

## Dairy Directions – Analysing Farm Systems for the Future

*Providing robust analysis of the impact of on-farm changes and innovation on the profitability of dairy farm systems*

### Irrigation re-use dams – do they pay?

#### Why should I consider an irrigation re-use dam?

Farmers continually strive to use water more efficiently on their farms. Irrigation water use efficiency may be achieved by capturing runoff water from irrigation bays with a re-use system.

Re-use systems consist of a capture dam, pump and drains or pipes to deliver water to and away from the dam. Runoff water from irrigation and rainfall collected in the re-use system can be utilised on the farm, therefore, improving water use efficiency.

Potential advantages of irrigation re-use dams include:

- ◆ Increased pasture production and reduced reliance on purchased supplements
- ◆ Increased feed supply flexibility within the farm system
- ◆ Increased water use efficiency
- ◆ Ease of irrigation management
- ◆ Water and nutrients remain on the farm

Potential disadvantages include:

- ◆ High investment/installation cost
- ◆ On-going operating costs
- ◆ Increased repair and maintenance costs
- ◆ Loss of productive milking area
- ◆ Not necessarily useful as a drought strategy

#### Is an irrigation re-use dam a good investment?

A partial budget analysis, over a 10 year period, was used to determine whether the installation of an irrigation re-use system was a worthwhile investment. This analysis was done using a case-study farm in the Macalister Irrigation District (MID).

Two dam sizes (6 ML and 9 ML) and two water re-use rates (10% and 20% of irrigation water applied plus rainfall) were analysed. A sensitivity analysis was conducted to determine the minimum pasture response per megalitre of re-use water saved (t DM pasture consumed/ML), required to justify installation of the system.

The measures used to assess the profitability of the re-use system were nominal internal rate of return (IRR) and years for cumulative net cash flow to break even before interest. A re-use system was considered a good investment if a nominal IRR of 10% or greater, was achieved.



Factors to consider before installing a re-use system include construction and installation costs, legal obligations and the ease of operating the final system. The maximum size of the re-use dam is restricted to one ML for every 10 ha of titled area (Farm Dams Act, 2002).

#### Estimated construction costs

The layout and design of irrigation re-use systems vary between farms, depending on the topography and area of land available. The capital costs associated with construction of the re-use systems tested in this analysis are detailed in Table 1.

**Table 1. Estimated installation costs for irrigation re-use systems**

Dam size	6 ML	9 ML
Application fees (\$)	3,500	4,500
Construction of dam (\$)	42,000	63,000
Installation of the pump (\$)	20,000	20,000
Installation of pipes (\$)	10,000	10,000
Installation of fencing (\$)	900	1,100
<b>Total (\$)</b>	<b>76,400</b>	<b>98,600</b>



Some general assumptions made in the economic analysis included:

- ◆ Before installing the re-use system, best management practices for irrigation were assumed.
- ◆ The benefits of the re-use system were captured as additional pasture grown and consumed.
- ◆ All additional pasture was consumed by cows at grazing, therefore no additional conservation costs have been included.
- ◆ Water re-use was estimated on an annual basis and based on the total amount of water used (irrigation and rainfall). Annual rainfall of 450 mm was assumed.
- ◆ The dam was built to the maximum allowable size for the titled area, i.e. if 90 ha was available a 9 ML dam was constructed.
- ◆ All runoff water was captured by the re-use system. Before installation, all runoff water flowed off farm into the district drainage supply.
- ◆ Water was re-used at 10% and 20% of total water applied. These values were estimated averages; actual runoff will vary with season, time of year and irrigation practice.
- ◆ No additional labour was required to operate the system.
- ◆ No other nutrient savings were included.
- ◆ There are a number of ways of utilising re-use water on farm. For example, irrigating new areas of land or applying more water to existing irrigated pasture. To simplify this in the analysis, three pasture response rates per megalitre of re-use water have been assumed.

