

## Effluent & Irrigation Case Study

### Customer

DS & SM Rogers

### Issue

A solution to meet the effluent compliance for storage capacity, required by the Waikato RC, whilst utilizing a Larall Smart Hydrant (LSH), to better improve the irrigation process.

### Solution

Effluent & Irrigation Design System (E&I)

### Outcome

Better Utilization of Nutrients, Saving Labour, Low Application, Improved Uniformity and a simplified Management Plan



### Summary:

The New Zealand Dairy Industry is facing enormous challenges in terms of managing its effluent resource in relation to storage and irrigation. Utilizing traditional effluent systems no longer results in better management of our resources. However, over engineering the solution is also counterproductive. A simple design will produce less strain on labour, land, energy and the bank.

Although the main reason for installing the system was to comply with the regional effluent regulations, DS & SM Rogers took it as an opportunity to acquire a solution that would allow them to manage their storage and irrigation with a lot more control, and build more efficiencies into the effluent use and distribution.

### Background:

The challenge for New Zealand's primary processing sector, is producing more without utilizing more resource. That is, how can it double dairy output but use less resource like fertiliser, water and other nutrients? How can it increase production without increasing groundwater pollution? How can it protect soil quality as production is expanded?

At the same time, there is growing pressure on other parts of the New Zealand economy to protect the natural resources better; reduce pollution of our water ways, reducing carbon emissions, whilst improving animal health etc.

Spreading effluent onto paddocks is a common function across New Zealand Dairy Farms, but how can that function be transformed into away that changes the way effluent users behave?

With involvement across the dairy industry, as independent consultants for various dairy farmers and a provider of solutions for effluent design, project management, installation and servicing across the country, E&I has a unique perspective on these issues. It's a perspective that offers important insights for dairy farmers, as they grapple with the challenge of ensuring effluent nutrients becomes more and more utilised more efficiently, allowing the farmer to focus more on improving milk productivity.

### The Story:

Effluent & Irrigation partnered with rural pump supplier's Pump & Valve and Pump & Pipeline, rural pond lining company Enviro-line, Digger Operator John Teague, and our very own LSH Techno wizz Les, to deliver an effluent storage & delivery solution to DS & SM Rogers.

This solution was developed in response to regulatory pressures, with a combination of sufficient storage and uniformity of application being foremost front of mind. The challenge for E&I was delivering a solution that included a future Feedpad system and Low Application LSH, allowing the farmer time and sufficient storage during calving where irrigation could be deferred for approximately 10 weeks, if required.

### Commentary and Analysis:

Fundamentally the solution was aimed at enabling the dairy farmer to comply with government regulations, but in the longer term it was envisaged as a tool for improving the management of

more sustainable and natural effluent nutrients, farm-wide.

The solution implemented by E&I was to give the dairy farmer better effluent management control such as deferred irrigation, timed irrigation operationally, better spread & utilization of nutrients & uniformity, and labour savings. Some LSH's are faraway from the farmhouse, and knowing that if there's a low or high pressure situation, the system will shutdown the main effluent pump, giving the Roger's peace of mind.

Other key challenges for this particular project were the soil types, which are all high risk and generally greater than 7 degree inclines. These included; Kohuratahi Loam, Morrinsville Loam over Clay and Taitapu Loam over Clay which are described as having high to very high PAW. Generally, low application systems are successful with these types of soils, which prevent run off and ponding of the effluent when applying to land. The reason for the success of the low application systems are the use of oscillating sprinklers. The sprinklers are specified to apply at rates that are as low as 3mm up to 5mm per hour. The total depth that is applied is governed by time. For example if the sprinkler is applying at the rate of 5mm/hr and was spraying for 3 hours the total depth would be 15mm. Over time, they also cover the irrigated area with reasonable uniformity. Because of this low rate and manageable depth, nutrients in the effluent are better utilized and the problems with runoff, leaching and ponding on the surface are eliminated.

### Smart Hydrant purpose:

The purpose of the Smart Hydrant is to disperse effluent onto the ground at a rate that is within the soil's ability to absorb it. The effluent is spread at a rate and depth in which the plant can utilise a larger percentage of nutrients. Because of the low rate the Smart Hydrant will avoid run off and ponding. Run off and ponding of effluent is a breach of regional council rules.

