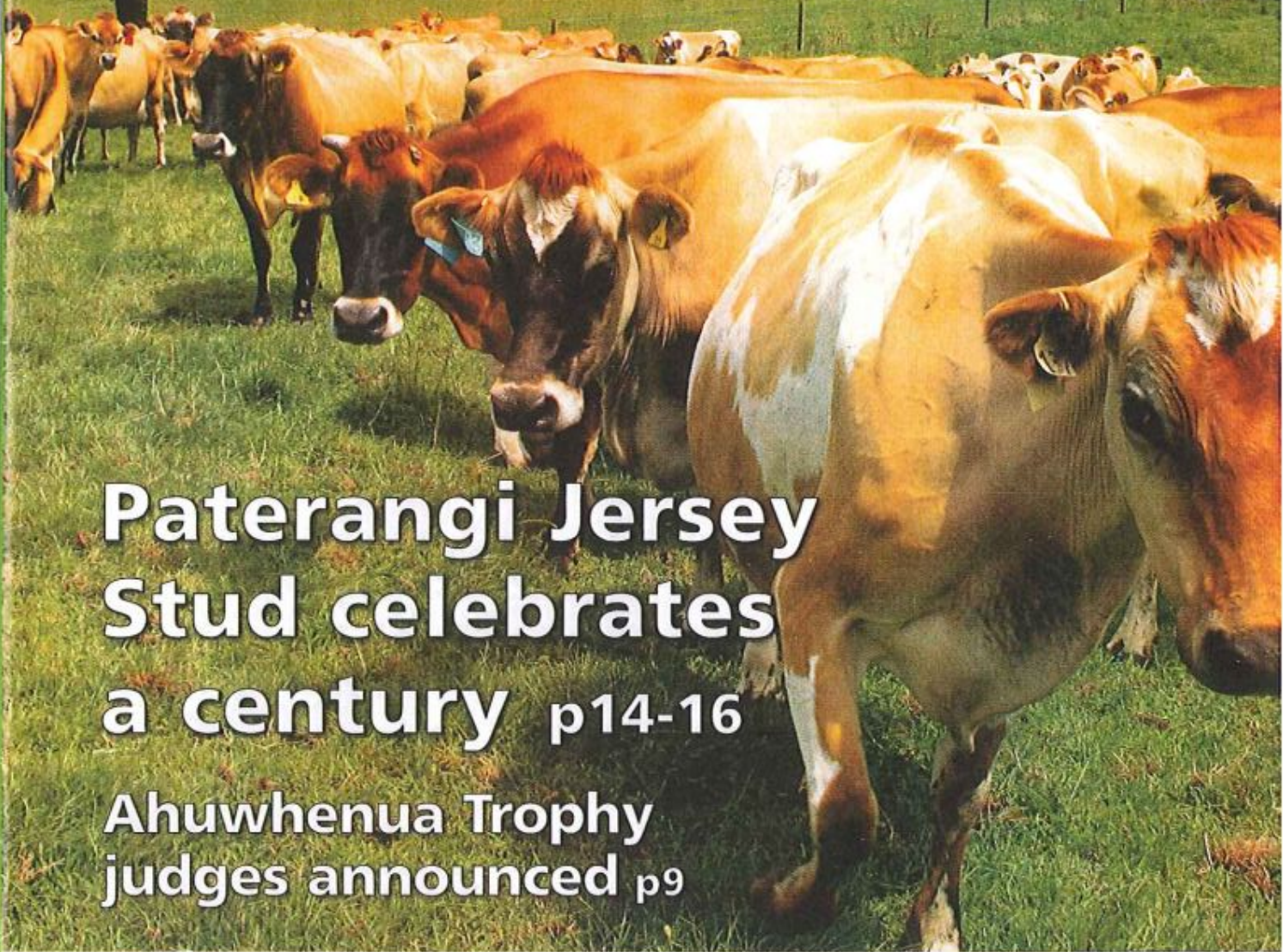


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Design considerations of lined ponds

By VAUGHAN PODBIELSKI

WITH the growth of dairy in New Zealand, coupled with the growing regulations requiring environmentally friendly effluent management, lined effluent ponds are becoming commonplace to help farmers achieve compliance. This is especially so given that councils are promoting greater storage capacity ponds, with 30 to 90 days now commonplace. Artificial geomembranes are the most cost-effective way to achieve large volume storage capacity, and then later use this effluent as a valuable nutrient source.