## What about dam size?

In this example, construction of a re-use dam resulted in a loss of productive milking area. Therefore, the value of this area, in terms of lost pasture production/consumption, needed to be considered. The value of lost productive milking area would be higher where initial pasture consumption was high, or with larger dams, which require greater area.

Operating and maintenance costs will vary with the amount of water re-used, and the hours required to run the pump to utilise this water. Annual operating costs are detailed in Table 2.

**Table 2. Annual operating cost for each option analysed**

Dam size	6 ML		9 ML	
	6A	6B	9A	9B
Option				
Water re-use rate (%)	10	20	10	20
Area of pasture lost (m <sup>2</sup> )	1,500	1,500	2,250	2,250
Value of lost pasture (\$)	293	293	439	439
Total volume reused (ML)	63	126	95	189
Pump capacity (ML/hr)	0.5	0.5	0.5	0.5
Annual operating hours	126	252	189	378
Annual maintenance cost (\$)	500	1,000	800	1,600
Annual operating cost (\$)	1,000	2,000	1,500	3,000
Total running cost (\$/Yr)	<b>1,500</b>	<b>3,000</b>	<b>2,300</b>	<b>4,600</b>



## How do the economics of the different systems compare?

The analysis showed that when a 6ML dam was built and 10% of applied water was re-used (option 6A), the nominal IRR was sufficient (12%) for a re-use system to be considered a worthwhile investment based on economics alone (Table 3). Doubling the amount of water re-used to 20% increased the IRR to 29%.

**Table 3. Economic analysis of investing in an irrigation re-use system, assuming 1 t DM additional pasture per ML re-use water. Additional pasture was valued at \$150/t DM**

Dam size	6 ML		9 ML	
	6A	6B	9A	9B
Option				
Water re-used (%)	10	20	10	20
Total capital cost (\$)	76,400	76,400	98,600	98,600
Water re-used (irrigation + rainfall) (ML)	63	126	95	189
Years to break even	9	4	8	4
Internal rate of return (nominal)(%)	12	29	15	35



In a sensitivity analysis, the amount of additional pasture consumed per megalitre of water, required to justify the investment decreased, as the percentage of water re-used, or the value of the pasture increased (Table 4).

**Table 4. Extra pasture consumed to achieve a nominal IRR of 10% under different systems**

Dam size	6 ML		9 ML	
	6A	6B	9A	9B
Option				
Water re-used (%)	10	20	10	20
t DM/ML required for IRR of 10% at \$100/t DM	1.4	0.8	1.2	0.7
t DM/ML required for IRR of 10% at \$150/t DM	0.9	0.5	0.8	0.5
t DM/ML required for IRR of 10% at \$200/t DM	0.7	0.4	0.6	0.4

It is important to note that fodder price and pasture response vary across seasons, so in this analysis the values used are an average for a 10 year period.

It is clear from the analysis that if a low percentage of water was re-used and fodder price was low, pasture consumption would need to increase substantially to achieve an IRR of 10%. In addition, the economic benefits of a re-use system assumed that the operator utilises the additional pasture, and reduces the amount of purchased supplements.

When fodder costs were high, installing an irrigation re-use system for pastures grazed by dairy cows was an economically attractive investment. Even when a low percentage of water was re-used, and a low pasture consumed, higher fodder prices were able to justify the investment and generate a nominal IRR of 10% or more.

## Other factors that may need consideration include:

- ◆ What area will be irrigated with this water?
- ◆ How long will it take to empty the dam?
- ◆ Does it meet the requirements of the EPA and irrigation authority?



- ◆ Can new areas of the farm which were previously not serviced by channel water be irrigated?
- ◆ Ensuring drainage lines are sufficient to deal with a rainfall event after an irrigation.

## In summary

The analysis indicates that the installation of an irrigation reuse system can be a worthwhile investment for an irrigated dairy farm in the MID. As the proportion of water re-used increases, pasture consumption per unit of re-use water decreased to justify the investment and achieve a nominal IRR of 10% or more, decreases.

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### Further Information

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