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Subject: Plan Change 7 CLWP - Meridian Energy - Evidence in Chief
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Attachments: [Evidence in Chief: Plan Change 7 Land & Water Plan Canterbury Regional Council. Final.pdf](#)
[Evidence: Andrew Feirabend Plan Change 7 Land & Water Plan Canterbury Regional Council. Final.pdf](#)
[Evidence: Matt Turner Plan Change 7 Land & Water Plan Canterbury Regional Council. Final.pdf](#)

Good afternoon.

Please find attached 3 briefs of Evidence in Chief on behalf of Meridian Energy in support of its submissions to Plan Change 7.

Can you please acknowledge receipt of the same.

Regards

Andrew

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BEFORE THE CANTERBURY REGIONAL COUNCIL

UNDER

The Resource Management Act 1991
(RMA)

IN THE MATTER

Proposed Plan Change 7 to the
Canterbury Land and Water Regional
Plan

STATEMENT OF EVIDENCE OF MARK RICHARD JAMES

FOR

MERIDIAN ENERGY LIMITED

17 July 2020

INTRODUCTION

- 1 My full name is Mark Richard James.

QUALIFICATIONS AND EXPERIENCE

- 2 I am an aquatic ecologist holding the following degrees, BSc Victoria University, Wellington; BSc (Hons) Victoria University, Wellington and PhD (Aquatic Biology), University of Otago, Dunedin.
- 3 I have a background in basic and applied research in marine and freshwater ecology and biology with over 40 years' experience including research, consulting and management of science organisations.
- 4 Following two years with the Institute of Nuclear Sciences, Department of Scientific & Industrial Research (**DSIR**) I was employed in 1982 by the Taupo Research Laboratory, DSIR, then moved to Christchurch in 1992 as a scientist with the National Institute of Water & Atmospheric Research (**NIWA**). In 1994 I was appointed as a Project Director and led large multi-disciplinary Foundation for Research, Science & Technology (**FRST**) funded programmes including "Lake Ecosystems" and "Sustainability of coastal ecosystems". In 2000 I moved to Hamilton to take up the position of Regional Manager with NIWA and in 2002 was appointed as NIWA's Director Operations. In 2008 I retired from this position taking up a brief position as Chief Scientist for Environmental Information before leaving NIWA in late 2008 and setting up as an independent environmental consultant and ecotour operator.
- 5 Since 1982 I have been involved in research on the ecology of freshwater and marine systems. These studies aimed to gain a better understanding of ecological processes in lakes, rivers, coastal and open ocean systems. I have worked in New Zealand, Finland, Denmark, Australia and in Antarctica. My research has been published in over 45 papers in scientific journals and books. These publications have included scientific papers in international journals and book chapters on the ecology of freshwater and marine invertebrates, freshwater management, coastal sustainability as well as the effects of sediments, lake level management, and other anthropogenic activities on aquatic ecosystems.
- 6 During my 40 years' experience I have been involved with Regional Councils, government departments and industry in establishing guidelines

for ecological assessments, providing descriptions of freshwater and marine communities and assessments of potential ecological effects for a wide range of projects throughout New Zealand.

- 7 I have been involved in lakes, rivers and coastal systems throughout New Zealand since the 1980s. My specific experience with the Waitaki Catchment started in the mid-1980s and in the 1990s when I led government funded programmes on understanding the ecological processes in lakes. I first published work on freshwater mussels in the mid-1980s and thus have a very good knowledge of their life-cycles and distribution.
- 8 I have been providing advice to Meridian Energy Ltd on aquatic issues associated with hydroelectric development since 2010 and prior to that to MFE on lake management and to other hydroelectric companies for a number of other hydro-development schemes.

