

## SUMMARY OF EVIDENCE OF DAVID WILLIAM WEST

- 1 My evidence raises the possibility of effects of the proposed water takes on wetlands, ephemeral wetlands, springs, streams, lakes, ponds and threatened freshwater species.
- 2 In my opinion a better assessment of relevant surface waters is needed to understand the potential adverse effects. This assessment is also required in order to review the adaptive management regime and proposed monitoring plans.
- 3 Effects on sensitive ecosystems and on species that rely on ephemeral conditions or groundwater supplements, have not been mapped in most of the separate AEEs.
- 4 While the applicants' groundwater model predicts a small reduction in surface water flows across the aquifer, in most cases localised reductions in flow are not considered. Even if considered for streams, individual applications appear to not have taken into account the updated (February 2020) modelling.
- 5 Significant effects may occur in some areas of drawdown where there are small sensitive (e.g. ephemeral) unmapped freshwater bodies, threatened freshwater species or significant dune lakes.
- 6 I disagree that there is sufficient information to state that the proposed groundwater takes "*do not pose significant risk in terms of surface water depletion*".<sup>1</sup>

### Wetlands

- 7 The primary driver of wetland ecosystem function and composition is hydrological regime. Alterations to wetland water levels can lead to irreversible changes in ecohydrological functioning and cause the loss of indigenous ecosystems and species.
- 8 As seen in the now dryer parts of the Kaimaumu-Motutangi, declining water levels due to drainage, water diversion or groundwater extraction can lead to increased dominance of dryland species (i.e. invasive fire prone wattle: Boffa Miskell 2018).
- 9 Within the area affected by these applications the Kaimaumu-Motutangi wetland complex is the largest (2931 ha) and contains a high diversity of coastal and inland wetlands and is a nationally significant site for the protection of New Zealand's natural heritage.
- 10 There are over 40 other wetlands mapped in the affected area in FENZ (Ausseil et al 2008) (Figure 1.), but the true number and extent of wetlands is very likely to be underestimated.
- 11 The scope of the current applications are widely dispersed. A large number of (often unmapped) waterbodies, in addition to the Kaimaumu-Motutangi wetland, could potentially be affected. Increasingly dry summers and droughts, forecast dry periods and

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<sup>1</sup> WWLA AEE page 37 last paragraph.

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intensification of landuse in the Region, add to concern that the potential adverse effects on these waterbodies have not been adequately assessed.

### **Ephemeral wetlands and turfs, springs, streams and lakes**

- 12 Some types of ephemeral wetlands and turfs such as dune slacks, or depressions can be fed by groundwater from a considerable distance inland (Johnson & Rogers 2003). These types of wetlands will occur on coastal margins of the Aupōuri aquifer and could be at higher risk of impact from reductions in groundwater levels.
- 13 As with ephemeral wetlands, springs, except large ones, are rarely mapped or assessed in New Zealand. Being at the interface of three distinct ecosystems, groundwater, surface water and terrestrial; alterations of all three can have significant effects on spring habitat and integrity (Barquin & Scarsbrook 2007).
- 14 As groundwater dependant ecosystems, springs may be the first places where any effects of groundwater level reductions will be seen.
- 15 Small streams are also often poorly mapped summer low flows in streams are often maintained by groundwater inputs, so a larger than expected effect could be seen especially in summer drought conditions such as Northland has been experiencing. Small streams have a critical influence on downstream stream-river networks (Wohl 2017).

### **Dune lakes**

- 16 Northland is renowned for its dune lakes and NRC has put extensive effort into monitoring and identifying priority management actions for them (Champion 2012, Champion 2014). The Sweetwater lakes have been identified as Outstanding Natural Features in the Proposed Regional Plan and Lake Rotoroa is in the top 10% of Northland Biodiversity Ranking - Lake Ranks. Water level change is one of the top 3 threats to Dune lakes identified by Champion 2012.

### **Threatened and At Risk species**

- 17 Almost all the remaining northernmost populations of the At Risk (Dunn et al 2018) black mudfish occur within the bounds of the Aupōuri aquifer. Mudfish are adapted to occupy ephemeral habitats that dry out during summer (Ling & Gleeson 2001). Many threatened plants occur in turf communities and even small alterations in drying and wetting regimes can change whole turf communities (Johnson & Rogers 2003). In my evidence I list other At Risk fish species and nationally threatened plants found in the modelled area. The flora and fauna of these unique and vulnerable ecosystems are adapted to the fluctuation in hydrology of each particular location.

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In my opinion it is inappropriate to dismiss any effects on these types of waterbodies and species based on coarse regional predictions of groundwater level changes. Groundwater can be important in supplementing predominately surface water features during critical dry periods, increasingly likely to occur in the Northland Region.