

Dairy Effluent Recycling System



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1. Current Situation

As it is well known throughout New Zealand, the dairy industry has a problem with dairy effluent. The standards and compliance issues are huge and demand a lot from a farmer. Along with this there are water issues as well, whether it is water quality or quantity, there is always a need for water at a better quality for use on high yielding farms.

Solution

Forsi Innovations have spent the last eight years developing an effluent recycling system. This system was designed to help every dairy farmer meet regulations from authorities for dairy effluent compliance. The system will also eliminate the need for large storage ponds, which in turn will save on valuable land that would be otherwise wasted.

The system comprises of four steps:

- Solids separation
- Suspended solids removal
- Water polishing
- Sterilization

1.1 Objectives

The effluent recycling system will take all dairy shed waste, and from this, produce clean clear water. The water can be reused on the dairy shed yard or for irrigation to pasture without the adverse effects commonly known today.

- Objective 1 - Produce clean, clear water to a high standard
- Objective 2 - Future proof effluent system compliance



“We never know the worth of water till the well is dry.”

THOMAS FULLER

2. Components

Forsi has developed and designed the system components to work efficiently. It is constructed of high quality materials to ensure a long lasting service life. Each component is mounted, plumbed and wired into a customized 40-foot container for ease of transportation and installation. The container has internal walls to separate wet and dry areas.

Sloping Screen

The Forsi sloping screen has been constructed from 304 grade stainless steel. The wedge wire screen has a .5mm aperture width, curved with the optimal angle for efficient share action to separate solids. This screen has a designed flow rate of up to 120m³ per hour. The unit is designed to be self supporting and comes with a galvanized walk around platform. Also included with the screen, is an automated wash system, keeping the screen clean and ready for the next batch of effluent.

2.1 Suspended Solids Removal

This highly specialized part of the system is a two step process. First the fine suspended solids are subjected to a rigorous upward thrust, forcing the larger solids out. The second part has our formulated reagent, combining the very fine particulates, which are then separated out.

2.2 Water Conditioning

The water is conditioned using UF water polishing. This polishing stage takes all contaminates out of the water including bacteria. The unit is constructed from chemical grade PVC and mounted on a stainless steel frame. It has an automated backwashing procedure keeping the hollow fiber strands at optimal condition and runs on a pneumatic valving system for optimized backwash operation.

2.3 Sterilization

The sterilization process ensures the filtered water is bug and pathogen free, guaranteeing it will meet the strictest regulations set by any authority.

2.4 Monitoring

The effluent recycling system comes with monitoring at each stage to ensure water quality is maintained. If one of the parameters is not met, the system will automatically divert the water back to the buffer tanks and alert the serviceman of a fault via GSM communication. The parameters being monitored include turbidity, nitrate and bio-reagent levels.

3. Cost

The full effluent recycling system is priced at:

