

Appendix 5: Terrestrial biodiversity (including wetlands, avifauna) technical expert advice

Fast Track Approvals Act 2024 (FTAA) Technical Advice

Date	21/10/2025
To	Jeremy Ecker, Consent Planner
From	Jean Jack, Environment Canterbury Team Leader Land Ecology
Cc	Philip Grove, Principal Scientist Land Ecology
Project advice provided for	RMA253705 - Meridian Energy Limited - Lake Pūkaki Hydrostorage and Dam Resilience Works
Documents referred to	Ecological Impact Assessment – Lake Pukaki prepared for Meridian Energy Limited by Tonkin & Taylor dated October 2025
Qualifications and Experience	PhD (Ecology), Post-graduate Certificate in Environmental Management from Lincoln University, and a Bachelor of Commerce & Administration from Victoria University. 15 years of experience in biodiversity.
Code of Conduct	I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. This technical report has been prepared in accordance with that Code. In particular, unless I state otherwise, the opinions I express are within my area of expertise, and I have not omitted to consider material facts that might alter or detract from the opinions that I express.

Executive summary

1. This advice relates to potential effects on freshwater avifauna and wetlands from the occasional lowering of Lake Pūkaki below 518m and down to 513m. The provision would be for a period of 3 years.
2. The duration of a drawdown event (below 518m) is predicted to be between 4-7 months. The frequency and timing of these events is unknown.
3. The Ecological Impact Assessment (EclA) considered very low to low level effects might occur from the proposed lowering of the lake to 513m.
4. I consider the potential effects as being of a cumulative nature in relation to the wider management of lake levels by Meridian Energy Limited. And therefore, the level of effect of the proposed drawdown may compound to result in higher levels of effect than assessed by the EclA for wetlands or freshwater avifauna.
5. I recommend provisions to assure drawdowns below 518m are infrequent and timed to avoid more sensitive times of the year for avifauna – June to December. And to ensure the existing hydrological fluctuations of lake Pūkaki for most of any year (as envisaged by the EclA) is maintained. And for any monitoring of freshwater avifauna be shared with CRC.

6. I recommend effects management aligns with relevant effects management provisions sought by CRC in respect to the consent applications for the wider Waitaki Power Scheme currently referred to the Environment Court.

Agreement with the applicant

7. With regards to wetlands and freshwater avifauna, the applicant identifies the key ecological values of the 'Pukaki zone' which might be adversely affected by the proposal. These include:
 - a. *Wetland ecological values associated with Lake Pūkaki range from moderate to very high. Most wetlands have limited hydrological connectivity to the lake; however, the Tasman River Delta has a 'high' hydrological connectivity to the lake. Wetland habitats referred to are shown within Attachment 1.*
 - b. *Avifauna ecological values associated with Lake Pūkaki range from low to very high. Several Threatened and At Risk freshwater bird species utilise the habitats, including, notably, kakī/black stilt (*Himantopus novaezelandiae*). The Tasman Delta habitat provides important winter and spring feeding grounds to avifauna.*
8. I agree with the identified potential adverse effects provided by the EclA report:
 - a. *Potential adverse impacts on wetlands from the proposed eased access of lake water level include changes to wetland and wetland plant extent and condition, and potential modification of resources for wetland/riverine-associated birds.*
9. And that:
 - a. *an overall very low to low level of impact is expected for wetlands and wetland/riverine birds.*
 - b. *Potential adverse impacts are confounded by a range of factors that influence wetland extent and condition, such as upstream inflows, surrounding weed burden and pest animal presence. And, I would add, the wider power scheme operations and lake level management.*
10. While I agree with the applicant's conclusions regarding the potential level of effect, I do not agree that any low-level effects would not require effects management (Table Appendix B.5.). Efforts to address low-level effects should be taken where feasible. This is particularly important when considering cumulative effects such as might occur here.
11. There is also some uncertainty regarding the proposal's modelling for when and how often the lake may be drawn down to 513m¹.
12. Given the confounding nature of effects of this proposal with that of the wider operation of the power station scheme, a pragmatic approach is to consider the drawing down of the lake to a lower extent alongside the scheme's wider operation.

