

ClearTech Case Study: Thorneycroft dairy farm

## Thorneycroft dairy farm, Geraldine, Canterbury

**There's no doubt that farming on the outskirts of a township comes with its own unique set of challenges.** But the installation of a ClearTech effluent treatment system has allowed Geraldine farmers Neil and Margaret Campbell reduce the impact of returning farm dairy effluent (FDE) back to pasture.

The Campbells own Thorneycroft, an 800-cow operation that supplies Synlait. The 240ha farm (160ha irrigated, 80ha leased dryland) borders the water collection zone for the Geraldine township.

It was while working with Ravensdown's environmental consultants to renew Thorneycroft's farm consents that the idea of installing a ClearTech unit came about.

"The ClearTech science was a plus with the information we were putting together with our consents to farm," says Neil.

Developed in conjunction with Lincoln University, Ravensdown's ClearTech system uses a coagulant to bind colloidal particles together to settle them out from the water. This clarifying process reduces the environmental and safety risks linked with farm dairy effluent (FDE) by killing 99% of *E. coli* bacteria in the clarified water, the effluent odour and the risk of phosphorus leaching from the FDE applied to pasture.

Stripping out the *E. coli* and other bacteria from FDE means the clarified water (69%) can be used to wash down the dairy yard and irrigated back onto paddocks. Freshwater use on farm is reduced dramatically, while effluent storage capability is increased. The remaining 31% Treated Effluent (TE) is pumped to the holding pond before irrigation. Furthermore, when configured in such

a way that the treated effluent is irrigated immediately after clarification, the *E. coli* in effluent spread on the paddocks is reduced by 91% - in the Campbell's case, significantly reducing the risk to the community drinking water supply.

**“ There are so many positives, and the science is all there behind it. ”**

The science behind ClearTech technology appealed to Neil in particular. "It's pretty smart technology and that got me going to start with," he said.

In the first year of the ClearTech plant's operation the Campbell's have recorded a 60% reduction in the annual volume of farm dairy effluent (FDE) returned to pasture, and as far as Neil is concerned, each step towards addressing the environmental impact on farm is a step in the right direction — now and for future generations. "You've still got the cows out in the pastures 24-7 doing what they have always done but by making an effort with the waste captured on the concrete, it's one little step up the ladder in helping things out as far as water quality goes."

In addition to addressing FDE return, Neil found other benefits, both expected and unexpected. "Our effluent spreading system is just a conventional travelling irrigator, so the less material we have to spread with that, the less labour involved," he said. "The guys [on-farm] quite like that side of it."

Another plus has been the improved setup for using recycled water to wash the yard and entry areas. A second high-pressure hose pump was installed and the main ring around the dairy shed was split into two, halving the time his team spend on cleaning up.

Neil's seen first-hand how much easier it has made things for the staff on Thorneycroft.

"It's a lot quicker cleaning up because you've got an extra pump running instead of having just one pump and one system," Neil says.

"There are so many positives, and the science is all there behind it."