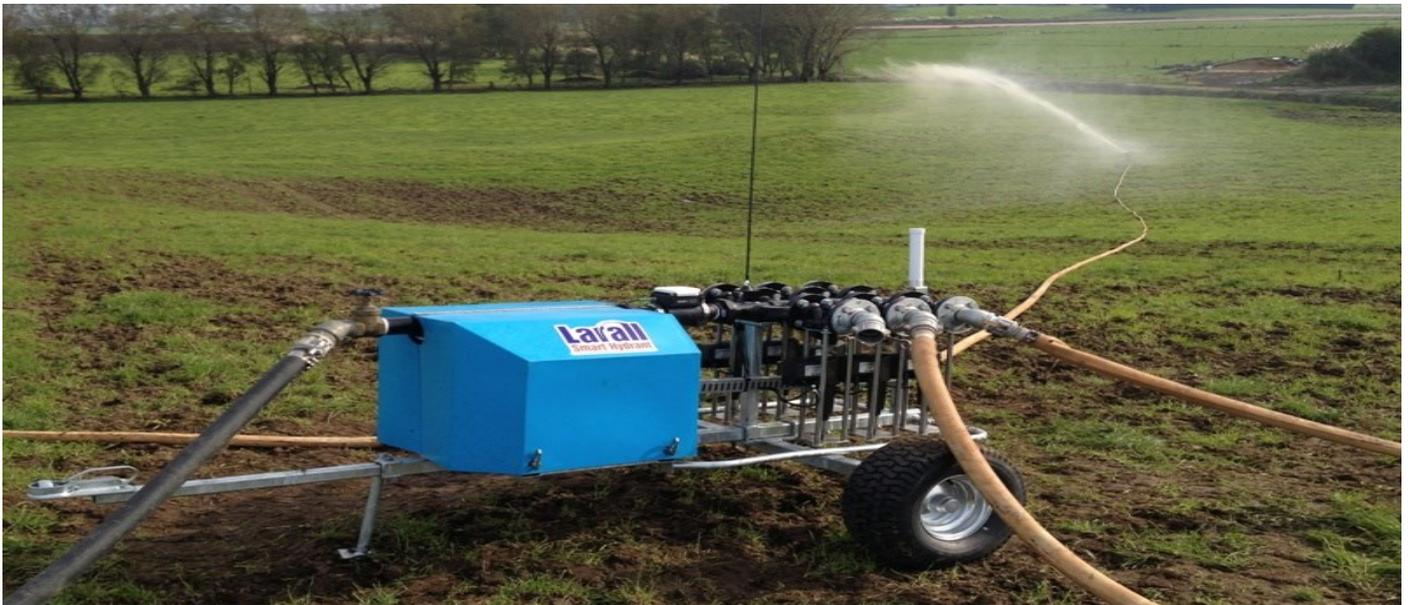
The effluent is mostly dairy effluent but the smart hydrant can be used to disperse any waste liquid such as pig effluent.

### Smart Hydrant setup & results:

The Smart Hydrant is connected to a paddock hydrant and effluent is pumped through the Smart Hydrant to a series of sprinklers. The typical set up will have six sprinklers connected to them via 63mm MDPE drag hose. Lay flat hose can be used as well. The lengths of drag hose vary from 50m to 150m. Up to twelve sprinklers are placed apart in a single paddock.

The Smart Hydrant measures the amount effluent flow after a pre determined amount of time and then a valve will close and another open. A typical amount of effluent would be 3000 liters. The area covered would be approximately 2000m<sup>2</sup>. This process is repeated continually though each of the 4—12 valves. Each sprinkler will receive the exact amounts of effluent. Based on 18,000l/hr pumping volume the amount sprayed onto the ground (total depth) would be approximately 1.5mm. The application rate is 9mm/hr.

To determine the effective area per shift we have to allow for the overlapping of sprinklers, this is done by taking the paddock area and dividing it by the number of shifts/sprinkler and then again by the number of sprinklers. In this example, we'll use 6.



So for a 3ha paddock with 3 shifts the effective area is  $3/3/6 = 0.167\text{ha}$  ( $1,670\text{m}^2$ ). The effective application on this area over 10 minutes would be  $3\text{m}^3/1670\text{m}^2$  or 1.8mm - even though the sprinkler has actually spread it at an average of less than 1mm over a larger area.

