Agriculture Notes

Dairy effluent: Storage pond sizing

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Single or multiple storage ponds should be designed to hold all the effluent produced from a dairyshed, feedpad or other intensified animal areas for a specified storage period depending on the region.

The pond design should also take into account the 90th percentile rainfall entering the effluent stream that is rainfall from roofs, holding yarding and what actually falls on the pond surface.

Storage period

The storage period is when effluent should be collected and stored until it can be safely re-used on pastures or crops. This period is when average rainfall exceeds average evaporation and the potential for nutrient runoff is more likely. Storage periods can range from 92 days in the northern catchments to 180 days in the high- rainfall southern catchments. An example of a storage period is illustrated in Figure 1.

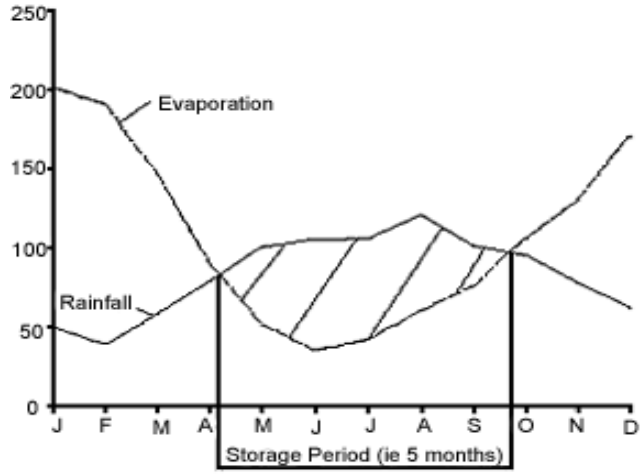


Figure 1. Storage period where average rainfall exceeds average evaporation

Managing storage ponds

In some instances storage ponds may need to be extended to accommodate a longer storage capacity to suit the irrigation season. This is common in the northern catchments, which rely on the channel systems to supply water. These storage ponds are usually emptied by shandying effluent with flood irrigation water via the farm irrigation channel system. The recommended storage period therefore include the months of May to August when there is no irrigation water available for shandying.

In high rainfall regions additional storage months may need extending as paddocks can be too saturated to safely apply effluent. The extra storage time can reduce the likelihood of paddock pugging and pasture damage, whilst protection waterways from nutrient runoff.

Management of storage ponds should include:

- emptying prior to the storage period commencing
- desludging once the capacity is less than 50%
- reducing the potential for solids and fibrous material entering the pond
- conducting regular nutrient sampling to determine appropriate application rates

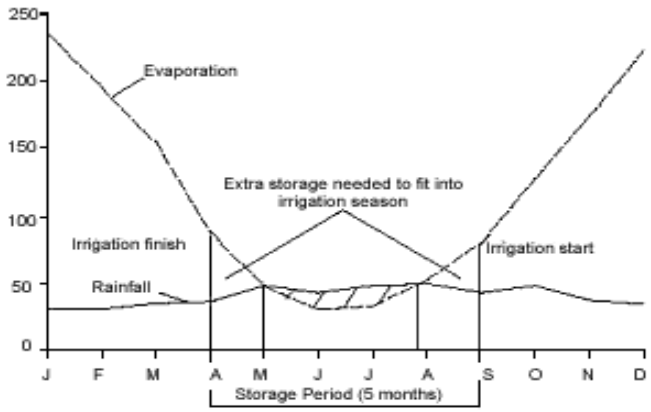


Figure 2. Typical irrigation region weather pattern: storage period extended to accommodate the irrigation season.

Pond sizing

The following formula can be used to estimate the volume of effluent storage required:

V = A + B + C + D

Where:

V = **Pond volume**

A = **Effluent produced -** the amount of effluent water delivered to the storage pond during the expected storage period. This includes; plant and vat rinses, pit, platform and yard washing, cup sprays, platform sprays, teat wash and platecooler water. Note it is a preferred option that platecooler water be diverted away from the effluent ponds.

B = **Stormwater from shed and yards -** the amount of rainfall runoff from the milking shed roof's, yards and stock races which cannot be diverted away from the effluent system in a year of high rainfall. (90th percentile rainfall)

C = **Rainfall onto pond surface -**the amount of direct rainfall on to the pond in a year of high rainfall. (90th percentile rainfall)

D = **Freeboard -** the volume taken up with the required 0.6 metre freeboard on the storage pond. The freeboard being an engineering safety factor.