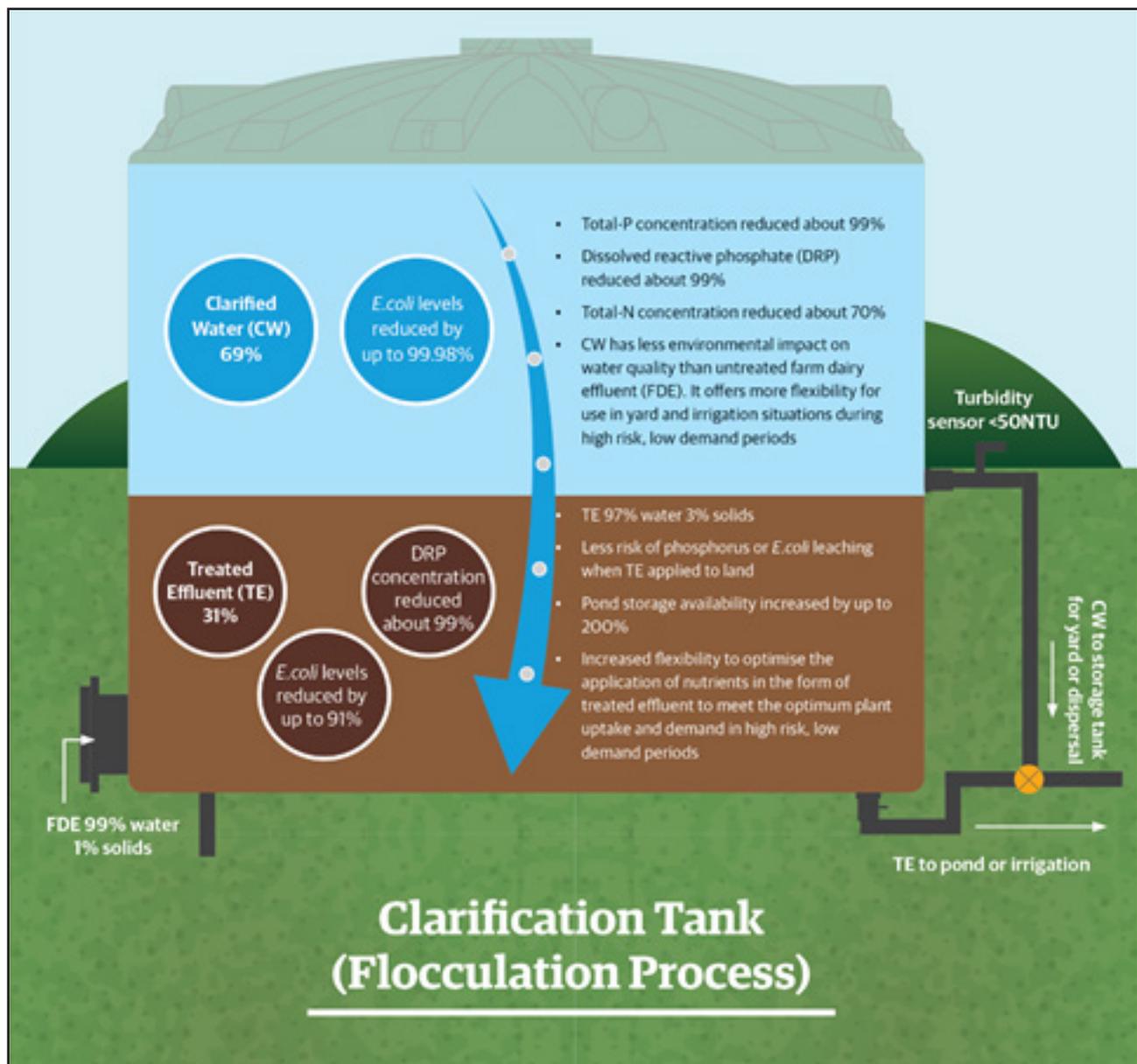


## How does it work?

The ClearTech system uses a coagulant and flocculation batch process to treat FDE, producing approximately **69%** Clarified Water (CW) that can be recycled as yard wash-down water and **31%** treated effluent (TE) that is pumped to the holding pond before irrigation.

As well as reducing the volume of effluent to be managed and therefore enabling deferred irrigation best management practice, further benefits include reduction in dissolved reactive phosphorus (DRP) and *E. coli* in the treated effluent.

While there are a range of benefits the ClearTech unit brings to the farm, the key factor for Thomeycroft Dairy is the reduction in *E. coli* and volume of TE that enables better flexibility and timing of effluent irrigation. When configured in such a way that the treated effluent is irrigated immediately after clarification, *E. coli* in effluent spread on the paddocks is reduced by **91%**, significantly reducing the risk to the community drinking water supply.



