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Peer review of ‘Essential Freshwater Package: Cost Analysis’, draft report 8 April 2020

Overall assessment

- This draft report is fit for purpose as a technical note providing cost estimates to feed into separate CGE modelling and CBA exercises.
- Given the likely time (and budget) constraints and data limitations, the analysis appears credible and logical. Many of our comments could have been addressed with the luxury of time.
- The technical aspects of the modelling appear robust, given the assumptions employed. These assumptions are generally clearly documented.
- The main exception is the set of rules employed around how reduction targets are met.
 - It is not clear to us the difference between land use change being lower cost and land use change being more effective – the second and third components of the mitigation rule.
 - The ‘Other’ bucket of mitigation-related costs also warrants additional explanation. We understand it to be a ‘residual’ between the reduction target and the modelled reductions from mitigation measures plus land use change. We wonder how it is that land use change cannot deliver the targeted reductions and it’s not obvious to us that an average cost of reducing discharges is the right choice for valuing this residual.
- The interpretation of the results would be materially aided with an additional section at the start that explains the analytical framework that sits beneath the modelling more clearly. A brief discussion of the baseline assumptions (e.g. around future growth, or rather its absence) would also be helpful here.
- This section could also provide a qualitative indication of what the model might be expected to show if it is performing as hoped.
- While we appreciate this report is primarily designed to provide cost inputs to the CGE analysis and broader CBA, a little more discussion of the results (especially the ones that look – but are probably not – unusual) would give the reader confidence that the model is behaving as expected.



- We have provided a tracked changes version of the draft report containing minor edits and presentational suggestions.
- We shape the rest of this review around the questions we were asked to consider. We note that a formal model review/audit was out of scope, but would be a good idea if feasible including because it would help to clarify, for a reviewer, exactly how the targeted reductions are being met and the logic behind it and reasonableness of the results.

Are the assumptions clearly documented, technically sound and defensible? Is uncertainty addressed sufficiently?

1. In general, the modelling assumptions are clearly stated, and data sources are referenced.
2. Some of the implications of the assumptions could have been teased out further. For example, is the assumption that “mitigation can occur on any tract of land in the catchment” a material one? What does that imply for the distribution on costs (and benefits)?
3. The effectiveness assumptions would benefit from a clearer definition. What are the % relative to? At present, the report relies on readers knowing the referenced literature in some detail.
4. This would help the interpretation of Tables 5 and 6, which appear to show a sharp decrease in effectiveness per unit of cost for dairy (i.e. diminishing marginal returns from mitigation, which is sensible), but not so for sheep and beef.
5. The document would benefit from a separate section on the baseline against which the costs are compared. If the discharge reductions are compared against a 2013-2017 base from CLUES, then presumably the adjustment costs are too. This implies zero output growth in the baseline. This may be an assumption made for the sake of simplicity, but some discussion of its implications would be useful.
6. The technological change assumptions of 1% and 1.75% appear reasonable but would have been better if supported by historical data and clarifying that these gains are over and above what would otherwise have happened.
7. Any region-specific assumptions about land use change opportunities would be better stated and justified up front. For example, the reader doesn't find out that there is a restriction on changes from dairy to forestry in Canterbury until the 'Summary' section. Presumably this causes the very large "Other costs" for Canterbury. What is this telling us?
8. Uncertainty is addressed appropriately using sensitivity analysis around key parameters. The use of a zero discount rate is somewhat extreme, although we appreciate the conceptual point being made. We note the benefits report by the same author we briefly read uses a 1% discount rate for this purpose, which is inconsistent.¹

Are there any significant gaps in the analysis or areas where further analysis is required to confirm the results?

9. Without a 'set up' section at the front, it is difficult to know whether any significant gaps exist. The interpretation of the results would be aided with an additional section at the start that

¹ The section on discount rates is also disproportionately long in the content of a fairly short report. It could be summarised in a table or appended.



explains the analytical framework that sits beneath the modelling more clearly. A brief discussion of the baseline assumptions (e.g. around future growth, or rather its absence) would also be helpful here.

