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Ministry for the Environment
Wellington

To Mary McCulloch

Re: Review of "Impact of possible environmental policy interventions on case study farms" by Macfarlane Rural Business Ltd, 31st May 2019

I have read through the above report by MRB and the associated appendices provided by MfE that describe a farm-scale modelling analysis of the potential impact proposed MfE policies could have on 4 different case-study farms. I have not seen the detailed modelling analyses conducted by MRB so this review is only of the material provided in the final report and appendices.

Overall the modelling analysis describes a combined analysis that used (a) Overseer to assess the N and P losses from the case-study farms, (b) Farmax to assess the feasibility of the created farm systems and finances and (c) an unknown MRB spreadsheet for other analyses. The farm systems chosen for the 4 different case-study farms are quite complex, involving multiple crops rotating around predominantly pasture based farm systems. However, these systems are based on the local knowledge of MRB clients that are likely to be using these systems and I assume that these systems have been modelled appropriately. It is important to note that there are a number of strategies that could be used on farms to meet the proposed policies that may have generated different results.

The modelled scenarios appear to have been focused on managing N losses from the farm systems with any changes in P losses being a co-benefit of the changes. N losses are typically driven by changes to the farm system so it is appropriate to model N losses using the Overseer/Farmax approach. However, P losses are often more critical source area based and it appears that many of these options have not be investigated (for more detail see: https://www.mfe.govt.nz/sites/default/files/assessment-strategies-mitigate-impact-loss-contaminants-agricultural-land-freshwater_0.pdf). For example, two major sources of P loss are from P fertilizer type and from soil erosion which is itself dependant on the Olsen-P levels in the soils. The MRB report does not provide any information on the Olsen-P levels on the case-study farms or if any changes to the P fertilizer type were investigated. I believe that more mitigation options were available (see link above) but were not modelled in this analyse. Some of these mitigation options could have been modelled in Overseer and others would have required additional adjustments to the Overseer outputs.

The report does highlight the significant importance that the level of debt used in the modelling analyses has on estimates of changes to profitability. I note that in paragraph 1.9 that all 4 case-study farms have debt repayment periods that are beyond 30 years for the Status Quo indicating that current agricultural practices are not financially sustainable by this metric. For this analysis MRB have used typical levels of debt for each case-study farm and it is important to note that the level of debt is different for each farm type. This comment is probably beyond the scope of this particular project for MfE but, I can see that the level of debt on a farm will be an impediment or barrier to change practise on that farm, but debt should not be a factor in setting environmental targets. I wonder if future

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economic analyses could be conducted both with and without farm debt to understand this financial impact?

In section 6.1.1 the report makes an important point about the N losses from individual blocks verses the whole farm average losses. They note that one of the blocks in this Red Meat/Hill Country farm had an eye watering N loss of 146 kg/ha but the whole farm average was still below the 60 kg/ha target. Defining the boundaries for any environmental policy will be important.

I note that the modelling of each case-study farm was conducted by different personal in MRB and as a result the information provided for each farm is not consistent. For example, the dairy farm provides information on the soil types on the farm, but this information is not provided for the 3 other farm types.

Comments on Scenario 2 - Stock Exclusion:

I really struggled to get my head around how Scenario 2: Stock Exclusion has been modelled in the report. The fencing costs are simply a factor of the length of the streams on the farm, multiplied by the cost of the fencing (per km), multiplied by the number of sides of the stream that require fencing (dependant on existing fences or farm boundaries). This information has not been directly provided in the report which prevents simply comparison of the results between farms and extrapolation of these case-study results to other farms. Furthermore, the analysis has included an estimate of the "lost land value" of the stream fencing mitigation. These costs are based on a number of assumptions that have not been recorded in section 10 - Limitations. Firstly, is the assumption that all land produces equal forage production. Secondly, that the farm is currently maximising the profit from the current production levels. Thirdly, that the fenced off area can have no further value to the farm.

