Redmond, S., 2019. Helping farms comply with environmental regulations: case studies in the Manawatu. In: *Nutrient loss mitigations for compliance in agriculture*. (Eds L.D. Currie and C.L. Christensen). http://flrc.massey.ac.nz/publications.html. Occasional Report No. 32. Fertilizer and Lime Research Centre, Massey University, Palmerston North, New Zealand. 6 pages.

HELPING FARMS COMPLY WITH ENVIRONMENTAL REGULATIONS: CASE STUDIES IN THE MANAWATU

Simon Redmond

Thinking outside the Square, RD5, Palmerston North
Email: s.redmond@maxnet.co.nz

Introduction

There is technology currently available that allows farmers to either, substantially reduce their leaching while holding their production level, or to hold their leaching and increase their production. Two case studies are presented. A high production farm and a once a day (OAD) minimal input farm. Both farms are profitable.

High Production Farm

Table 1 Physical Attributes of a High Production Farm

Attribute	High producing farm
Soil	Clay loams
N leaching past root zone	45
Area (ha)	89
Soil classification	II
Soil	Clay loams
N leaching past root zone	45
Area (ha)	89
Soil classification	II

The farm has flat fertile silt clay loam soils with a soil classification of II. Almost all of the land is imperfectly drained, it is wet late Winter and very dry in March. The farm winter milks, with a N leaching figure of 45 units N going past the root zone. Not being in a priority catchment, there is are no contraints on N leaching, the only constraints are the land's ability to hold cows in Winter and absorb effluent. Half of the farm has high risk soils for effluent infiltration and half has low risk soils.

Table 2 High production farm performance parameters

Farm Description	High producing farm
Number of cows	350
Milk production (kgMS)	175,000
Cow live weight(kg)	480
Production per cow (kgMS/Cow)	500
Total feed used (TDM)	1,960
Supplements used on farm (TDM)	845
Dry cow feed (TDM)	350
Pasture and N harvested (TDM)	1,115
Pasture and N harvestt (TDM/ha)	12.5
N used (kgN/ha)	200

The high production farm has both high per cow production at 500kgMS per cow which is just over 100% of cow liveweight, and high production per ha with 3.9 cows per ha. The farm produces 175,000kgMS to the factory (1966kgMS/ha). Total feed used is high at 1,960 Tonnes Drymatter, with 43% purchased off farm, (845 TDM). (Dry cow grazing is off farm and is identified separately.) The feed total demand was derived through energy balance equations and the grass harvest arrived at by subtracting purchased feed.
1960TDM- 845TDM = 1,115TDM or 12.5TDM/ha including the nitrogen grown grass. There is 200kg of N applied in applications of 40 units of N or less. To bring down the N loss figure to mid 20's, several mitigations need to be implemented.

Mitigation Strategies

Table 3 Summary of Mitigations

Mitigations	High producing farm
Feed Pad	Existing
Covered	Probably will consider
Time on Feed Pad	12 hours January to May
Production (kgMS)	Same, 175,000kgMS
Milking Cows on farm	Same, 350
Upgrade Effluent system	Not directly
Solids Separation	Yes and export solids
Map	Basic
Supplement changes	None
Other changes	No dry cows on farm

The key mitigation stragegy is to make sure the cows spend 12 hours on the feed pad from January to May each year. This changes the pattern of N leaching over summer, as the time spent on paddocks is minimised so the urine patches are distributed through the effluent in a diffuse manner. Importantly, cow numbers and production stays the same. Solids separation also needs to be implemented to allow effluent to be exported from the farm to gain the highest drop in N leaching. The nutrients exported will be captured in the maize blocks on the runoff. There is a saving in fertiliser to grow the maize silage. This advantage is not factored in and neither is the increase in organic matter on the maize paddocks. It is highly likely, that for cow comfort a shelter would need to be built, to provide

shade and minimise liquid effluent. While there are advantages from increased cow performance due to the cows being cooler and more comfortable, this has not been factored in. The soil types identified are favourable to effluent dispersal based on the Massey Pond Size Calculator so it is not proposed to more precisely map the farm soils.

