CASE STUDY

SUSPENDED SHADE CLOTH STRUCTURE FOR EVAPORATION CONTROL

GOLDEN VALLEY ORCHARDS, STANTHORPE

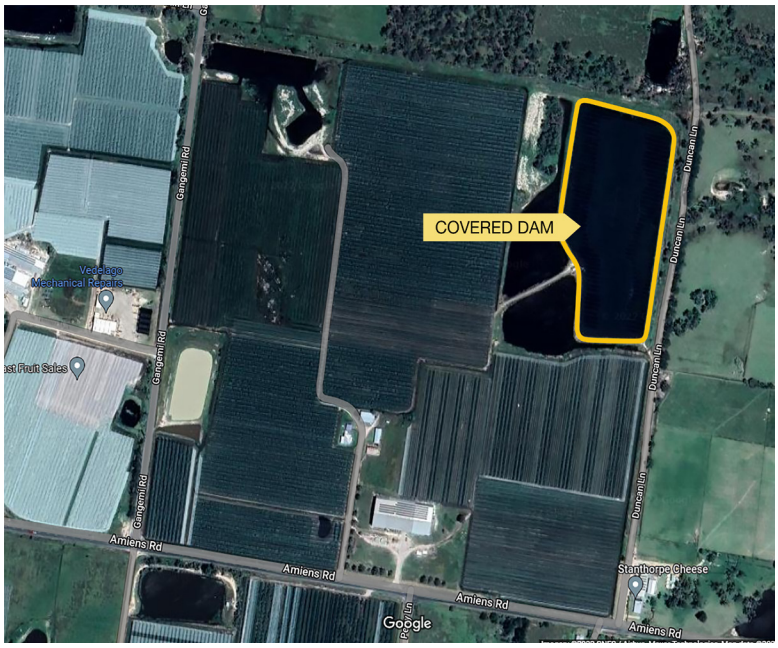
In 2003, the Andreatta family at Golden Valley Orchards, Stanthorpe, installed a NetPro suspended shade cloth dam cover, as part of a Queensland Government research project evaluating the effectiveness of evaporation mitigation technologies.

During the most recent drought in Stanthorpe – when some irrigators had to truck in water at a cost of more than $10,000/ML – Golden Valley Orchards was able to irrigate from the covered storage, when surrounding farmers were without water, safeguarding their production levels.

Golden Valley Orchards' Renato Andreatta says the cover provides a "very secure" water supply, something critical for their 83ha apple operation.

"The dam is used as the storage of last resort. If the crop is near maturity and we miss a critical irrigation this can have a huge impact on quality and price, so the value of water is therefore very high," he says.

Despite some repairs and maintenance being required since the 2003 installation by NetPro, these have been covered by insurance.



▲ *Satellite photograph indicating covered storage.*

"Generally, the repair and maintenance has been minimal. We have not measured evaporation savings, but they appear significant. We have also covered another dam of 3ha using a floating modular system incorporating shade cloth."

The covered dam

The covered storage itself has a length of 300m and average width of 125m, and is about 6m deep and in 2003, the installation cost was $220,000. The covered dam has a capacity of about 130ML, and the surface area of the cover is 3.8ha.

Golden Valley Orchards collects local creek runoff and extract groundwater to fill the covered dam, using it as a holding dam to take full advantage of the reduced evaporation loss. The dam is unlined, but seepage rates are low as the bed material is a well compacted clay.

Australian Government Department of Agriculture, Fisheries and Forestry
Future Drought Fund
University of Southern Queensland
qcwt
SQNNSW Innovation Hub

The SQNNSW Innovation Hub receives funding from the Australian Government's Future Drought Fund

The evaporation cover

The cover was installed when the storage was empty, using 85% shade cloth and 7.4mm galvanised steel cables. These are anchored to the bank with 2m anchors and with internal supports at 60m spacing.

Based on UniSQ trial results, an evaporation saving of around 70%-80% is expected from the shade cloth used. The capital cost of the system was $220,000, or approximately $6/sqm, of which $80,000 was contributed via the Queensland Government-funded research project.

The structure was damaged in 2019, when one of the cables broke and sections of the covered subsided. Apart from repairing this damage, the maintenance has been minor and limited to repairing cloth tears.

▲ *View of shade cloth cover from above and below*

Installation costs

When deciding if the cost of purchase and installation makes financial sense, the supplier quote should be based on your site, and take into account current product technical and pricing specifics.

