

SUMMARY OF EVIDENCE OF TIMOTHY MICHAEL BAKER

- 1 My evidence assesses the robustness of the assessments of effects made by the Applicants' and s42A Report writers, based upon the regional scale model developed by WWLA.

The Model

- 2 The revised model (Aupōuri Aquifer Groundwater Model) has been used to assess the impacts on surface flows at a regional scale and predicts an overall reduction of 4.3% in annual minimum flows. However, the assessment does not apportion the reduction to specific waterbodies, nor does it account for the likely spatial variability in the predicted reduction.
- 3 Understanding the degree of connection between the deep and shallow aquifer, and the uncertainty around the spatial changes in this connection, is important when assessing the potential effects on surface waterbodies.
- 4 My evidence shows that drawdown is not uniform across the model domain. Drawdown is focussed near areas with more groundwater takes, and areas where more drains/streams are represented in the model. The area with the most drawdown (0.5 m or greater) are between Ngataki and Pukenui in the north, and between Ahipara and Sweetwater in the south. The cumulative drawdown is simulated at up to 2 m and the additional drawdown relative to a 'consented baseline' is up to 1 m.

Limited Identification of Water Bodies Affected

- 5 Some (11 out of 24) of the individual applications have identified drains, streams or surface water bodies that are close to each of the proposed takes. Where it is presented, the assessment of impact on these identified waterbodies is based on modelling data from the original model, not the revised model.
- 6 No updated information was presented in the revised AEE or in the s42A report about the flows and functionality of individual streams in the area.
- 7 Mr Hughes in his s42A report states that anecdotal evidence suggests that flow in many drains is likely to be maintained by the drainage of perched groundwater tables (the reason the drains were originally installed). Other streams have been noted in WWLA (2020a) to be ephemeral. These are general statements, and while they may be correct, are not necessarily reflective of all surface waterbodies.
- 8 NRC provided the Department with summary maps of currently consented surface water takes in the Aupōuri Aquifer area. The maps show that there are in excess of 100 surface water takes of up to 250 L/s across the model domain. The mapping suggests that there are currently two streams located in the area of predicted cumulative drawdown that are over allocated.

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Assumed Bore Information

- 9 The AEEs presented for most applications are based on modelled data and have not included data obtained from aquifer and pump testing of the proposed abstraction bore. The assessment assumes that all of the new bores will have aquifer properties similar to existing bores.

In my experience, assessments of effects are normally supported by data obtained from aquifer testing, pump testing and measurement of effects on neighbouring bores as a result of testing the proposed abstraction well.

- 10 Assumptions that new wells will behave / have similar effects to existing wells should be tested post-installation.

Effects of Surface Water Flows

- 11 In my experience, when preparing an AEE for a groundwater take, the Applicant would clearly identify individual waterbodies in the area around the take where drawdown might be expected.
- 12 Evidence of groundwater contribution to streams does exist, but the source of the groundwater (shallow/deep) has not been identified. Radon samples were collected in accordance with the MWWUG GMCP conditions in 2019. The results from this indicate that there is groundwater contribution at site 'Salles Downstream' and 'Okohine Stream'. The Radon concentrations at these sites were higher than other drain and wetland results, and not reflective of background conditions. This indicates that it is feasible that streams in the modelled area could be affected by groundwater takes and therefore require identification.
- 13 Overall, further work is needed to explain the variability (if any) of flow reductions across the modelled area and to demonstrate the location of, or absence of, water bodies that may be linked to groundwater.

Effects on Wetlands

- 14 The assessment of effects on wetlands is addressed by the Applicant using an analysis of predicted effects on drain flows. Overall, the AEE concludes that that as the predicted reduction in annual minimum flow is low (4.3%) then the effects on wetlands would be expected to be less than minor. Again, further explanation of the spatial variability in flow reduction is required in order to be able to develop an informed position on this conclusion.
- 15 Mr Hughes presents an analysis of water level data collected in and around the Kaimaumu wetland over the past year as part of the MWWUG GMCP.
- 16 Mr Hughes concludes that although the monitoring period is short (particularly for the MWWUG sites), based on available data there are no clear indications of any substantial hydraulic connection

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between the Kaimaumau Wetland and the underlying Aupōuri Aquifer (based on data from the MWWUG monitoring sites).

- 17 Given the low abstraction rates of use in this Stage 1-year potential effects may not have propagated into the wetland and I do not consider robust conclusions can be drawn from only nine months of monitoring data.
- 18 Mr Hughes assessment does not address any other wetlands in the modelled area. Dr West's Evidence maps over 40 other wetlands.

Effects on Dune Lakes

- 19 In some of the original applications, effects on individual water bodies were assessed. However, a revised assessment based on the 2019 model updates has not been presented. Other applications appear to have assumed that all dune lakes are disconnected from groundwater and no assessment has been carried out.
- 20 The predicted drawdown in the shallow aquifer beneath these lakes is 0.1 m. Mr Hughes assesses this as unlikely to have any significant effect on these lakes. In my opinion further information on the values and functioning of these identified lakes is warranted to determine if they should be included in a GMCP. Lake 23671 appears to be connected to a stream or drain and is close to two proposed wells.
- 21 A number of dune lakes are located in and around the Sweetwater area, where the greatest drawdowns in the shallow aquifer are located.
- 22 Continued monitoring in and around the Sweetwater area is warranted given the increase in abstraction volumes and locations.

Proposed Monitoring

- 23 The GMCPs proposed are useful plans, and the staged abstraction approach is strongly supported. However, this staged approach needs to be informed by relevant data. Currently it is not clear whether there are additional surface water bodies that should be added to the plans for monitoring purposes.
- 24 I believe it is important that the GMCPs provide for a robust analysis and documentation of baseline conditions. This includes the identification of groundwater dependent features that may not have been surveyed to date current groundwater, lake and stream hydrology.