There are two major types of lining membranes available in New Zealand, considered suitable for this commercial application – each with its pros and cons. Farmers should do their homework when exploring their lining options, and need to ask questions and insist on written confirmation of what they are promised. There are many general “liners” on the market, but not all can be considered fit for the purpose.



Figure 1: Incorrect gas drainage under a pond can have drastic consequences.

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Farmers are increasingly looking at future proofing, and should therefore check on:

- 1) Warranty – what period is offered and who issues the warranty? (UV breakdown etc)
- 2) Maintenance – who repairs the product should it become damaged, and how?

Effluent ponds generally fall into three categories:

- New dairy with new ponds
- Existing dairy with existing unlined pond, now requiring a liner
- Existing dairy with no pond, now requiring a pond.

There are a number of different pond systems being promoted in different parts of the country, the most prevalent being:

- Single pond with stirrer
- Two-pond system (aerobic and anaerobic)
- Weeping wall sludge bed combined with one holding pond for the clean, solid-free liquid

Each system has its pros and cons and is site specific and therefore should be discussed with your local effluent management specialist or council dairy extension officer/Fonterra sustainability dept.

1) Site selection

One of the first considerations for new ponds is site selection. This is normally as close as possible to the dairy shed, with sufficient fall to avoid pumping from shed to pond. The nature of the sub-grade should also be considered since soft and compressible peat is unstable and hard rocky areas, or areas with pumice, may require thicker underliner to protect the membrane. Areas where the groundwater level is higher than the base of the pond should be avoided if possible, if not, then water drainage (draincoil) will need to be installed under the liner to avoid a rising water table lifting the liner.

There are three methods of constructing a pond:

I. Fully excavated – entire pond below ground level. This is the lowest cost, but water tables can be a problem.

II. Raised embankment or turkey nest – half below and half

above ground level. This has easier drainage but higher cost and the risk of an unstable bank.

III. Semi excavated – compromise of both, medium cost.

2) Site layout:

- The pond base should have a fall of two per cent to assist with easy draining and positive gas movement under the liner.
- Embankment batters or slope are dependent on the underlying sub-grade. If no slope stability study has been done, a minimum batter of 2:1 is recommended if the maximum depth is less than 5m. The liner must not be used to provide stability to the embankment.
- Embankment crest at the top of the slope should have a minimum width of 1m before the anchor trench is dug, to provide enough stability to both the batter and the anchor trench.
- Anchor trenches are set 1m back as above, and are a minimum of 400mm wide and 400mm deep in cohesive soils, and vary according to batter, pond size and soil type.
- Freeboard of at least 300mm below the top of the pond should be maintained (providing the top of the pond has been built level) since overflowing liquid can compromise batter and anchor trench stability.

3) Preparation of the supporting surface for the membrane is very important. It should be free of loose rocks, stones and vegetation and needs to be well compacted, prior to laying the liner. Unless the surface to be lined is perfect, most liner manufacturers recommend the use of a geotextile underliner (similar to carpet underlay) to help protect the

lining membrane.

Incorrect gas drainage under a pond can have drastic consequences, especially where effluent is concerned (see Figure 1 and 2). I will discuss correct gas and water drainage in my next lined dam design feature.

Lined ponds have to be treated differently to earth ponds.

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EFFLUENT/WATER MANAGEMENT

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Some precautions should be followed:

- Diggers cannot be used to de-sludge ponds
- Third party contractors working in, on or around the lined pond (effluent pumpers/pump and pipe tradesman) must be notified before they commence work that the pond contains an expensive liner which can be damaged.
- A protective pad (thin concrete slab or concrete-filled tyres laid on top of underliner) should be installed below where the stirrer sits, just in case it is lowered too close to the liner.

These guidelines are a brief summary of only some of the issues which need to be considered when constructing and lining a pond. A design professional should be consulted for site specific specialist advice.

A comprehensive design booklet called "Firestone Installation Guideline" is downloadable free of charge at the following site: <http://www.cosio.co.nz/index.php/firestone-inf-data>

— *Vaughan Podbielski is product manager for Firestone EPDM Liners, distributed in New Zealand by Cosio Industries Ltd.*



Figure 2: An example of a pond with incorrect gas drainage.