Desalination of groundwater for improved water supply

Groundwater can be a valuable on-farm water resource; but this is dependent on its quality. Water quality may be improved through desalination. This fact sheet outlines the desalination process, including summarising two on-farm case studies.

Introduction to water desalination

Reducing the proportion of salts in solution through desalination will improve water quality and improve its agricultural suitability.

The most common process used for desalination is reverse osmosis where a semi-permeable membrane separates salt from water. Very high pressures are required to force water through the membrane. The energy required for reverse osmosis increases with water salinity and decreases using warmer water. Systems can be designed to cater for a certain water quality in, and a certain quality out. Generally stock watering systems are at a much higher salinity than for irrigation or domestic use.

A pre-treatment step such as coagulation, filtration or microfiltration of water is often required to ensure adequate water quality and to reduce the chance of membrane failure. Water samples should be tested before installing a desalination plant to assess salt and mineral contents and to assist selection of appropriate equipment. High iron content in the water source can also cause problems in the Barossa Ranges as iron bacteria can build up in pipelines/block drippers (to reduce this impact, aeration techniques may be required before water entry to pipes).

The process of desalination is expensive in terms of energy requirements and equipment. Desal plants do not last as long as traditional water treatment equipment and they also require regular operation and maintenance to prevent corrosion/blockages. Highly saline waste is generated as part of the process and guidelines must be met for its disposal. If the system is above EPA SA requirements a license is required (for further information, visit https://www.epa.sa.gov.au/).

On-farm water desalination case studies

BIGG has inspected several on-farm desalination units. These include Yumali in the Coorong region, which is mostly used for stock water (Figure 1) and Eden Valley, which is used for vineyard irrigation. These two examples are summarised in Table 1.

In the case of the Yumali unit, desalinated water is shandied back with the bore water, but to a level that cattle consume without affecting their productivity.

Figure 1. Yumali property owner, Gerard Vandenbrink and his water desalination unit.

Table 1. On-farm water desalination unit details and their costings.

Property	"Wandoo"	"Boongarrie Estate"
Location	Yumali	Eden Valley
Use	Cattle	Vineyard
Installation	2011	2020
Untreated water	9,000 EC units (approx. 5,400 mg/l)	4,500 mg/l
Treated water	3,250 EC units (approx. 1,950 mg/l)	200 mg/l
Effluent	Into an evaporation dam (around 30,000 EC units)	Into an evaporation dam
Capacity	6.5 ML/year (but could be higher if required)	2.5-10 ML/year (dependent on how much yearly run-off into dams)
Desal plant costs	$37,000	$63,200
Additional costs*	$93,000	$146,800
Total cost	$130,000	$200,000
Annual Operating	$0.65/kl (compared to mains at $3.49/kl). Power and new membranes (every 18 months)	Solar power set up which goes into a grid, annual costs linked to pumps and screens

**Additional costs may include effluent dams, trenching, generator or solar water pump units, tanks, pipelines, fittings etc.*

References

- Desalination for livestock water supplies. https://www.coorong.sa.gov.au/__data/assets/pdf_file/0027/674046/1.-Desalination-for-Livestock-Water-Supplies-Fact-Sheet.pdf

- Water quality for livestock (SheepConnect SA website). https://www.sheepconnectsa.com.au/management/water/water-for-livestock/water-quality-for-livestock

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