¹ see CRC staff advice of Kate Bailue and Tina Bayer.

13. The proposed lower lake level would, for three years, essentially form part of the schemes operating range, contributing to the periodicity of lake levels – a key driver of wetland and freshwater avifauna habitat extent and condition.
14. Like high lake levels or differing fluctuations, low lake levels might reduce the extent of habitat wetland plants might persist within or reduce the effective edge-microhabitats at which waders such as black stilt/kakī feed during certain times of the year.

Potential effects on wetland plants

15. As noted by the EclA, *Wetland plants on the Tasman River Delta rely on a regular disturbance regime consisting of upstream snowmelt/rainfall inputs, and Lake Pūkaki inundation. Wetland plant distribution and persistence on other wetlands around the lake or associated with the Pūkaki River would also rely on underlying hydrological drivers including upstream inputs and Lake Pūkaki inundation.*
16. Potential adverse effects on wetland plants include. *Temporary shifts in wetland plant distributions. Potential loss of individual wetland plants where wetland areas are less frequently inundated.* And less frequent inundation could increase dryland plant/weed invasions.
17. Monitoring of At Risk and Threatened plant species at the Tasman Delta has found that operational fluctuations of lake levels likely drive the persistence of these plants. Monitoring of *Isolepis basilaris* indicates communities of this plant can colonise new areas yet its occurrence is related to intermittent habitat inundation. Authors of the Boffa Miskell (2011) report cited by the EclA and documenting this monitoring note that the two years surveys are insufficient to draw strong conclusions about the location of the plant's communities relative to lake level dynamics.
18. I understand future operations of lake levels will see higher levels of inundation during spring, while this proposal might result in longer periods of lower lake levels. It is unclear to me whether this will result in a lake periodicity that will continue to support the current distribution or extent of At Risk and Threatened plant species at the Tasman Delta. And therefore, further monitoring of these plants considered alongside lake levels to generally inform At Risk and Threatened plant species management at the Tasman Delta appears warranted.

Potential effects on avifauna

19. The key concern for avifauna is the impact of lake levels on avifauna feeding habitat.
20. My colleague Tina Bayer provides further comment with regards to potential adverse effects of the proposal on lake littoral habitats and their productivity. She notes a drawdown to 513m is a large change (6m) to what aquatic communities are adapted to. Reduced productivity in the littoral zone could diminish avifaunal foraging habitat. I am not aware of any monitoring that assesses how prolonged wet or dry periods, in the context of low or high lake levels, affect aquatic invertebrates in Lake Pūkaki.
21. I understand the rate at which lake levels change might adversely affect the feeding habitat of wading birds. A slowly lowered or raised lake enables invertebrates to move with the

water². And small and short drawdowns have been shown to improve the feeding habitat of waders in some Mackenzie Basin delta³.