The quantity of nutrients applied to the pasture can be determined by the nutrient values of the effluent.

For example if the nitrogen value was  $0.35\text{kg}/\text{m}^3$ , which would equal 3.5kg of nitrogen per hectare per millimeter of application. 1.8mm application would equal 6.3kg of nitrogen per hectare. If you wanted to apply 35kg's of nitrogen per hectare to a 3ha paddock ( $35\text{kgN}/\text{ha} * 3\text{ha} = 105\text{kgN}$ ), at  $0.35\text{kgN}/\text{m}^3$  this would require the application of  $105\text{kgN}/0.35\text{kgN}/\text{m}^3 = 300\text{m}^3$  of effluent. Doing this with 3 shifts would be  $100\text{m}^3/\text{shift}$  and at a pumping rate of  $18\text{m}^3/\text{hr}$  it would take  $100\text{m}^3/18\text{m}^3/\text{hr} = 5.5\text{hrs}/\text{shift}$ .

### Effluent Nutrient Utilisation:

Investing in a well-designed effluent system can give you a significant financial return on investment through reduced fertilizer expenditure, whilst minimizing animal health issues associated with effluent application and significantly cutting down labour inputs normally required to manage effluent disposal.

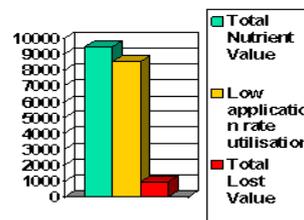
The red data below illustrate how different the utilisation of nutrients from effluent can be on farms that operate on Low Application Rate Systems and on those of High Application Rate Systems, and the amounts of nutrient that inevitably go to waste. Only 10% of the nutrient produced by cows will go to waste on low application rate systems versus 60% wastage on high application rate systems.

Because the application rate is 9mm/hr and the depth are 1.5mm/hr, there is minimal risk of ponding or run off. The effluent has time to soak into the soil. The uniformity of the application is also close to 100%. This is common with most stationary oscillating sprinklers. For every 100 cows, a farmer will save on average \$2,400 per annum on NPK when irrigating between 9 - 12mm.

To gain the maximum value of the nutrients produced in effluent you need to apply it as you would any other fertilizer at rates that plants can absorb.

The data illustrates that by using an LSH based system of effluent irrigation, 90% of nutrient produced are re-utilized, but with a high rate application effluent system, only 40% of nutrient produced are re-utilized.

### Maximising Nutrients (400 Cow Farm)



- Total value of N,P,K \$9,471.00
- Low application rate systems utilisation \$8,524.00
- Lost nutrient value \$947.00

This will give farmers on average a 16% ROI. (Please see your Financial Advisor for your farms specific results)

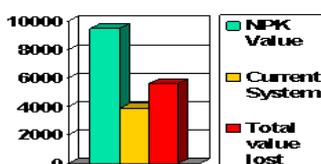
### About Effluent & Irrigation (E&I):

E&I's direct dairy industry experience and knowledge sets it apart from other providers, particularly as we are independent consultants that have no bias towards a particular hardware or solution, as every farm is different. In summary, we specialize in System Design, Project Management, Installation and Servicing of Effluent & Irrigation Systems. Established in 1998, E&I has performed work for clients as far south as Invercargill and as far north as Kaitaia, and has gained widespread recognition for its service commitment and levels of design innovation.

Much more than simply an effluent company, E&I's heritage is as a successful provider of turn-key on-farm operations across the dairy sector. Crucial to the success has been the technology tools we both have access to and developed ourselves in house, with a number of partnerships that include Pump & Valve, Tasman Tanks, RX Plastics and many others. E&I help dairy farmers comply with government regulations and improve their effluent nutrient uniformity through better designs, project management, installation and servicing.

E&I was sold to EIDNZ Ltd in 2014, continuing to grow and focus on Innovation, Customer-Centric, Growth and People Matter. EIDNZ's claim to fame is that it also owns and operates New Zealand's Largest Automated Teat Spraying Business Wetit, which also operating in the USA, UK, Europe and Aussie.

### Maximising Nutrients (400 Cow Farm)



- Total value of N,P,K \$9,471.00
- Current Systems Utilisation \$3,876.00
- Lost nutrient value \$5,595.00