CODE OF CONDUCT

- 9 I confirm that I have read the Environment Court's Code of Conduct for Expert Witnesses contained in the Environment Court Consolidated Practice Note (2014). I have complied with the code when preparing my written statement of evidence and I agree to comply with it when presenting evidence. My qualifications as an expert are set out above. I confirm that the issues addressed in this brief of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

- 10 I have been asked by Meridian Energy Ltd to provide evidence in relation to ECAN's Plan Change 7 (**PC7**). My evidence addresses the following science-related matters:
 - A brief discussion of key water quality issues in the Waitaki Catchment¹;
 - Definition and application of Indigenous Freshwater Species Habitat;
 - Mapping process for Indigenous Freshwater Species Habitat;

¹ For the purpose of my evidence I describe the Upper Waitaki Catchment as that part of the Waitaki River system upstream of the Waitaki Dam.

- Implications of Regional versus Waitaki specific outcomes and limits;
- Fish passage and implications for Meridian; and
- Temporary discharges of sediment-laden water during certain activities.

UPPER WAITAKI CATCHMENT WATER QUALITY (INCLUDING PERIPHYTON)

- 11 The Upper Waitaki Catchment (**UWC**) is highly regarded for its aesthetic, recreational and freshwater ecological values. These are largely related to its alpine ecosystems and habitats provided by braided rivers, natural high country lakes, tarns and associated wetlands. The braided river habitats are of international significance, and along with associated wetlands and springs are home to a number of threatened birds, fish and other taxa.
- 12 The UWC rivers above Lakes Tekapo, Pukaki and Ohau are largely untouched by modifications through farming and hydro-development and have high water quality. Below these lakes however, and in the Lower Waitaki River, water quality is reduced as a result of land use activities, and is in danger of continuing to decline with increasing pressure from developments such as further land-use intensification (including more intensive dairying and other farming activities), salmon farming, and other activities.
- 13 Periphyton is the collective term given to the matrix of benthic algae, cyanobacteria, bacteria, fungi and protozoa which are found on hard substrates in most rivers and the littoral zone of lakes. While it is often the basis for the food web, and at appropriate levels is desirable, it can also reach nuisance levels, particularly filamentous green algae in rivers.
- 14 The range of periphyton species found in the Waitaki rivers is similar to other comparable New Zealand rivers, and is composed mostly of diatoms. However, the invasive benthic diatom *Didymosphenia geminata* (**didymo**) was first recorded in the UWC in 2006 and is now found throughout the catchment. Didymo has now been recorded from the Ahuriri River, Tekapo River, Twizel River, Omarama Stream, Upper and Lower Ohau River, and Waitaki River as well as in the hydro canals.
- 15 Didymo is a special periphyton case as unlike other periphyton species it can proliferate, reaching high biomass, in nutrient poor, cold waters. It can be especially prolific in stable lake-fed rivers. Low phosphorus

concentrations in particular are thought to be a requirement for its presence and abundance in rivers. Excessive didymo growth can in turn impact on macroinvertebrates (snails, insect larvae, worms) and fish communities, and change community composition from high value species (insect larvae) to pollution tolerant species (eg, oligochaete worms and snails).

DEFINITION AND APPLICATION OF INDIGENOUS FRESHWATER SPECIES HABITAT

- 16 PC7 includes a list of freshwater species whose habitat is used to develop maps and define areas that various rules and policies will apply to. The areas are called Indigenous Freshwater Species Habitat (**IFSH**). The list and maps are largely based on:
- Gray, D.; Allibone, R. (2019) Prioritisation of native aquatic species habitat for protection under the LWRP Omnibus plan change. Memo to ECAN (21st May 2019);
 - Dunn, N. (2017). Mapping of non-migratory freshwater fish habitat fragment distributions. Report prepared by Department of Conservation.
 - Grainger et al (2018). Conservation status of New Zealand freshwater invertebrates, 2018. Report prepared by Department of Conservation.
 - Allibone, R.; Gray, D. (2018). Critical habitat for Canterbury freshwater fish, koura/kekewai and kakahi. Report prepared for DoC.
 - New Zealand Freshwater Fish Database (**NZFFDB**) which provides the distribution (note that other sources of distribution are used to define distribution as well and all are on a DoC database).
- 17 The conservation status of native fish is appropriate for those listed as Group 1 species in Gray & Allibone (2019) as these are all identified in the New Zealand Threat Classification System (**NZTCS**) (Dunn et al. (2018)) as Threatened, comprising Nationally Critical, Nationally Endangered or Nationally Vulnerable. However, there are also several Group 2 species listed, namely the giant kokopu, kakahi (freshwater mussel) and kekewai (freshwater crayfish). Their threat status is lower – “At Risk – Declining” or “uncommon”, or are very restricted or sparse in Canterbury; and less than 10% in Protected Crown Land (**PCL**).