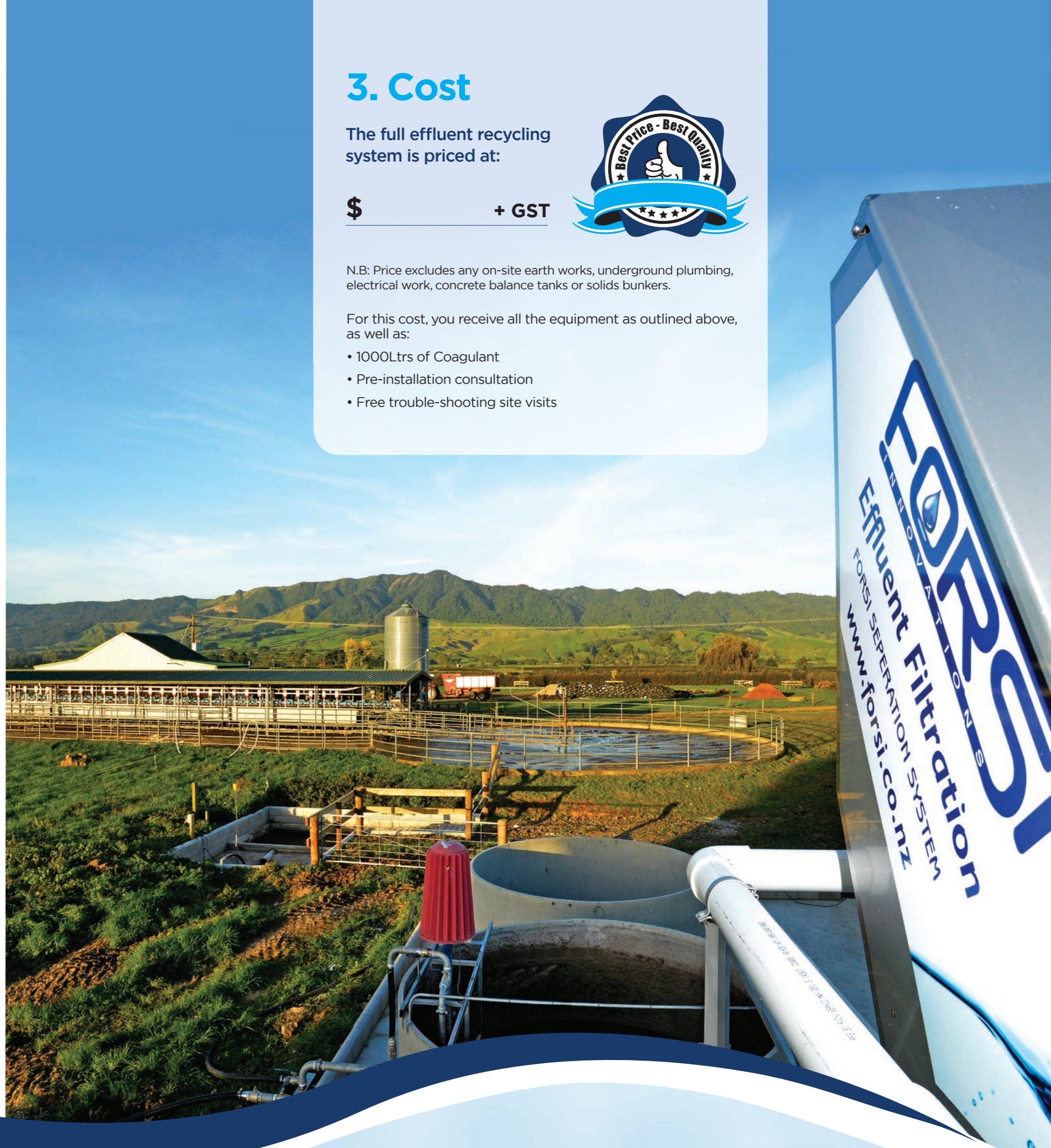
\$ _____ + GST



N.B: Price excludes any on-site earth works, underground plumbing, electrical work, concrete balance tanks or solids bunkers.

For this cost, you receive all the equipment as outlined above, as well as:

- 1000Ltrs of Coagulant
- Pre-installation consultation
- Free trouble-shooting site visits



“I recommend this system to any farmer faced with putting in a new effluent system, because its very effective and its got a good environmental aspect. We can use this water to washdown the yard everyday just by recycling it. Thats just amazing.”

4. Effluent System Overview

Our objective was to design and build a complete, closed loop effluent recycling system to take dairy effluent from the cowshed yard and process into clean, clear, pathogen and nutrient free liquid. This liquid can be recycled and reused as wash down water for the cowshed yard, or irrigated to the pasture without any negative environmental effects.

4.1 System description

The FORSI Effluent Recycling system will take effluent from the dairy shed yard, through a sand trap and over the solids screen. This screen will reduce the solids loading and separate all particulates larger than .5mm. Our findings show the use of a mechanical solids separator, scrubs a lot of the solids through the screen causing a larger suspended solids loading, creating issues with the liquid.

Once the liquid has been through the screen, using an specific coagulant, it is then passed through a particulate separation process, reducing the suspended solids loading. The liquid then travels through a particulate removal and water polishing stage, consisting of UF filtration and UV sterilisation.

The system is pre-fabricated and built into a modified 40 foot container comprising of:

- Stainless steel sloping screen
- Coagulation system
- Water polishing system
- Transfer pumps
- Dosing pumps
- Monitoring systems
- Tank level monitoring systems
- Flow monitoring
- Touch screen control system
- GSM communication module

- Note: System failures will default back to effluent sump (if any parameter does not meet criteria, the system diverts filtered effluent back to the start)

4.2 What are we dealing with?

On average, each dairy cow excretes approximately 60 litres of manure per day or six litres per excretion. Typically two of these excretions would occur in the cow shed when milking twice daily. For an average small herd of 250 cows, this equates to 3,000 litres per day or 6,000 litres for a herd twice the size. Add to this an additional 15-20,000 litres of water used daily to wash down the average sized cowshed, and you suddenly have a large problem.

When this mix is sprayed directly onto pasture during wet weather, both the soluble nitrates and phosphorus will leach into the ground water. The cost to install sufficient tank capacity, for storage during wet weather to enable irrigation only during dry periods, is unjustifiable. Spreading such manures onto pastures in wet periods also increases nitrous oxide emissions into the atmosphere.

It is important to note that 4.76kg of nitrous oxide = one tonne of CO2 emissions.

There is an alternative daily practice of leaving the shed effluent and wash down waste to settle



in a tank before pumping off the top layer of waste water for the next wash down. This can cause ammonia problems associated with slime growth on the concrete, plus the fact that this re-used wash down water does not comply with Fonterra's shed hygiene requirements. Also the pathogen and bacterial problems causing mastitis and other animal health issues can be associated with green water wash down systems.

We have a fully operational trial plant successfully removing solids from this waste, and filtering the water to a suitable quality (awaiting approval by Fonterra to meet shed health and hygiene standards) to be used again for wash down. The de-watered solids (manures) can then be collected on a regular basis for inclusion into organic matter based solid fertilisers. This can be used back on the farm to offer a material closed loop or full life cycle.

4.3 In Brief

This system has three phases:

- Phase 1:** Large particulate removal
- Phase 2:** Fine particulate removal
- Phase 3:** Water polishing



4.4 Facts & Figures

CONVENTIONAL POND SYSTEM

\$200,000 - \$750,000

- Annual maintenance - \$10,000 - \$40,000
- Annual running costs - \$10,000 - \$20,000
- Cost to pump water for wash down \$11,000 P.a
- Total running cost \$71,000 P.a

EFFLUENT RECYCLING SYSTEM

\$350,000

- Annual Maintenance - \$2,000
- Annual running cost - \$16,000
- Cost to pump water for wash down \$0
- Total running cost \$ 18,000
- R.O.I* = 7.5 years

Conclusion

In offering this system, we can:

- Reduce the annual running costs for an effluent management system
- Reduce the amount of water needed to be pumped out of the ground for wash-down water
- Reduce the cost of pumping wash down water
- Reduced impact on the environment through no nitrate, phosphate and pathogen leaching
- Reduced COD, BOD, NTU, suspended solids
- Reduced CO2 emissions from each farm
- Minimal operator attention needed - fully automated control
- Compact design, needing minimal room for installation
- High quality components and workmanship for durability for the harsh NZ conditions
- 100% NZ Made
- Closed loop system – no waste stream to deal with
- Constant processing flow rate of 12,000 litres per hour



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