

FARMER ENGAGEMENT IN FARMING WITHIN LIMITS

Leo Fietje¹ and Lyn Carmichael²

*¹Principal Planning Advisor, Environment Canterbury,
P.O. Box 345, Christchurch 8140, New Zealand*

*²Planner, Environment Canterbury,
P.O. Box 345, Christchurch 8140, New Zealand*

Introduction

The need for limits on loss of nutrients from the use of land has achieved considerable acceptance over recent years, but there are catchments for which capping losses at present levels may not be enough. This is envisaged in the National Policy Statement for Freshwater Management (NPS-FM 2014) which refers to both maintaining and improving water quality as a bottom line. The key pathways for reducing the impact of farming on water quality are the implementation of Industry-agreed Good Management Practices (GMPs), but what happens when this is not enough and we need to make further reductions? Is that feasible and if so at what cost?

There's no shortage of advice in the public arena, particularly around the benefits of reducing stocking rates and improving profitability for some farming sectors – but is it really that straight-forward?

To better understand this challenge, Environment Canterbury assembled two groups of farmers from separate planning zones that are each going through a process of establishing water quality outcomes and limits for their zones. Farmers were invited based on their reputation as respected and influential thought leaders covering the major farm types, along with industry representatives from DairyNZ, Beef + Lamb NZ, and Foundation for Arable Research. Meetings were generally held over dinner and lasted two to three hours, every four to six weeks. Each group established its own ground rules early on and while the groups never met as one, knowledge was exchanged between them

The results from both groups were presentations to the respective Zone Committees setting out the groups answers to the questions posed above and providing valuable information that will continue to be used in future decision-making. The work has highlighted the importance of considering all aspects when assessing mitigation options, including consequences of increasing the complexity of management, farming skill and resource required. Feedback from both Committees was very positive and both groups were recognised for their contributions.

Background

The Canterbury Water Management Strategy (CWMS, 2009) divides Canterbury into ten water management zones and empowers communities via their Zone Committees to have significant input into decisions made about the management of water within their respective zones. Three of these committees¹ are currently engaged in collaborative community processes to establish water quality and quantity limits that will inform plan changes to their respective sections of the Land and Water Regional Plan.

The key pathway for reducing the impact of farming on water quality is the implementation of Industry-agreed GMP. However, where it is uncertain whether water quality limits are likely to be met the collaborative processes will inevitably seek answers to questions around options and consequences for reducing impacts ‘beyond’ GMP.

Traditionally each industry sector, organisation or group would develop their own answers to these questions and argue why their conclusions should be preferred over those of others. This can become very negative and unhelpful for those seeking an honest understanding of options and consequences for reducing impacts beyond GMP. In a desire to better understand this challenge and actively seek a robust set of answers, lead farmers, industry representatives and farmer members of the respective Zone Committees were invited to establish reference groups within two of the zones (Waimakariri and Orari-Temuka-Opihi-Pareora) to investigate options and agree on consequences of further reductions in N loss from various farm types within their zones.

Methodology

The groups met over dinner every four to six weeks. While the Waimakariri reference group was established first, much of the modelling was completed concurrently, and the inputs and assumptions for the nutrient and financial budgets were reviewed and further refined by each group as the projects progressed.

The first meetings established the scope and key principles for the work undertaken, primarily:

- Focus on N loss;
- Only mitigations that can be quantified using OVERSEER®, either directly or via surrogates, would be considered;
- Full transparency and ability to have the information generated independently reviewed;
- Avoiding duplication and building on work previously carried out;
- Develop a consensus view;
- Use representative farm systems farming at GMP as a starting point; and
- Results must be robust and technically defensible

These are further discussed below.

¹ Waimakariri, Orari-Temuka-Opihi-Pareora (OTOP) and Hurunui-Waiiau Zone Committees

Focus on N loss

While other contaminants can also move through the soil profile, N in the form of nitrate moves very effectively with soil drainage and that is a major pathway for N loss over much of Canterbury, especially the lighter soils over alluvial gravels which have undergone considerable development in recent decades. Other studies looked closer at nutrients and other contaminants lost primarily through surface runoff.

Only consider mitigations that can be quantified using OVERSEER

OVERSEER is the tool of choice for managing nutrient outputs in the Canterbury Region and elsewhere and generates quantifiable estimates of nutrient loss, enabling the generation of defensible cost-benefit estimates. However, in adopting this principle it was acknowledged that there are other mitigations for which early science and anecdotal evidence is encouraging in terms of potential for N mitigation. These include the use of alternative pasture species such as plantain, chicory, short-rotation ryegrass and fescue as well as emerging technology such as the use of N inhibitors.

Transparency and Independent Review

Throughout the process participants were encouraged to have the information generated independently reviewed. In our view that was critical in establishing trust between members of both groups, particularly given much of the information was generated by the authors working for a regulatory body. Given that most of the mitigations related to dairying properties there was a close working relationship with DairyNZ staff, particularly Taisekwa Chikazhe who reviewed the OVERSEER files and financial data.