Example calculation a storage pond

Assume:

- 150 milking cows maximum in foreseeable future;
- 7200 litres/day water used in shed and on yard (based on measurement or conservative estimate);
- effluent to be stored for six months (May-October);
- total average rainfall during months of May to October is 500 mm, with the 90th percentile rainfall figure for the same time being 800 mm;
- rainfall runoff from the yard and shed surface area (200 m²) will not be diverted away from the effluent system;
- run-off from all uphill and surrounding areas will be diverted away from the storage pond.

Storage pond volume required for a 6 month storage period: V = A + B + C + D

A: Effluent produced.

7200 litres/day x 180 days storage period = 1300 cubic metres. (Rounded off0

(Note: 1 cubic metre = 1000 litres)

B: Stormwater from shed and yards.

200 m² yard and shed surface area x 800 mm, 90th percentile rainfall = 160 cubic metres

The effluent volume thus far is:

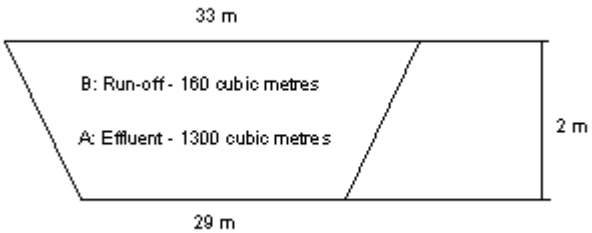
1300 + 160 = **1460 cubic metres**

To determine dimensions for the storage pond assume 2 metre depth for effluent storage, the area at mid-depth is:

Volume / Depth = Mid-depth Surface Area

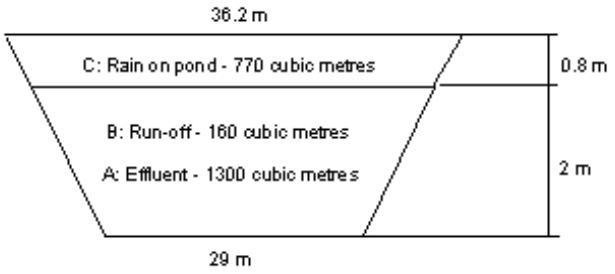
1460/2 m = 730 m² = 29 m x 25 m

With batters of 2:1, the bottom dimensions would be 25 m x 21 m, and the top dimensions would be 33 m x 29 m.



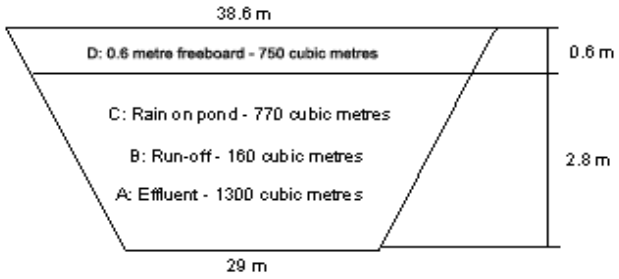
C: Rainfall onto pond surface.

Add 800-mm rainfall onto fluid volume:



D: Freeboard.

Add 0.6 metre freeboard to fluid volume to give the total pond volume:

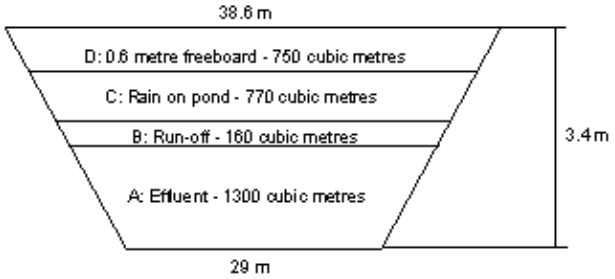


The storage pond volume required for a 6 month storage period for this dairy is: V = A + B + C + D

= 1300 + 160 + 770 + 750 cubic metres

= 2980 cubic metres (approximately 3 mega-litres) with a surface area of 38.6 m x 34.6 m and a depth of 3.4 metres.

How the storage pond volume is made up:



Construction notes

- pond depth will be determined by the height of the water table for the proposed pond site
- internal batter slopes for the storage pond will depend on the type of pondage system

Further information

Rainfall and evaporation data for different regions is available from the Bureau of Meteorology, as well as from DPI Customer Service Centre on 136 186.

DPI Nutrient Extension Officers have developed computer program, which can accurately determine effluent storage requirements, pond sizes and various design options. Any pond sizing should be incorporated into an Effluent Management Plan, which also takes into account the ponds integration into the farm system as well as its overall management.

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Acknowledgment

The original author of this note was Guy Corbett, and the previous version was published in July 1995.