22. A letter from the Department of Conservation and attached to a report by the Waitaki Working Party in 1992 considering the potential impact of lowering the lake's minimum level, suggested an ideal lowering rate would be no greater than 1-3cm per day⁴. This was based on work undertaken in the Cass River delta. This is a far slower rate than I understand might occur here. The EclA noted with regards to the application for the Plan Change 1 that *The rate of drawdown of lake levels was estimated to be 1.5 m to 3 m per month in low flow conditions*. That would equate to an average drawdown of up to 10cm per day.
23. The Waitaki Working Party report also proposed a monitoring programme in the early 1990s to assess the effects of lake levels on wading birds and their habitat. It is unclear whether this was implemented. If it was, the findings could inform this application; however, as lake levels have reportedly not fallen below 518 m since 1991, such monitoring may not address effects at levels below 518 m.
24. A PhD thesis by Mark Sanders in 1996⁵ researched the question "what are the likely effects on black stilts of lowering the legal minimum operating level of Lake Pukaki by five meters, from 518 to 513 m.a.s.l?". The work predicted that food availability for stilt below 518m is likely scarce and like that found between 518m and 524m due to the fine inorganic substrata (silt and fine sands) and other abiotic factors. The results of the various investigations and observations suggested that extending the operating range would have little or no effect on black stilts. Nevertheless, there is uncertainty of the impact of extended periods of low lake levels, and the author recommended monitoring the responses of black stilts to any drawdown below 518m.
25. Given the importance of this delta habitat to black stilt/kaki and other waders⁶ and that a key driver behind this habitat (lake level periodicity) may be altered, it appears plausible that this might change its character or extent, potentially resulting in an adverse effect. This is a matter being considered by parties deliberating the wider consent application of Meridian Energy Limited for the Waitaki Power Scheme that has been referred to the Environment Court.

² James, M., Mark, A. & Single, M. 2002. Lake managers handbook; Lake level management. Prepared for the Ministry for the Environment. ISBN: 0-478-24067-8.

³ Sanders, M. 1999. Effect of changes in water level on numbers of black stilts (*Himantopus novaezelandiae*) using deltas of Lake Benmore, New Zealand Journal of Zoology, 26:2, 155-163, DOI: 10.1080/03014223.1999.9518185.

⁴ Electricity Corporation of New Zealand (ECNZ). 1992. Assessment of the possible effects of reducing the lake level at Lake Pūkaki to range 518-513 m. *Based on work carried out for the Waitaki Working Party, anecdotal evidence and personal observation*. Available from the National Library of New Zealand ALMA 9914830553502836.

⁵ Sanders, Mark David (1996). *Effects of fluctuating lake levels and habitat enhancement on black stilts (Himantopus novaezelandiae Gould, 1841)*. PhD thesis, University of Canterbury, Christchurch, NZ.

⁶ Cromarty, P. & Scott, D. (eds). 1995. A directory of wetlands in New Zealand. Department of Conservation, Wellington, New Zealand. ISSN: 0-478-01776-6 and O'Donnell, C. 2000. Environment Canterbury Report U00/37 - The significance of river and open water habitats for indigenous birds in Canterbury, New Zealand (June 2000). Report by Dr Colin F. J. O'Donnell, Science & Research Unit, Department of Conservation.

26. Therefore, I recommend this activity is subject to those same (compensation) conditions determined through the current Environment Court process – albeit with any provisions specific to the lower lake level. In lieu of that decision, then guidance is found from proposed CRC conditions and recommendations of the s42A Officers report.
27. I understand that when lake levels drop below 518m, kaki/black stilt monitoring will be undertaken as per an agreement between DOC and Meridian.⁷ Subsequent to this agreement I understand levels have not been drawn down below 518m (or perhaps just once?), so while this agreement is in place monitoring may not have occurred – and therefore the efficacy of the arrangement to inform or mitigate any observed effects uncertain.
28. It is unclear if this kaki monitoring agreement includes provisions to understand the impact of lake levels – and in this case a lake level below 518m – on the wetland habitats that support kaki.
29. Apart from monitoring, a precautionary approach is to avoid those months for which drawdown might most impact winter feeding and spring breeding avifauna habitats (June to December). And in lieu of a known ideal, for the existing lake level periodicity to be maintained as much as possible.

Benefits of the project

30. The proposed lowering of the lake level does not have any specific benefits relating to freshwater avifauna and wetlands.

Outstanding areas of contention and significance of these.