## How does it work?

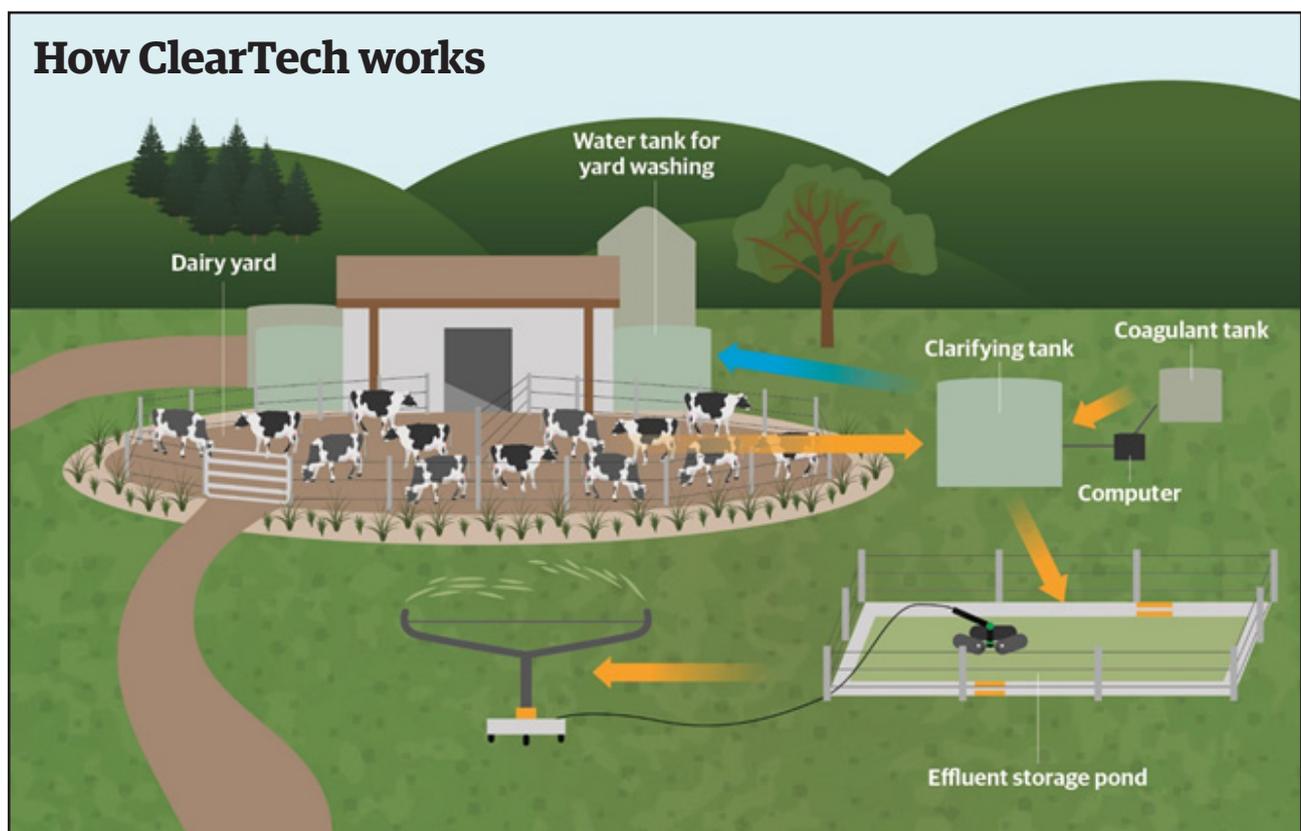
### Thomeycroft system configuration

The 30,000L ClearTech clarification tank, control unit and coagulant reservoir tank were positioned next to the enviro-saucer and permastore holding tank.

An additional 30,000L storage tank was installed next to the milking shed to hold the clarified water before being pumped to the yard wash backing gate. The original 30,000L freshwater tank remains to supply fresh water to the milking parlour.

### Batch process

1. During each milking, the FDE flows through the sand wedge and enters the enviro-saucer and purpose-built 30,000L sump.
2. The ClearTech control unit then switches on the pump to fill the clarification tank with FDE.
3. Once filled, 25L of coagulant is injected into the clarification tank.
4. After a 10-minute dwell period, the NTU sensor detects how well the coagulation process is occurring. If required, more coagulant will be injected.
5. The coagulation/flocculation process will continue until the target NTU reading is achieved.
6. The top two-thirds of the tank will now be clear, clarified water; ready to be pumped out to the clarified water storage tank ready for reuse through the backing gate.
7. The treated effluent making up the lower-third of the clarification tank is then pumped out to the holding tank or directly applied to pasture.
8. The ClearTech unit is then ready to receive the next batch of FDE from the enviro-saucer and sump.