Economics

Table 4 Farm Financials high performance farm

	High producing farm	
	Now	With Mitigation
Production (kgMS)	175,000	175,000
FWE (less wages and N)	$193,103	$193,103
Nitrogen cost	$33,600	$33,600
Supplement bought in	$235,995	$235,995
Dry cow grazing	$107,100	$107,100
Wages	$150,000	$150,000
Total FWE	$719,798	$763,548
Income at $6.50	$1,137,500	$1,137,500
Profit	$417,702	$373,952
Profit per ha	$4,693	$4,202
ROC	8%	6.8%

The high production farm is very profitable with efficient cost control of the farm working expenses and feed utilisation. Table 4 shows the costs summarised from the financial accounts. For mitigation, there is the capital recovery over 12 years of a Solids' Separator and some sort of shade structure. A capital allowance of $1500 per cow or $525,000 is allowed for, to build these. When there are no production gains, the profit reduces by the level of depreciation. This has the direct effect of lowering the return on capital.

Once A Day Farm (OAD)

Table 5 Physical attributes OAD farm

Attribute	Once a Day milking farm
Soil	Sands
N leaching past root zone	26 (16)*
Area (ha)	150
Soil classification	Mostly III & IV

The second farm this is a system 1/2 farm, milking all year around but once a day. It is on sand country with mostly class III and IV soils. Because of the soil classification, the leaching allocation is less. Depending on the soil map used the leaching number changes. The farmer has invested in a high quality soil map which, with better soil allocation has lowered, the leaching number. There are trees planted on some dry sand dunes.

The OAD farm has 250 cows, producing 332kgMS each or a total of 83,000kgMS. There is minimal N use and all the feed for replacements, dry cows and milkers comes off the block. Nitrogen use is minimal. Some nitrogen is applied in the spring and a second round in the autumn.

Table 6 Physical performance parameters

Farm Description	Once a day milking farm
Number of cows	250
Milk production (kgMS)	83,000
Cow live weight(kg)	450
Production per cow (kgMS/Cow)	332
Total feed used (TDM)	1100
Supplements imported (TDM)	0
Dry cow feed (TDM) - grazing on farm	250
Pasture and N harvested (TDM)	1350
Pasture and N harvested/h (TDM/ha)	9.0
N used (kgN/ha)	84

Because of the soil and land classification, there is less flexibility for the farm system to change. Even at low leaching, it does not meet the current One Plan Table. The farm solution is complicated by the proportion of high risk soils for effluent disposal, and their location, relative to the shed. However, it is possible to reach the required table and increase the productive capacity on the farm, by implementing the following mitigation strategies.

Mitigation Strategies

Table 7 Mitiagation Strategies OAD Farm

Mitigations	Once a Day milking farm
Feed Pad	Need to build a feed pad capable of holding all the animals over summer.
Covered Pad	Yes
Time on Feed Pad	10 hours January to May
Production (kgMS)	Lift to 140,000
Milking Cows on farm	350*
Upgrade Effluent system	Install pond and low rate application
Effluent Area	Increase effluent area and target low risk soils
Solids Separation	Weeping wall, distribute solids on targeted land types
Map	Specifically Mapped Changes leaching significantly from 26 to 16 units N
Supplement changes	Import 540TDM of maize / PKE
Other changes	Retire high risk soils with low production capability, class 6 and 7 plant in trees

The mitigation strategies are more complex because of the greater challenges facing the farm. However, it is possible to significantly lift production and cow numbers, and meet Horizons leaching constraints. There will be a capital spend of about $1,000,000, ($4,000 per cow), to make the changes. The higher capital spend compared to the higher production farm is because there is no existing infra structure in place, in the form of feedpads or shelter. The current effluent system is pumping from a sump. In practice, the farmer would find it more economic to milk 50 less cows (300) and achieve more per cow production. But for consent purposes, the farmer would apply for the higher cow numbers. Implicit in the mitigation are significant system changes and management changes of the farm.

Economics

In the current scenario the Once a Day farm is a tightly run ship, the farm working expenses per kgDM consumed are less than the high performance farm But the lower milk income is not to covered by the lower costs. Even though the capital cost is less per ha, the earning power is also substantially less which makes the Return on Capital lower. The challenge will be to make enough money to pay for the increase spend in mitigation.

Table 8 has a summary of the financials along with mitigation. The farm needs almost $M 1 to put the mitigation in place. Not an insignificant amount of money. Plus the farmer will need to upskill to make the system work. In the mitigation the capital is depreciated over 12 years.

Table 8 Farm Financials Once a Day farm

	Once a Day milking farm	
	Now	With Mitigation
Production (kgMS)	83,000	140,000
FWE (less wages and N)	$180,000	$180,000
Nitrogen cost	$5,800	$12,000
Supplement bought in	-	$278,388
Dry cow grazing	-	-
Wages	$85,000	$135,000
Total FWE	$270,800	$745,388
Income at $6.50	$539,500	$910,000
Profit	$268,700	$164,612
Profit per ha	$1,791	$1,097
ROC	6.0%	4.0%