For this example, the current cost of a suspended shade cloth structure has been assumed to be $13/sqm or $490,000. A high-density shade cloth would provide close to 95% evaporation saving, equivalent to 40ML/yr.

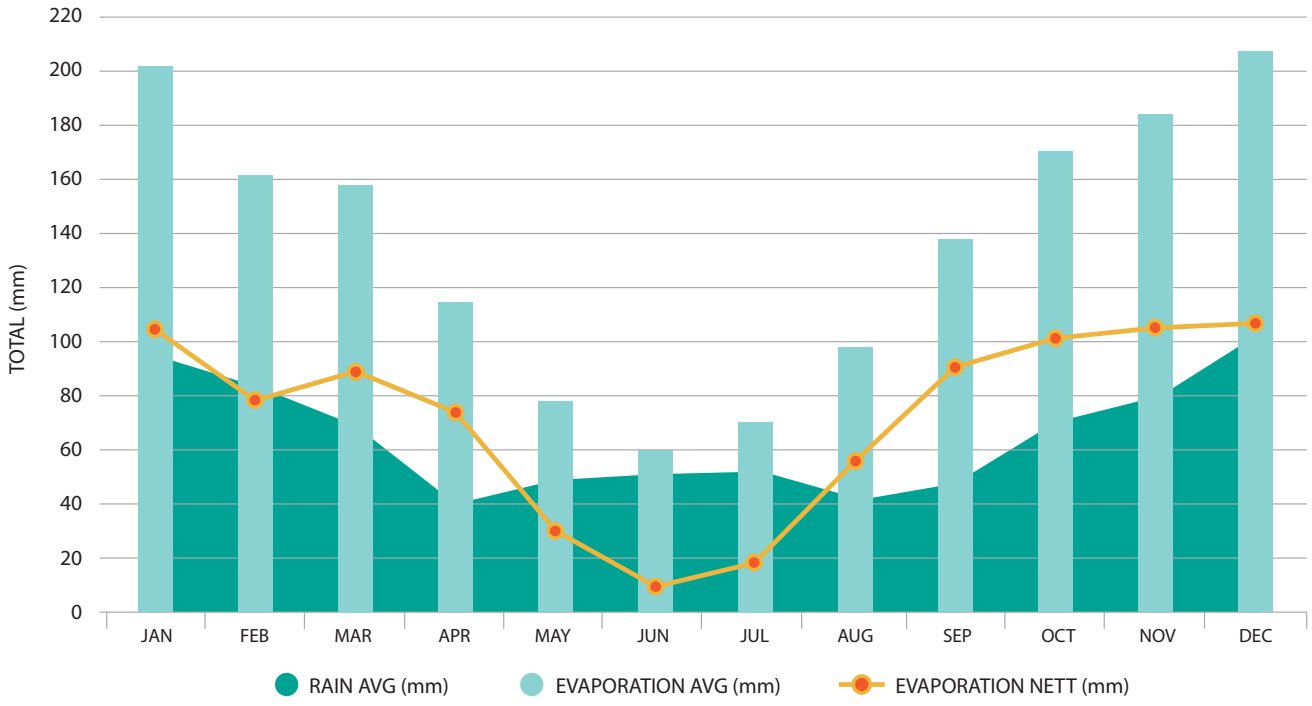
To determine the annual cost of the infrastructure per unit of water saved, we need to consider installation capital costs, and repair and maintenance costs, offset against the annual and seasonal water lost from the storage. (This will depend on local evaporation rates, storage operating conditions and the efficiency of the technology you select in reducing water loss.)

Based on the assumed costs at Golden Valley Orchards, at today's prices, the annual cost of this system is about $813/ML of water saved. This is based on a discounted assessment over the life of the product, with the expected life of the product being 30 years for the structure and 15 years for the shade cloth. An annual operating and maintenance cost of 0.4% of the capital cost or $2,000 has been included to cover basic repairs and maintenance with a discount rate, representing cost of capital, of 5%.

Weather data and evaporation losses

Average annual rainfall at the site is 790mm and average annual evaporation from the storage is about 1650mm. This equates to 52ML of evaporation loss per year from an uncovered full dam. The surface area of the water when the dam is full 3.1ha.