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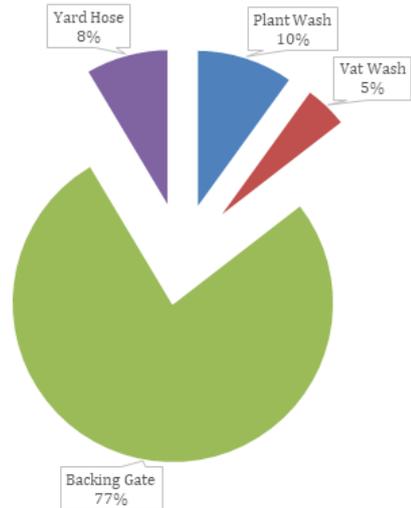
## Milking water use

Analysis of the dairy shed and yard water consumption identified that **85%** of the fresh water used was for washing down the yard through the backing gate and yard hose.

This presented a significant opportunity as ClearTech clarified water could be fully utilised by recycling it back through the yard wash, thereby diverting it from entering the holding tank. This greatly reduced the volume of FDE requiring irrigation to the paddocks.

This also reduced the demand for fresh water as the clarified water is recycled between milkings, ready for use through the backing gate.

Twice-a-day Milking Water Use



## The numbers tell the story



Ravensdown has calculated figures for Thorneycroft to illustrate the impact ClearTech has had on freshwater use and farm dairy effluent (FDE) storage capacity.

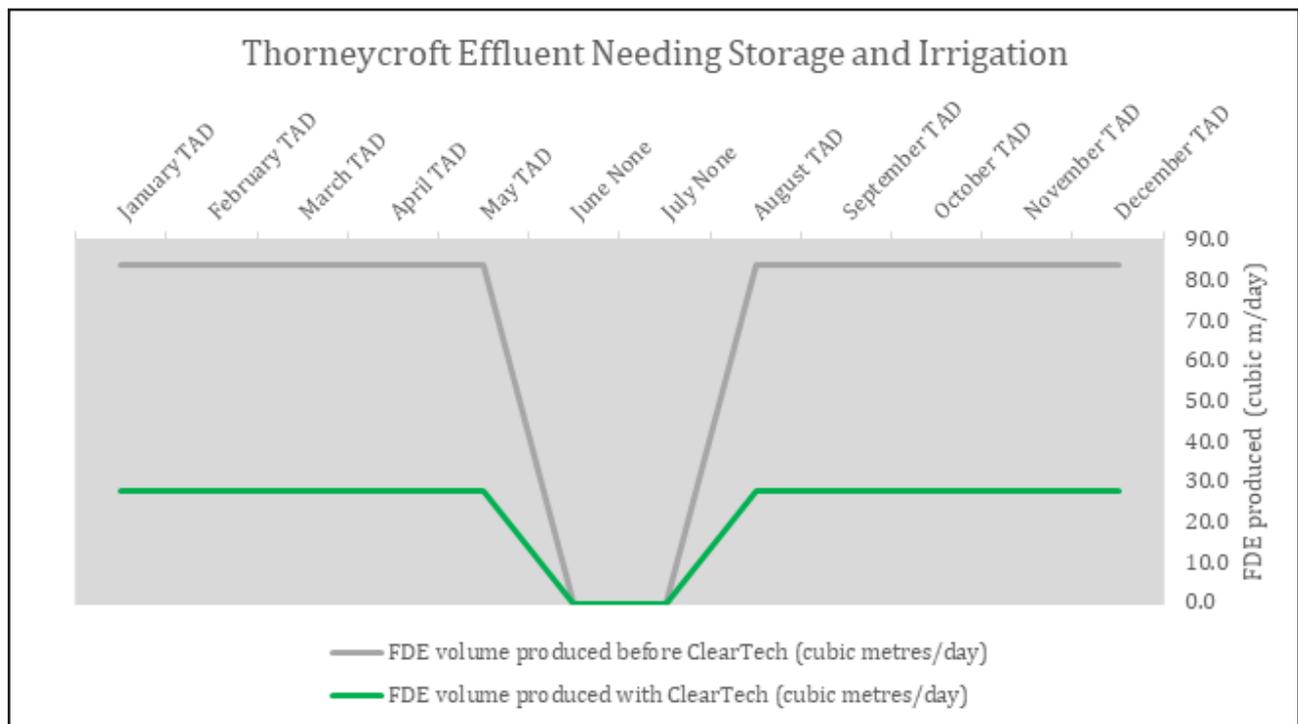
Numbers are based on volumes produced by Thorneycroft since January 2020 and calculated to an annual figure using the DairyNZ *Dairy Effluent Storage Calculator*.