- 18 While there is some conservation concern over habitat for these species in Group 2, and the classifications are appropriate according to this criteria, it is the identification of habitat for these species in maps that creates the real issue, as discussed below.
- 19 I note that some submitters are seeking to broaden the list of species classified as Indigenous Freshwater Species for the propose of identifying habitats that need special protection. Some have requested that taonga species such as tuna are added, while Forest and Bird has submitted that the definition should include all indigenous freshwater fish and aquatic macroinvertebrates, as well as indigenous stygofauna (groundwater fauna).
- 20 I consider that the present definition protects critical habitat for Threatened species as defined under the NZTCS system. Expanding this to a wider range of species, including species that are not nationally or locally threatened, is not appropriate, and would require comprehensive surveying of distribution or would have to include virtually all waterbodies.
- 21 As set out in the officers' report I support the change to "Critical Habitat of Threatened Indigenous Freshwater Species" and agree with the officers' analyses that no new species should be added to the list which was based on a prioritisation process for threat status, life history and habitat distribution².

MAPPING PROCESS FOR INDIGENOUS FRESHWATER SPECIES HABITAT

- 22 The following comments relate to definitions and new Policy 4.61A (abstraction of water) and Policy 4.101 (Habitat of indigenous freshwater species).
- 23 The mapping of the IFSH is directly relevant to the application of policies and rules, and therefore needs to be accurate. The maps identify areas with habitat for any one of the species listed as "High Priority" in Gray & Allibone (2019) as well as salmon spawning sites. I note that at present the maps do not include information on what species a particular water body

² Section 5.57 of 42A report

provides habitat for, thus the following is based on my understanding of the distribution of the relevant species.

- 24 The streams identified for the High Priority species are appropriate and generally consistent with distributions provided by a recent NIWA report to Meridian. Examples are spring-fed streams where threatened native species should be protected.
- 25 The High Priority species mostly inhabit streams or rivers and none of the Group 1 species are recorded in Lakes Benmore or Aviemore, as far as I can ascertain.
- 26 Kakahi or freshwater mussel (*Echyridella menziesii*) are found throughout New Zealand in lakes and rivers. The species is ranked as “At Risk – Declining” despite its wide distribution and relatively large populations in some places. There are concerns for this species due to habitat modifications and its reliance on small native fish to act as hosts for the early part of its lifecycle. Due to their sparse mapped populations and low percentage of the population in PCL in Canterbury, along with their national ranking, Gray et al. (2019) consider this species is “High Priority” along with Group 1 species.
- 27 My understanding from the various documents listed above is that because the freshwater mussel has been recorded in the Ahuriri Arm of Lake Benmore and the northern part of Lake Aviemore, the entire areas of both lakes have been included as IFSH and therefore accorded the higher protection. My understanding is that the presence of kakahi is the only reason for these lakes to be included as IFSH.
- 28 I do not consider the recording of freshwater mussels in parts of Lakes Benmore and Aviemore warrants mapping of the whole of these lakes as IFSH for the following reasons:
 - Its national threat status in the NZTCS is At Risk – Declining. It has not been assessed as Threatened;
 - Kakahi in lakes are found in sand or mud/sand habitats in the littoral zone – generally at depths of 2–15 m. They are not found throughout lakes, such as Benmore and Aviemore, and would be restricted to narrow bands where there are gently sloping shallow zones and sandy sediments; and