In parallel with the above, DairyNZ carried out several case studies on actual properties within each Zone to provide information on the costs of getting from current to Industry-agreed GMP; and going 10, 20 and 30% beyond GMP for those same properties. This information was invaluable in answering questions around the extent to which representative farms could be used to inform impacts on actual farm systems.

Avoiding Duplication

Various reports and modelling of potential mitigations for N loss have been undertaken in Canterbury for previously completed sub-regional plan processes. The groups considered these reports and used the representative farms generated in previous processes as a starting point for developing zone specific representative farms.

The groups also considered the work undertaken for the Pastoral 21 and Forages for Reduced Nitrate Leaching research programmes and presentations on this work were helpfully provided to the groups by DairyNZ staff.

Developing a consensus view

Virtual farms were developed and located within the catchments to best represent the mix of land use, management practices and farming environments within the two zones. The development of these virtual farms was critical to overcoming issues of confidentiality of information and for allowing full transparency of all the information used. However, the (confidential) case studies carried out by DairyNZ on actual farms were a necessary balance to ensure information generated was ground-truthed.

Developing consensus within the groups was important for both the process and the outcomes of the work completed. It was critical for consensus that all participants had full access to all the information generated through the process and could review the information used, including taking it away for review by their trusted advisors. The inputs for developing nutrient and financial budgets and representative farms were circulated both prior to and following the meetings. Meetings were an opportunity for discussion and debate – sometimes very robust – to ensure all views were tabled and evaluated and it is a credit to both groups that they could come to agreements and support the presentations of results to the respective Zone Committees.

Using Good Management Practice as a starting point

Given the focus on potential nutrient reductions ‘beyond’ GMP it was important to establish what this meant in modelling terms. Environment Canterbury had notified a Plan Change to the Land and Water Regional Plan to introduce the Industry-agreed GMP into its planning framework. This included a suite of OVERSEER modelling proxies which sought to translate the Industry-agreed GMPs into ‘modelling speak’. While essential to ensure meaningful analysis and comparison with other studies, it was nevertheless not without its challenges particularly given the Plan Change process occurred during the time the farmer groups were meeting and one of the matters that attracted significant attention was the appropriateness of the modelling proxies. At the time of writing some of these proxies have been appealed, including the two (fertiliser and irrigation) with most impact on N loss estimates.

This is where the work carried out by DairyNZ was an invaluable contribution, in that it demonstrated the range of costs incurred by the case study farms in achieving GMP.

Ensuring results are robust and technically defensible

Extensive technical work and catchment based modelling has been undertaken in each zone and representative data on soils, land use and climate was sourced from the technical reports. Farm production, performance and financial data was sourced from industry and government databases to ensure the representative farms were representative – necessary given it was clear that both groups performed at an above average level and needed reminding of that from time to time when carrying out analysis that applied to properties intended to represent both above and below average properties.

Both groups included local farm consultants among the farmer representatives and staff from industry organisations DairyNZ, Beef and Lamb and the Foundation for Arable Research. In each zone local consultants and DairyNZ reviewed the nutrient budgets to ensure they were technically sound and the input from these reviews was incorporated into the final budgets.

Process

The process began with a ‘brain dump’ of 14 possible mitigations, each of which was modelled in OVERSEER and results reviewed. Many of these were subsequently removed for reasons such as:

- The modelling and financial analyses was already being carried out elsewhere – e.g. cow genetics, Pastoral 21 and Forages for Reduced N Leaching Projects;
- The modelling surrogates were not feasible or gave erroneous results – e.g. increased riparian margins – is reduction due to reduced cow numbers to compensate for loss of land, or increased width of margin?
- The modelling showed only either very small reductions or even increases in N loss.
- Complexity and uncertainty – for example where a mitigation resulted in less area needed for the same level of production with lower total N loss it was recognised that unless the area formerly used was factored into the analysis, particularly the new land use, results would be misleading.

The remainder were analysed for change in profit associated with the mitigation which initially involved the preparation of full farm financial budgets. Following the preparation of the initial budgets it was apparent that analysis of marginal costs and benefits was adequate to understand the impact. This reduced both workload and debate around inputs not affected by the mitigation.

Results

Table 1 sets out the initial ‘brain dump’ of possible mitigations beyond GMP along with the results of the initial analysis.