The graph below illustrates that in the summer months of October to March the nett evaporation loss (difference between evaporation and rainfall), and the irrigation water requirement is highest. The dam is expected to hold water on 90% of years, as water can be transferred from other dams, but levels fluctuate depending on timing of pumped inflows and irrigation activity. During the drought years (2018-2020) the storage was close to empty. Considering typical water level fluctuations and changes in surface area, the average evaporation loss from the dam if uncovered would be 42ML/yr.



▲ *Average monthly weather data for site.*

Recent product development by NetPro

Canopies can be installed at either bank level or elevated using support poles, installed within the dam or using a suspension system with towers on the bank.

NetPro have substantially improved their product since 2003, including cloth density options now ranging from 70% to 95% cover. Evaporation saving increases with cover density, but so does weight, with price implications for both the shade cloth and load bearing structure. New shade cloth products are knitted rather than woven and are lighter with better stretch capability, and canopy panel widths have increased to reduce the installation cost of the system. Other improvements have included strengthening of cables and support structures to increase load carrying capacity.

How do I calculate cost-benefit?

When considering cost-benefit a widely used approach is to compare the annualised cost of the installation, based on cost per unit of water saved ($/ML), with the additional crop that could be produced, and hence extra revenue generated using the saved water. This approach usually looks at the crop gross margin (GM) per megalitre of irrigation water (GM/ML). An alternative approach is to compare the product cost ($/ML) with the cost to purchase water, or price that could be obtained when selling surplus water.

The gross margin of horticulture products will vary widely depending on quality, timing, market conditions; this information is also not widely available. During times of drought if water is available to produce a quality crop the gross margin per is likely to be high. For tree crops such as apples it is likely that GM/ML irrigation water is likely to exceed $1,500/ML.

Given the high value of horticulture products, and the high cost of purchasing replacement water, the $813/ML annualised cost of the shade cloth system would be considered a viable option for many horticulture farmers who would also benefit from water quality improvements.

Based on a gross margin of $1,500/ML for the additional crop that could be produced using saved water the net present value (NPV) of the investment, NPV would be $400,000 with a benefit cost ratio of 1.53 and internal rate of return (IRR) of 10%.

The impact of a change in assumed capital cost ($13/sqm, $15/sqm and $20/sqm) and value of water ($1,500/ML and $2,500/ML) is summarised below, illustrating the need to get a good handle on the value of water and an accurate quote.

An Economic Ready Reckoner tool *https://evapadvisor.com/* has been developed for undertaking site-specific analysis to inform potential users of the cost-benefit of each technology.

Water Value		Installation Capital Cost		
		$13/sqm	$15/sqm	$20/sqm
$1500/ML	Annualised Cost $/ML	$813/ML	$938/ML	$1251/ML
	Net Present Value	$394,000	$280,000	$0.00
	Benefit Cost	1.53	1.33	1.0
	Internal Rate of Return	10%	8%	5%
$2500/ML	Annualised Cost $/ML	$813/ML	$938/ML	$1251/ML
	Net Present Value	$1,150,000	$1,040,000	$750,000
	Benefit Cost	2.55	2.21	1.66
	Internal Rate of Return	19%	17%	12%

▲ *Impact of changing capital cost of installation and value of water on benefit-cost.*

Top points to consider

- **Fluctuating water levels** – the structure is not affected by fluctuating water levels.
- **Rainfall ingress** – the shade cloth is permeable and allows rainfall ingress and does not hold silt with associated plant growth.
- **Water quality** – the shade cloth cover significantly restricts light penetration and therefore algae growth resulting in reduced filtration costs. Windblown debris and bird and animal access is limited also resulting in improved water quality.
- **Reduction in bank erosion** – the cover limits wind interaction with the water surface thus eliminating waves and slowing down wall deterioration therefore saving costs in maintenance.
- **Reduction in weed and reed growth** - combating the continual growth of weeds and reeds in water storages has become an expensive and ecological challenge. Covering the storage helps control noxious weeds.
- **Local experience** – specialist engineering experience is required, however, there is widespread local experience and farmers are familiar with this type of technology.
- **Cost** – there is a relatively high upfront capital cost and cost benefit needs careful consideration.
- **Access** – there is easy access under the cover for maintenance purposes.

SQNNSW Innovation Hub

Email SQNNSWhub@usq.edu.au
Phone +61 7 4685 5005