Red Meat/Hill Country farm. Section 7.1.1 states that the setbacks in the upper reaches are up to 375 m and average 22.7 m which is considerably greater than the 5 m setback stated in paragraph 10.8 and will have a major impact on the "lost land value" calculations for this farm. I have assumed from the data provided (30,492 m of fencing) that the length of streams on this farm is 15 km. A setback of 5 m on this stream length would be 15 ha which is considerably less than the 53 ha assumed in the MRB analysis. I have seen fencing in very steep county that has not required a bulldozer to install the fence, and I am unsure of the implications of a bulldozer on the cost estimates used for this farm. The cost estimate used for this analysis on this farm seem to be very high. The Wetland re-vegetation cost ($412,592 / 5.26ha) is almost $80,000 per ha with no description of what this money was to be used for. This wetland cost seems extremely high even compared to NIWA estimates for constructed wetlands. The MRB fencing and fence line clearing costs ($650,025 / 30,492 m) is approximately $21/m which is at the upper end of the estimates in the MPI report $12.06 to $24.88 / m available from https://www.mpi.govt.nz/dmsdocument/16537/direct. The MBR water reticulation costs ($283,484 / 545 ha) is $520/ha which is significantly higher than the Canterbury estimates of $126/ha and $134/ha estimated in the MPI report (Table 5) available from https://www.mpi.govt.nz/growing-and-harvesting/land-care-and-farm-management/stock-water-reticulation/. The combined costs of these appear to provide a significant over estimation of the costs for this scenario. Section 7.1.3 makes the statement that "it is not economically viable to fence off all waterways and wetlands on hill country properties" but this appears to be a judgment call based on very high cost estimates and a specific farm

system scenario. There may be other farm system approaches and farm layout changes than could keep animals out of streams and still provide an economic return from the land that have not been modelled. Section 7.1.3.1 shows a breakdown in costs of "high and low" stocking intensities but makes no comment or suggestion of the relative environmental benefits of only fencing at higher stocking intensities.

Dairy. The MRB fencing costs ($58,957 / 10,206 m) is approximately $5.80 /m which is in the range of the MPI estimates of $2.91 to $10.58 / m for flat to rolling landscapes.

Dairy Support. The MRB fencing costs at $6.50 and $7.00 / m are in the range of the MPI estimates of $9.90 to $16.36 / m for flat land. Note – the additional costs required for a centre pivot to go over these fences in the MRB analysis is appropriate and would not have been considered in the MPI report.

Arable Mixed Cropping. This scenario doesn't appear to provide the actual data on the length of fencing, so I will assume this was 14,400 m based on the estimate of 7.2 ha and a 5 m buffer width. Therefore, the MRB fencing costs ($124,720 / 14,400 m) is approximately $8.66 / m in the rage of the estimates from MPI.

Drainage Density. A good metric to compare the relative length of streams on a property is to calculate the drainage density which is the length of the stream divided by the area of the property. I have summarised this data in the table below.

Case-study farm	**Area of Farm (ha)**	**Length of Stream (m)**	**Drainage Density (km/km^2)**
Red Meat/Hill Country	545	15,246	2.8
Dairy	318	5103	1.6
Dairy Support	475	5390	1.1
Arable	348	7200 (assumed)	2.1

These drainage density values are actually quite low but may be appropriate for a Canterbury landscape. Usually the drainage density will increase with land slope, so it is good to see the Hill country farm with the highest drainage density. Higher drainage density will lead to higher relative fencing costs on a property. Reporting this metric would help with comparisons between different farms.

Other comments:

In section 5.1.1.2 I could not get the areas of land for sprinkler irrigation or centre pivot irrigation block to add up correctly. These figures need to be checked to see if the crop areas and total block areas have been modelled correctly in Overseer and Farmax.

In section 5.2.1.2 I could not get the soils areas to match the farm areas. Total area of the 3 soil types add up to 291 ha which does not match either the title or effective area of the farm. These figures need to be checked to see if the crop areas and total block areas have been modelled correctly in Overseer and Farmax.

In section 8.6.3.3 and in Table 48 the P loss values are quoted as kg P / ha but those numbers are not physically possible. The accuracy of these loss rates in tables 47 & 48 need to be checked.
Also, in section 8.6.3.3 the final paragraph suggests an approach to mitigating P losses from a laneway, but I am not sure that it is a feasible solution for this modelling approach. The Overseer model assumes that a proportion of all laneway runoff is discharged directly to the stream, but this proportion is fixed in the model and cannot be adjusted to represent the approach suggested in the MRB report.

Regards

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