	No Effluent Treatment	With ClearTech	% Reduction
Annual Volume FDE Produced*	26,176m <sup>3</sup>	10,470m <sup>3</sup>	60%
Travelling Irrigator Runs	146 runs/yr	58 runs/yr	60%
Travelling Irrigator Labour	292 hrs/yr	116 hrs/yr	60%
Annual Freshwater Use**	23,611m <sup>3</sup> /yr	7,870m <sup>3</sup> /yr	67%
	105L/cow/day	35L/cow/day	67%
Effluent Irrigation Start Date***	16 <sup>th</sup> August	7 <sup>th</sup> September	22-day extension

\*This is the volume of FDE that requires storage and irrigation to pasture  
 \*\*The difference in annual freshwater consumption and FDE produced is due to additional rainwater and solids  
 \*\*\*DESC calculation of when Spring effluent irrigation can start with 90% probability of adequate storage

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## The numbers tell the story



ClearTech reduced the daily volume of effluent needing storage and irrigation from 83.7 to 27.9m<sup>3</sup>/day.

The coagulant reservoir tank (below) has integrated level sensing and telemetry enabling remote monitoring of coagulant levels thereby triggering re-supply.



## Costs and benefits

**Reduced risk of fines/abatement notices** from effluent management non-compliance events as greater storage capacity has been created within your existing infrastructure.

**Peace of mind** that your effluent system has ample storage capacity for the coming season.

**Smart nutrient management.** The reduced effluent volumes and extra storage capacity created by ClearTech means the start of effluent irrigation can be delayed into spring. Warmer temperatures and more daylight hours mean greater pasture demand for nutrients. Matching your applications to this demand means more efficient use of the nutrients in your farm's effluent.

**Coagulant costs:** Based on 26,176m<sup>3</sup> of FDE being treated per year, using 25L per 28,000L batch, 23,371L of coagulant is used per year. At \$1.13 /L, total cost = \$26,410 /yr.

**Improvements in animal health** from better yard hygiene from more water available for wash down. Reduced mastitis meaning more milk production and reduced cost of antibiotics.

**Labour savings/re-purpose:** By reducing the volume of effluent to pump from the holding pond from 26,176 to 10,470m<sup>3</sup>/yr, on average the number of irrigation runs could be reduced by 88 runs. At two hours labour per run at a cost of \$20/hr, that's \$3,520 per year saved on average. Of greater value still is the repurposing of the labour to higher value jobs on farm such as animal health and pasture management.



**Electricity, wear and tear savings from reduced pumping:** The volume reduction of effluent needing irrigation is 15,806 m<sup>3</sup>/yr. This translates to a cost saving of **\$2,619/yr** in energy consumption and pump maintenance.

Recycling water to the yard avoids pumping it out of the ground which saves an estimated **\$136/year**. This cost saving is comparatively low due to the shallow groundwater. In inland areas e.g. Darfield or Methven, this cost saving could rise to nearer \$1,000 due to deeper groundwater.

NB. Additional energy consumption costs are incurred due to the pumping required to lift the FDE into the clarification tank and then transfer the clarified water and treated effluent following the coagulation process. These were calculated to be \$1,505/yr for this farm. As a sump was installed to enable transfer of FDE into the clarification tank, the sump stirrer is also an additional energy consumption cost calculated to be \$1,489/yr.

**Freshwater savings:** By recycling the clarified water through the backing gate and yard hoses, it is estimated that 15,741,000 litres /yr of freshwater consumption can be avoided. For Thorneycroft, dairy shed freshwater consumption has reduced from 105 to 35L/cow/day.

### CONTACT

If you would like to find out more about ClearTech for your farm dairy effluent treatment please contact your Ravensdown agri manager or phone 0800 100 123.

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