Understanding the economic impacts of nutrient limits on Waituna farms and catchment

Background
To assess the impact of nutrient allocation limits being set in the Waituna Catchment in Southland, a comprehensive economic modelling study was undertaken. This study evaluated the options available to reduce farm nutrient losses and assessed what the impacts of different nutrient reduction targets would be on individual farms and the wider catchment. These findings allow the economic and social values of the catchment to be taken into consideration together with other technical information as part of any decision making process. This work aims to contribute towards finding a long-term solution for the Waituna Lagoon in which sustainable farming and a thriving community can be ensured alongside a healthy catchment and lagoon ecosystem.

Key findings

Impacts on individual farms:
1. On-farm strategies required to reduce N are very different than for P (Fig. 1, Table 1). Uncertainty around which nutrient should be targeted represents a significant business risk to individual farmers.

2. The response of individual farms to different nutrient reduction scenarios is highly variable due to differences in system type, existing leaching rates, soil type, stage of development and farmer practices and philosophy (Fig. 2).

3. A limit setting approach which ‘grandparents’ existing nutrient loss rates but requires a uniform percentage reduction leaching across all farms irrespective of system or farm type would heavily penalise low intensity farms.

4. Nutrient reduction scenarios of less than 10% for N and 5% for P have relatively small (within 5%) impacts on farm operating profit.

Nitrogen
5. For N reduction, impacts on operating profit are greatest for low intensity farms due to the limited options available to further mitigate N without moving to capital investment (e.g. stand-off pads). High intensity farms have higher N losses and in turn more options available to reduce N leaching.

Phosphorus
6. Reducing P losses is challenging with limited options available for the dominant soil types in the catchment. P reductions greater than 5% will have significant impacts on farm operating profit for most system types. Reductions beyond 15-25% could not be modelled as most farms were no longer viable.

Land Use
7. The profitability of support blocks is heavily dependent on winter grazing. Mitigation strategies aimed at winter grazing will therefore have significant financial risks for these businesses.

8. Wintering cows outside of the catchment will significantly reduce nutrient leaching but is not considered a long-term sustainable solution by Waituna farmers.
Debt Levels

9. Farms with a higher debt, for example farms recently purchased or developed, will be more severely impacted by reductions in farm OP.

10. Higher debt makes farm businesses less resilient to shocks such as low milk prices or adverse weather.

11. Short-term reductions in profit due to mitigation action may also affect the ability of farmers to afford new mitigation options through investment in technology or infrastructure.

12. The cost of mitigation is slightly exacerbated by temporarily lower milk prices but the greatest effect is the longer time period needed to recover, because mitigation has reduced the ability to take advantage of the higher payout years.

Impacts on the catchment:

13. Current operating profit (before drawings, debt servicing and taxes) for all Waituna catchment farms is estimated to be 25 million dollars annually (range 20-29 million dollars) (Table 2).

14. Nutrient reductions greater than 15% for N and 5% for P start to demonstrate significant impacts on operating profit at the farm and catchment scale.

15. N reduction scenarios of -25%, -35% and -50% are estimated to lead to reductions in catchment operating profit of 3, 8 and 12 million dollars, respectively, per annum (Table 2).

16. The greatest impacts are observed for Dairy Support and Sheep & Beef farms, with scenarios targeting >25% N reduction leading to businesses no longer being viable (100% reduction in operating profit).

17. Actual impacts at the farm and catchment scale are much greater once debt levels are taken into consideration.

Table 1: Summary of on-farm mitigation strategies required to reduce nitrogen and phosphorus losses by less than 10%, 10 to 20% and more than 20%. Strategies in green are considered practical with little change on existing farm operation, strategies in orange will impact farm operation but can be undertaken if necessary, and strategies in red will have significant impacts on existing farm operations. The best combination of measures within each category is highly farm-specific.
Table 2: Results of four nitrogen reduction scenarios on catchment-wide annual operating profit (OP, in million dollars per year) for Dairy, Dairy Support, Sheep & Beef and all farms in the Waituna catchment. OP reflects farm profit before debt servicing, taxes and principal repayments or drawings beyond estimated market wages, and should not be interpreted as actual profit. Sensitivity of dairy clustering technique represents the economic baseline and impact as a range based on different clustering approaches to extrapolate the model farms to all dairy farms in the catchment. * represents farms are no longer viable for this scenario (100% reduction in operating profit). The end reduction scenarios modelled represent hypothetical examples as the limit setting process in this catchment has not yet commenced.

