Science Snapshot Report

Summary of water quality models in the Kaituna and Rangitāiki Catchments

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BAY OF PLENTY REGIONAL COUNCIL TOI MOANA

About the reports

A series of four reports have been prepared as part of our work to improve water quality in the Bay of Plenty and the implementation of the National Policy Statement for Freshwater Management (NPS-FM) 2020. This is a summary of the modelling report for the Kaituna and Rangitāiki Water Management Areas.

This summary explains the how the modelling worked and some key results, but we encourage those who are interested to dive deeper into the full technical reports on the website. These models will add to a wide range of other information in the Rangitāiki and Kaituna Water Management Areas.

About the models

Catchment models have been built for the Rangitāiki and Kaituna Water Management Areas to help understand how changes we make on the land could affect the health of our rivers, estuaries and lakes.

The model estimates in-stream nitrogen, phosphorus, *E. coli* bacteria and suspended solids concentrations and loads across different scenarios.

Four different land use scenarios were modelled to help understand how nutrient, sediment and bacteria levels might change as land use changes.

1. The natural state – the water quality that would have existed under natural vegetation.
2. Current state – what the water quality conditions are now, based on current land cover and land use practices.
3. Potential future scenario (Scenario C) all other current scenario conditions are the same except:
    - land use change to wetlands in the lowlands
    - increased kiwifruit on land suitable for growing
    - increased mānuka and plantation forest on steeper uplands.
4. Potential future scenario (Scenario D) all other current scenario conditions are the same except:
    - land use change to wetlands in lowland areas (although around 50% less than Scenario C)
    - increased dairy on land suitable for farming
    - increased mānuka and plantation forest on steeper uplands.

These land use scenarios were tested against **two different mitigation scenarios.**

1. No additional mitigation (current practice)
2. Complete uptake of 'good practice' across all land uses (called the M1 bundle).

About the tables in the reports

The table below illustrates how this information is displayed in the reports. In this example, the nitrogen load in the Maketū and Waihi estuary is compared across the four land use scenarios, with the 'no mitigation' and the 'M1 mitigation' scenarios sitting side by side.

For scenarios C and D, figures are shown as the percentage change from the current land-use scenario.

The target figures are interim estimates provided by Regional Council Scientists and they provide some indication of what may be required to restore the estuaries to a moderately healthy ecological state.

			Total load to Maketū estuary		Total load to Waihī estuary	
			No mitigation	M1 mitigation	No mitigation	M1 mitigation
Total Nitrogen	Land use	Natural	139 t/yr	N/A	101 t/yr	N/A
		Current	479 t/yr	-8%	556 t/yr	-10%
		Scenario C	-34%	-37%	-49%	-52%
		Scenario D	-15%	-21%	-37%	-43%
		Target	179 t/yr (- 63%)		212 t/yr (- 62%)	

Note: Climate change has not been incorporated in any model runs to date. Initial modelling is still in the early stages and we are refining the tools and techniques. The forecast impacts of climate change will be incorporated into future scenario modelling.

Kaituna results - Ngā hua mō te Rohe Whakahaere Wai o Kaituna

Modelling in the Kaituna showed several key points:

- None of the scenarios or mitigations modelled meet interim targets for Waihī or Maketū estuaries.
- Scenario M1C shows the greatest reduction in total nitrogen, total phosphorus and *E. coli.* This indicates that the land use change and mitigations applied under M1C provide the greatest environmental benefit of the scenarios modelled (excluding natural state). These reductions are largely a result of the decrease in dairy, sheep and beef land uses, and an increase in kiwifruit, wetland and plantation forestry under this scenario.
- However, scenarios C and D both result in increases in total suspended solids in the estuaries. Interim targets require reductions across all the contaminants, so a different combination of land use or mitigations would be required to ensure environmental benefits.
- The land uses that contribute the greatest load of total nitrogen and total phosphorus are dairy (55% and 66% for nitrogen and phosphorus respectively), sheep and beef (13% and 12%), and kiwifruit and orchards (10% and 12%). Fifty percent of the *E. coli* load comes from dairy.

Rangitāiki results - Ngā hua mō te Rohe Whakahaere Wai o Rangitāiki

Modelling in the Rangitāiki showed several key points:

- Scenarios C and D both show increases in total nitrogen and total phosphorus in Lakes Matahina and Aniwaniwa, however there is a reduction in total suspended solids. These changes are largely a result of the decrease in plantation forest (resulting in reduced total suspended solids load) and an increase in dairy and kiwifruit land uses (resulting in increased total nitrogen and phosphorus).
- The only scenario that reduced the nitrogen and phosphorus concentrations in Lake Matahina to a level close to the interim targets is the M1 Current scenario
- The land uses that contribute the greatest load of total nitrogen and total phosphorus are dairy (37% and 41% for nitrogen and phosphorus respectively), plantation forest (29% and 23%), sheep and beef (19% and 12%), and native forest (12% and 20%). Forty five percent of the *E. coli* load comes from native forest, 39% from plantation forest and 10% from dairy.

Conclusions

- As expected, contaminants are substantially higher for the current state than the modelled natural state.
- For the Kaituna, none of the land use or mitigation scenarios modelled met interim estuary targets. More effective mitigations or different land use changes would be required to meet these interim targets.
- For the Rangitāiki, interim phosphorus concentration targets are already being met in Lake Matahina. Mitigations in the M1 bundle are almost sufficient to meet the interim total nitrogen concentration target. However, these interim targets may not be low enough to meet community or iwi aspirations for the waterways.
- In both the Kaituna and Rangitāiki, mitigation (the M1 scenario) only made a relatively small impact on contaminant levels. Land use change had a much greater impact than mitigations alone. Where a large reduction in the contaminant reduction is required to meet targets, substantial change will be needed through land use change or much more effective mitigations.
- In both the Kaituna and Rangitāiki, dairy contributes the greatest amount of total nitrogen and phosphorus, and plantation forestry resulted in higher total suspended solids.
- Dairy was the largest contributor of *E. coli* in the Kaituna models.
- Native forest was the largest contributor of *E. coli* in the Rangitāiki models because of the steeper slope (where water running off the land on these steeper slopes means more *E. coli* is transported to streams), land area (bigger area generates more mass), and the assumptions of natural *E. coli* contamination in the model. However, the model didn't perform as expected for *E. coli* and these results should be used conservatively. This has been noted for future development of the model.

For more information

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