Table 1 Results of Initial Analysis of Possible Mitigation Options Beyond GMP

Possible Mitigation	Result of Initial Analysis
Higher genetic merit animals	Medium to long term option, research promising but feedback from industry = that it is too early to be ‘bankable option’. Deleted.
Better feeding to improve condition score at calving	Requires low condition score cows to begin, not realistic. Deleted.
Replace grass silage with grain	Feasible option, but potential for health effects if introduced too quickly.
Replace grass silage with fodder beet	As above
Mop-up crop after winter feed	Only works on light land, good information available from trial work, no additional benefit in modelling. Deleted.
Reduce stock numbers	Key P21 outcome, considerable trial work at farmlet and whole-farm level so no additional benefit in modelling through this process. Deleted.
Winter cows on dairy platform using fodder beet	Needs whole-system evaluation including knowledge of what the land previously used for wintering will now be used for. Deleted
Spread effluent over larger area	No benefits in reduced N loss given N input unchanged. Possible benefit if there are issues with runoff and insufficient storage. Deleted.
Feed fodder beet for the last two months of milking	Modelling showed significant reductions available.
Substitute urea with slower release and ammonia ion fertilisers during shoulder periods	No change in modelled N loss. Deleted.
Restricted grazing to reduce urine deposition at high risk times	Modelling showed significant reductions available.
Increase riparian buffers	Only applicable to farms on heavy soils. Increase in riparian margin from one to five metres showed small reduction in estimated N loss but likely to show greater reductions for other contaminants separately analysed and greater still if margin followed land contour. Deleted.
Install wetland	As above re applicability and reductions in other contaminants. Deleted.

By establishing a starting point of all farming systems at GMP it was immediately apparent that there was limited ability for any significant reductions in N loss beyond GMP for systems other than dairy and dairy support. For dairy systems most of the N lost in leaching is from excess N excreted as urine patches. The mitigations that provided significant reductions in N loss beyond GMP worked in either of two ways: by reducing urinary N concentration; or reducing the number of urine patches deposited directly on the paddock.

Reducing the concentration of N in urine

In addition to the fodder beet and grain in Table 1 maize was also subsequently shown to reduce N loss when used as a supplement to replace grass silage. Importantly and somewhat surprisingly these three alternative supplements were shown to be extremely cost-effective when compared with grass silage, after taking account of factors such as:

- Moisture content;
- Cost of transport, storage and feeding out;
- Metabolizable energy (ME); and
- Feed wastage.

When all the above factors were considered the cost of lower-protein supplements ranged from 3.8 – 4.3 c/MJ of ME versus 5.4c/MJ of ME for grass silage. However, both groups raised issues with the use of alternative supplements that for some would preclude use despite the economic benefits. These included:

- Management complexity – compared with an all-grass and grass supplement system;
- Stock health – particularly transition from pasture to fodder beet and grain, long term effect of lower protein feds on overall body condition and effects of soil ingestion when feeding fodder beet;
- Crop reliability especially with possibility of late frosts;
- Effect of fodder beet on soil structure;

There was robust debate around the significance of these issues and level of management needed to overcome them hence they were simply listed as intangibles with no attempt made to evaluate or cost out. One of the main management challenges with low-protein feeds is found in the management of the transition from grass – there were several reports of cow deaths during this period, especially using fodder beet and to a lesser extent grain.

Integration into the farm system is also a challenge that was not fully explored. Fodder beet is not available for the entire milking period unless stored and when stored loses quality due to loss of leaf. Further if the quantity of low-protein supplements fed out exceed the quantity of grass silage fed out in the underlying base model, issues of pasture management and potential for perverse consequences such as the need for stocking rates to increase to maintain pasture quality need to be factored in.

Reducing the number of urine patches deposited directly on the paddock

Restricted grazing was modelled by incorporating a feed or standoff pad used for three hours, twice a day in the shoulder months. Cost of building the infrastructure is significant but can be halved if the herd is split in two shifts and the pad is used for 12 hours per day rather than six. At ~ \$1,000 per cow place including approaches and tracking, with 3% for maintenance, 7% interest and 8% depreciation, cost per cow is \$150/annum or half that if each cow place is used by two cows.

Reduction in estimated N loss

Table 2 shows the reduction in estimated N loss from the two mitigations options further analysed:

Table 2 Reduction in N loss from use of low protein supplements and restricted grazing

	Light Soils % reduction from base model	Heavy Soils % reduction from base model
Replace grass silage with grain	5	0
Replace grass silage with fodder beet	12	12
Replace grass silage with maize silage	5	0
Use fodder beet for last two months of milking	7	14
Restricted grazing in shoulder months	11	12

Other Results

During the process several other options were discussed and analysed to various degrees. These included early cessation of autumn irrigation and late-season applications of N fertiliser; heavy culling in April and rotating maize and short-rotation ryegrass through pasture blocks on the dairy platform. Some of these show promise that merits further investigation and analysis.

Conclusions

While the absence of ‘silver bullet’ solutions may be disappointing for those hoping there are multiple readily-available and affordable options for reducing N loss beyond GMP, the work described above shows this is not the case. Even the two groups of mitigations that emerged from the process are not without their challenges. Restricted grazing through the use of pads introduces a level of management complexity and cost; and similarly the use of alternative supplements introduces further management complexity with potential effects on animal health and other impacts including long-term impacts on soil structure and animal health. Understanding the ‘unintended consequences’ of options is invaluable and made possible only through the generosity of the two farmer reference groups – generous with their time and with their willingness to impart their knowledge and engage in debate.

The results and conclusions from these studies were presented to the respective zone committees, where they were well received and have informed decision making. The zone committees acknowledged and appreciated that the information was tested through the generous efforts of the leading farmers involved and the input from industry bodies, to ensure the results are credible and defensible.

References

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