10. In terms of understanding what this report sets out to achieve, and how it will be used in the CGE modelling in particular, it would be helpful to explicitly explain how these results will be translated into modelling inputs elsewhere. That is, how will the costs be shaped into exogenous 'shocks' for the CGE modelling – productivity decreases, industry output changes, etc.?
11. Some comparison of the modelled costs to other similar exercises carried out in New Zealand or overseas on environmental issues would add confidence that the results are reasonable. Clearly the results will be specific to the EFW policy design and New Zealand's freshwater and economic characteristics, but some indication that the results are in the ballpark relative to other similar research would give the reader confidence that all is in order.
12. The targets would be clearer if shown as % changes from the NPS2017. It would also be helpful to explain why ostensibly identical targets in Table 3 differ from those in Table 2 (e.g. P Peri10 appears in the column of both tables but the targeted amounts differ in the two tables). Are these differences material, in terms of targets or purely the result of updated monitoring data, for example?
13. The discussion of mitigation measures and costs ought to include some discussion of the connection between mitigation measures and the targets being modelled. It is not clear that there is a simple relationship. One imagines that there is a rather uncertain and variable relationship between mitigation measures and nutrient loadings and periphyton spatial exceedance probabilities. Assuming this is true, can anything be said about whether this variance is likely to bias the cost estimates – either up or down? The use of simplified relationships and a lot of averaging seems appropriate in this context, but it would be helpful to discuss the extent to which these simplifications are influencing the cost estimates.
14. Similarly, we wonder if the use of averages and weighted averages, to estimate cost-effectiveness of mitigation measures, could bias estimates of mitigation costs. Some light could be shed on this by explaining the nature of the averages that have been gathered from Daigneault et al (2016) and whether these are arithmetic averages over a particular unit of account (a farm, a catchment, a study or some other unit) or weighted averages and if so, what they are weighted by?

Have any large costs been missed and have the reasons been clearly documented?

15. The reason for omitting implementation costs and costs associated with land use change is clearly stated. Its implication could be more boldly described – this "will" underestimate land use change costs, rather than "may".
16. There is no mention of any additional administrative costs for regional councils between NPS2017 and EFW. These are likely small in the grand scheme of things, but this could have been noted.

Have any sectors and stakeholders not been considered and have the reasons been clearly documented?



17. There is no mention of Māori interests. This may well have been out of scope for the modelling exercise here and may be explored in the broader CBA instead, but given the commentary in section 1.2.1 regarding poor engagement with iwi/hapū, a brief discussion of the potential implications of the modelling for Māori landowners would have been helpful.
18. More broadly, there is no discussion of the distributional impacts of the costs, presumably due to the assumption of equal profitability per hectare of each land use type within each region. Again, this may have been out of scope and using averages is a reasonable approach under time and data constraints, but a brief comment recognising that the impacts will not be felt evenly by all landowners would have been useful.

Have the mitigation costs been incorporated in a reasonable way?

19. It is difficult to state with certainty – based on the report alone – that the mitigation costs have been incorporated in a reasonable way. There's no obvious indication that there are any problems, but the description of the abatement choice 'rules' assumed is overly brief, given its importance for the results.
20. The report would be significantly enhanced with a clearer explanation of these rules, perhaps in the form of an "If...then..." type logic, along with a couple of examples to demonstrate how the rule works in practice.
21. It is not clear to us the difference between land use change being lower cost and land use being more effective. Isn't effectiveness also a measure of the environmental benefits gained per dollar of mitigation?
22. The 'Other' bucket of costs also warrants additional explanation. We understand it to be a 'residual' between the model abatement from mitigation plus land use change and the target. It's not obvious to us that an average cost of reducing discharges is the right choice for valuing this residual. If abatement can't occur through mitigation technologies and/or land use change opportunities in the model, wouldn't additional mitigation likely be more costly? If this is not the case, a short discussion to the contrary would elucidate.
23. If both P and N contribute to periphyton exceedance, how does the model deal with the interaction between P and N discharge and determine objectives/targets for each separately?

Are the conclusions reasonable and consistent with the analysis undertaken?

24. This is difficult to answer. The report is largely a technical one, rather than a piece of policy advice with 'so what?' conclusions and implications.
25. That is not a criticism, since the aim of the analysis is clearly to provide inputs into subsequent CGE and CBA exercises that will be better vehicles for exploring what it all means for the New Zealand economy and society.
26. The question of reasonableness is again hard to judge. As flagged above, without an upfront section explaining conceptually how EFW might be expected to affect costs in the land-based sector, there's no way of assessing whether the model is performing sensibly.
27. Presenting the results as % changes would help the reader assess their relative magnitude, as would a discussion of how much of the cost in key regions is due to the overall size of the



regional economy, the structure of the primary sector, and any region-specific assumptions, etc. Levels results hide these nuances.

28. That all said, we have no reason to doubt the results (rather than conclusions) are consistent with the analysis undertaken.