Discussions with applicant

31. I have not had expert discussions with applicant.

Outstanding areas of contention

32. The EclA identifies low level adverse effects might occur on wetlands and avifauna. I consider some impact management is warranted to address low level adverse effects, particularly given the potential for higher cumulative effects.
33. I consider it important that the Applicant's effects management approach includes provisions for wetland plants and avifauna habitats within the Tasman Delta.
34. There is no assurance that lake levels below 518m will be infrequent and of short duration. Or that the rate of drawdown will not be of concern.

Solutions and/or Conditions sought

35. Provisions to ensure drawdowns below 518m are infrequent, not of a rapid rate (tbc), and timed to avoid more sensitive times of the year for avifauna – June to December.

⁷ The EclA notes that this is as per the Emergency Electricity Supply Agreement between the Director-General of Conservation and Meridian Energy Limited, 2012.

36. Provisions to ensure the existing environment's hydrological fluctuations is maintained to minimise potential adverse impacts of any eased access.
37. Provisions to monitor At Risk and Threatened plant species at the Tasman Delta.
38. Provisions to monitor kaki where lake levels drop below 518m, focused on the Tasman Delta.
39. Consider compensatory measures to address the potential effects on wetlands and freshwater avifauna habitat at the Tasman Delta.
40. Suggested condition wording in Table 1.

Table 1: Solutions

Issue	Solution	Condition wording
<p>Potential loss in extent of wetland and avifauna habitat.</p>	<p>Avoid rapid or extreme low levels during freshwater bird winter feeding and spring breeding season months (June to December) where possible.</p>	<p>Levels below 518m during freshwater bird winter feeding and spring breeding months (June to December) will be avoided where possible.</p> <p>A maximum daily rate of drawdown of [to be determined] cm/day.</p>
	<p>Provisions to ensure the existing environment’s hydrological fluctuations is maintained to minimise potential adverse impacts of any eased access.</p> <p>Operational lake level fluctuations are maintained to ensure the persistence of existing distributions of Threatened plant species including <i>Isolepis basilaris</i>.</p> <p>The EclA noted <i>I. basilaris</i> required inundations every 3-5 years – this requires further consideration.</p>	<p>Representative monitoring of threatened plant species through the three year duration would help understand implications on these sensitive species.</p>
	<p>As described by the EclA: Monitoring under the existing PC1 agreement between Meridian and DOC, kakī monitoring will continue to be undertaken, focused on the Tasman Delta (or elsewhere if the birds shift in response to changing lake levels) when the lake level drops below 518 m. [In the event that lake levels below 518m] impacts this threatened bird species, this monitoring will detect any change, and management may be undertaken under the existing agreement.</p>	<p>When lake level drops below 518 m monitoring of kaki will occur, focused on the Tasman Delta (or elsewhere if the birds shift in response to changing lake levels). If lake levels below 518m apparently impact this threatened bird species management will be undertaken to mitigate or remedy any adverse effect. Further investigation into how prolonged wet or dry periods, in the context of low or high lake levels, affect aquatic invertebrates in Lake Pūkaki is to be considered.</p> <p>Monitoring results and any effects management actions will be shared with CRC.</p>

	Provide for the potential effects on wetlands and freshwater avifauna habitat at the Tasman Delta through compensatory measures.	May also fall within with the proposed compensation package 'Kahu Ora' currently proposed by Meridian and to be considered by the Environment Court.
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Attachment 1 – Wetlands hydrologically connected to Lake Pukaki. From Boffa Miskell report prepared for Meridian, July 2023. Tasma Delta = ‘2’.