- Lake Benmore and Lake Aviemore are artificial lakes created by the Waitaki Power Scheme, not natural lakes which would have originally had kakahi in larger numbers.
- 29 I do not consider the freshwater mussel has been adequately mapped in these lakes and the existing information about its actual distribution combined with its known habitat preference does not justify the identification of the whole of both lakes as critical habitat for this species.
- 30 I understand from Mr Feierabend's evidence that Meridian Energy's concern is for the impact identification of the lakes as IFSH will have when works are required around the edge of the lakes, such as management of invasive aquatic weeds. While the Canadian pond weed (*Elodea canadensis*) is common throughout the lakes and canals of the Waitaki it is the spread in the lakes of the invasive vigorous oxygen weed Lagarosiphon major that is the major concern. This species requires ongoing surveillance and control in the Ahuriri and Haldon Arms of Lake Benmore. This work is undertaken by ECAN, LINZ, and NIWA and presently uses both divers to remove the weeds, as well as mechanical removal by suction. These activities can result in a plume of suspended sediment (discussed below).
- 31 My recommendation is that the policies and rules for these activities include a requirement to identify if there is important mussel habitat as part of any permitted activity standard. The activity status should not change based simply on the mapping of the entire surface areas of the lakes.

CHANGES TO REGIONAL VERSUS WAITAKI SPECIFIC OUTCOMES AND LIMITS

- 32 This issue relates to Tables 1a and 1b and Schedule 8, the generic tables for outcomes and limits for Canterbury in proposed PC7. They set different outcomes and limits and in some cases different parameters from the Waitaki limits in Section 15 of the present plan. It is not clear whether the generic tables in PC7 take precedent over the FMU specific tables developed earlier in the plan for the Waitaki. This needs to be clarified as also discussed further in the evidence of Jane Whyte and Andrew Feierabend.
- 33 A key concern for Meridian is that in Section 15 of the current plan the diverted Lower Ohau and Pukaki Rivers are included in a footnote as being exempt for river outcomes in the Waitaki specific tables. However, these

are not excluded in the PC7 generic Regional Limits. The diverted water bodies result from consented diversions and are critical for energy production. As a result of the diversion of flows into the hydro canals they will not meet region-wide outcomes or limits.

- 34 I support a number of the changes introduced in Tables 1a and b, such as the introduction of exceedance frequency for periphyton and clarification that it only applies to the wadable parts of a river.
- 35 However, in Tables 1a and b there is no consideration of glacial flour and natural processes, or the presence of invasive species (didymo) when applying siltation, suspended sediments, periphyton chlorophyll-a biomass or macroinvertebrate community index outcomes. These will be exceeded in some years for the Upper and Lower Ohau Rivers, and Lower Waitaki River for reasons beyond the control of Meridian. It is important that these are taken into account for the Waitaki as is done in Table 15B (a) in the current plan.
- 36 Temperature at times can be naturally elevated in both regulated and unregulated streams/rivers of the Waitaki and at times would not meet the generic outcomes in PC7. This has been an issue in recent years with warmer temperatures in general and could become more of an issue with climate change.
- 37 There needs to be a statement in PC7 to the effect that the water quality limits and outcomes for the Waitaki Catchment prevail over the region wide limits in Schedule 8. This should be made clear in PC7 for the Waitaki and would resolve the matters raised above.