<table>
<thead>
<tr>
<th>Farm type</th>
<th>Base OP (mil$/yr)</th>
<th>N-10%</th>
<th>N-25%</th>
<th>N-35%</th>
<th>N-50%</th>
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<tbody>
<tr>
<td>Dairy</td>
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<td>-3%</td>
<td>-9%</td>
<td>-18%</td>
<td>-34%</td>
</tr>
<tr>
<td>Dairy Support</td>
<td>$2.7</td>
<td>-3%</td>
<td>-46%</td>
<td>-98%</td>
<td>*</td>
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<tr>
<td>Sheep &amp; Beef</td>
<td>$2.1</td>
<td>-5%</td>
<td>-9%</td>
<td>*</td>
<td>*</td>
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<tr>
<td>All farms</td>
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<td>-3%</td>
<td>-13%</td>
<td>-34%</td>
<td>-46%</td>
</tr>
<tr>
<td>Sensitivity of dairy clustering technique</td>
<td>$20.3 to $29.4</td>
<td>-3 to -5%</td>
<td>-8 to -14%</td>
<td>-8 to -26%</td>
<td>-34 to -49%</td>
</tr>
</tbody>
</table>

Fig. 1: Model results of the impact of 11 different nitrogen (green) and phosphorus (blue) mitigation scenarios (horizontal scale) on annual farm operating profit (vertical scale) for one representative Waituna dairy farm. Changes are expressed as a percent difference from the base situation. These results show that most mitigation strategies applied have a different impact on N loss than P loss. For example Scenario 6 achieved a 40% reduction in N loss but only a 10% reduction in P loss, which resulting in an overall 45% reduction in farm OP. Scenario 9 represents once a day milking and Scenarios 6, 7 and 8 covered wintering structures.
Fig. 2: Model results of the impact of a range of nitrogen reduction scenarios (0 to -50%) on annual farm operating profit for six representative Waituna dairy farms. Changes are expressed as a percent difference from the base situation. For example for Farm Dairy 3 (green line), a 40% reduction in farm N leached (horizontal scale) results in a 40% reduction in annual farm operating profit (vertical scale).

How was this study done?

A case study approach was chosen to quantify the effect of nutrient loss reductions on farm system and profitability for ten representative Waituna Farms. Model farms were selected based on a clustering approach which recognised groups of farms that were broadly similar, taking into consideration land use, soil type, location in the catchment, intensity of system and farm performance levels. The final farms examined in detail were 6 dairy, 2 dairy support and 2 sheep and beef farms. The modelling tools used were FARMAX Dairy Pro® and Overseer 6.1.2® using the 2012-13 year as the basis.

On-farm visits were undertaken to understand the farmers’ goals and objectives, farm system preferences, preferred options for strategies to mitigate nutrient losses and to collect model input data. Four nitrogen (N) and phosphorous (P) reduction scenarios were modelled for each farm; -10%, -20%, -35% and -50% reduction from the existing situation. The overall modelling approach as the mitigation strategies selected for each scenario was peer reviewed through a technical workshop and farmer reference group.

The economic impacts on farm operation were examined based on farm operating profit. Operating profit reflects farm profit before debt servicing, taxes and principal repayments or drawings beyond estimated market wages. Operating profit should not be interpreted as actual profit, but is similar to earnings before interest and tax (EBIT).

The impacts of the four load reduction scenarios on the entire catchment were estimated by extrapolating the model farm results to all catchment farms based on clustering of similar groups, existing N and P losses and farm area. A parallel study examined the potential impact of load reduction targets on the wider socio-economic values of the catchment.

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