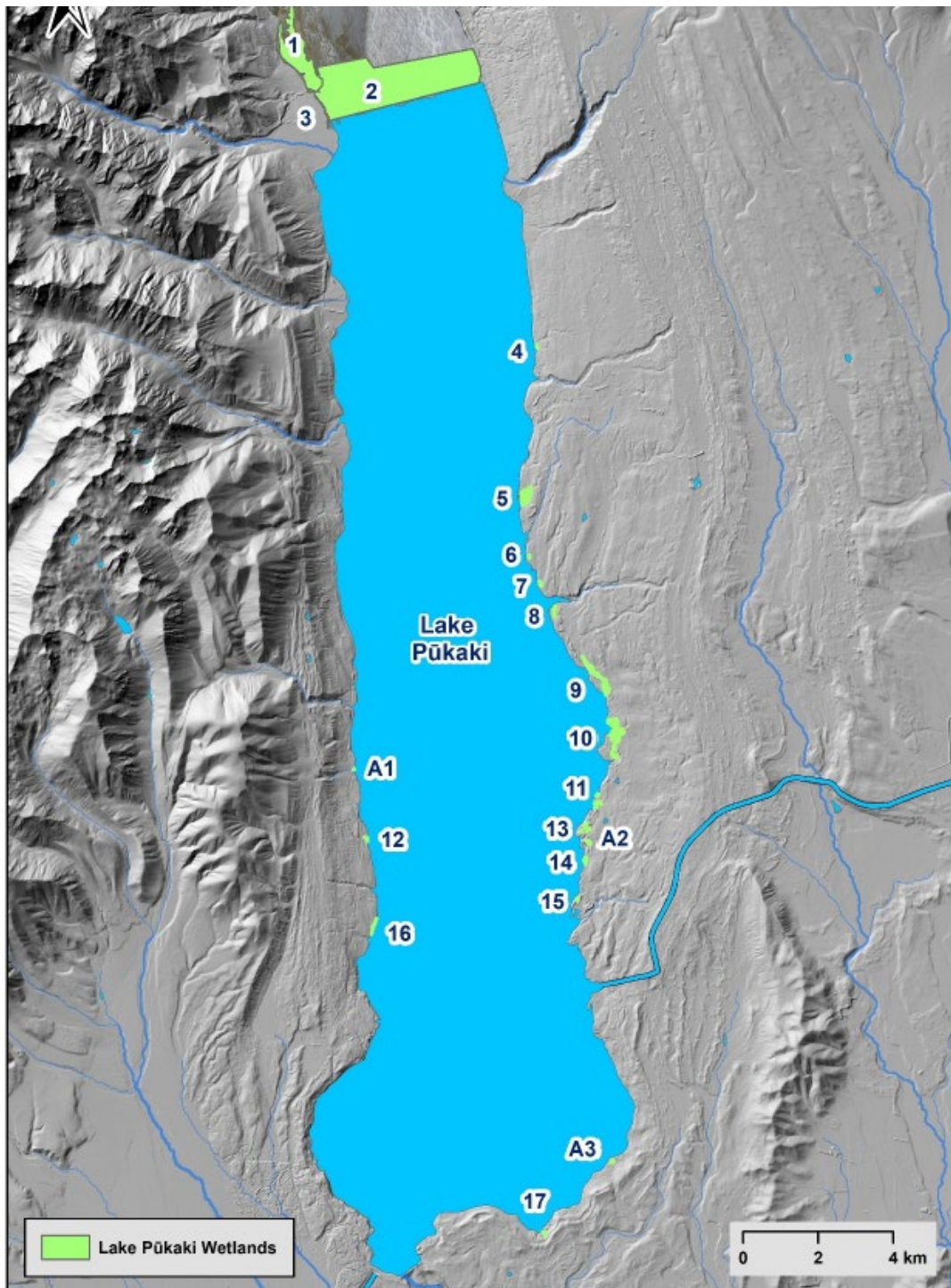


Figure 2. Lake Pūkaki wetlands map. Wetlands hydrologically linked to the lake are numbered 1-17 are discussed below. Wetlands A1-A3 (not linked to lake levels) are summarised in Appendix 1.

Table 1: Wetlands in the vicinity of Lake Pukaki and the Pukaki Canal that are hydrologically linked to the WPS.

Wetland Number – Name	Wetland Area	Wetland Classification: Landform(s) / Hydrosystem(s) / Wetland class(es)	Ecological Significance / Value Score	Hydrological Linkage to WPS	Other Hydrological Influences (not associated with the WPS)	Relative Importance of WPS Hydrological Linkage for Wetland Hydrology
1 - Glentanner Wetland	119.45	Floodplain, Shore, Channel / Lacustrine, Palustrine, Riverine / Marsh	Yes / High	Lake Inundation	Stream, Other Groundwater	Low
2 - Tasman River Delta	486.91 (map estimate)	Delta / Lacustrine, Riverine / Marsh	Yes / Very High	Lake Inundation	Tasman River Groundwater, Other Stream Inflows, Flood Inflows	High
3 - Glentanner Airstrip	2.11	Terrace / Palustrine / Marsh	Yes / Moderate	Lake Inundation	Other Groundwater (probable)	Low

Wetland Number – Name	Wetland Area	Wetland Classification: Landform(s) / Hydrosystem(s) / Wetland class(es)	Ecological Significance / Value Score	Hydrological Linkage to WPS	Other Hydrological Influences (not associated with the WPS)	Relative Importance of WPS Hydrological Linkage for Wetland Hydrology
4 - North Camp	0.22	Shore, Riparian / Lacustrine, Riverine / Marsh, Shallow Water	Yes / Low	Lake Inundation	Stream Inflows	Low
5 - Boltons Gully 1	8.13	Depression / Palustrine / Seepage, Shallow Water	Yes / High	Permeable Lakeshore Gravels (probable)	Upslope Surface / Groundwater Flows	Low (probable)
6 - Boltons Gully 2	0.20	Channel / Palustrine / Marsh, Shallow Water	Yes / Low (probable)	Permeable Lakeshore Gravels, Lake Inundation	Upslope Surface / Groundwater Flows	Low
7 - Boltons Gully 3	0.54	Shore / Lacustrine / Shallow Water, Marsh	Yes / Low	Permeable Lakeshore Gravels, Lake Inundation	Other Groundwater	Low
8 - Boltons Gully 4	0.97	Shore / Lacustrine / Marsh (probable)	Yes / Low (probable)	Lake Inundation	Other Groundwater (probable)	Low (probable)
9 - Hayman Road 1	7.73	Shore, Terrace / Palustrine / Marsh, Swamp	Yes / Moderate	Lake Inundation	Upslope Surface / Groundwater Flows	Low
10 - Hayman Road 2	14.41	Channel, Shore, Terrace / Lacustrine, Palustrine / Marsh, Swamp	Yes / High	Lake Inundation	Upslope Surface / Groundwater Flows	Low
11 - Hayman Road 3	0.56	Shore, Channel / Lacustrine, Riverine / Marsh, Shallow Water	Yes / Low	Lake Inundation	Stream Inflows	Low
12 - Boundary Stream South	0.52	Shore / Lacustrine / Marsh, Shallow Water	Yes / Low	Permeable Lakeshore Gravels, Lake Inundation	Terrace Seepage, Stream (probable)	Low
13 - Hayman Road 4	0.60	Shore / Lacustrine, Palustrine / Marsh	Yes / Low	Lake Inundation	Stream Inflows	Low
14 - Hayman Road 5	0.66	Shore / Lacustrine / Marsh	Yes / Low	Lake Inundation	Upslope Surface / Groundwater Flows	Low
15 - Hayman Road 6	0.31	Depression / Lacustrine, Palustrine (mostly) / Marsh (probable)	Yes / Low (probable)	Lake Inundation	Groundwater	Low
16 - Jack Steel Stream	0.73	Channel, Shore / Lacustrine / Marsh, Shallow Water	Yes / Moderate	Permeable Lakeshore Gravels, Lake Inundation	Stream Inflows	Low
17 - Lower Pūkaki 2	0.49	Depression / Palustrine, Lacustrine / Swamp	Yes / High	Lake Inundation (probable)	Terrace Seepage	Low