FISH PASSAGE AND IMPLICATIONS FOR MERIDIAN

- 38 A matter of concern for Meridian identified by Mr Feierabend is proposed changes in policies and rules related to fish passage. Policy 4.102 requires safe passage of indigenous fish while preventing passage of invasive, pest or nuisance fish. I agree that it is critical to protect habitat and passage for native threatened species. It is also important in places such as small spring fed streams where there are small populations of threatened species that unwanted fish (including salmonids) are excluded.
- 39 In my opinion there does need to be an element of practicality around the large hydro dams in the Waitaki catchment where there are fish values that need to be addressed. The policies and rules also need to take into account

mitigation measures, such as trap and transfer, where it is not practical to provide for fish passage directly. This approach has been approved and is very successful in the Waiau Catchment and could be improved in the Waitaki Catchment.

- 40 At present elvers migrating upstream are collected at the Waitaki Dam and transferred to the Ahuriri Catchment. Downstream migrating adults are trapped in the lakes of the middle catchment and transferred below the Waitaki Dam to continue their way out to sea and on to breeding grounds in the Pacific.
- 41 Upstream passage of elvers via infrastructure changes has been tried in the Waitaki River and other systems but has not been successful for high dams, such as the Waitaki Dam where Meridian has resorted to trap and transfer. As Mr Feierabend describes, Meridian continues to work with local iwi on this approach. In my opinion it is clear that providing suitable structures is not the only approach, and in some cases is simply not practical. Alternative methods of ensuring passage, such as trap and transfer, can provide a satisfactory approach in these cases. Alternatively an exception should be provided for existing structures.

TEMPORARY DISCHARGES OF SEDIMENT-LADEN WATER DURING CERTAIN ACTIVITIES (RULE AND 5.141 ADDITIONS)

- 42 Ms Whyte discusses some issues in relation to the provisions in Rule 5.141. It is within my area of expertise to comment on the appropriateness of including a mixing zone exemption. In my opinion the addition of a reasonable mixing zone as an exemption would be appropriate as it would allow for a zone in the immediate vicinity of a temporary discharge to be impacted as long as it was only for a short period and localised area. This is consistent with Schedule 5 Mixing Zones and Receiving Water Standards where for lake locations there is an allowance for a mixing zone and a simple measure of water clarity (% change) applies outside these zones. The ecosystem can recover from such perturbations and no communities would be affected or lost.
- 43 Invasive weeds need to be controlled or removed as soon they are discovered in order to protect indigenous biodiversity values. Ms Whyte discusses the importance of such activities therefore being permitted rather than being subject to a resource consent process. It should also be noted that the sediment that may go into suspension for a short time as a

consequence of these activities is natural sediment from these lakes and should also be enabled through the use of the mixing zones provided for in Schedule 5 of the Plan.

SECTION 42A REPORT

- 44 A number of the issues raised above are addressed in the Section 42A report.
- 45 The report does not satisfactorily respond to the issue of mapping the entire surface area of Lakes Benmore and Aviemore for a particular species (in this case kakahi) where it only has restricted distribution in the lakes, yet the whole lake has been demarcated or defined in PC7 maps, as described in my evidence. In response the report notes that this is the approach taken with all lakes. While that might be so, most of the other lakes in the various Canterbury catchments are very small and shallow, with more homogenous habitat characteristics. By contrast Lake Benmore and Lake Aviemore are large and mostly deep, and it is clear the majority of the mapped lake areas will not have kakahi present.
- 46 The report notes that kakahi and kekewai are included as threatened species because less than 10% of the populations are protected in PCL. However, as stated above these species have not been adequately mapped to be able to make this statement.
- 47 I do not agree that the issue with point source discharges is sedimentation and that application of a mixing zone is not appropriate. I have been involved in a number of studies and consents that apply a mixing zone and suspended sediment limits. Wave action and longshore currents would prevent permanent deposition of fine material in the shallow littoral zone of lakes. I agree with the recommendation in the report that the sediment discharge limits referring to 10 hours in any 24 hour period and 40 hours in any month should be reinstated.
- 48 To address the concerns I have identified I suggest that the maps are redone to take into account the specific habitat for freshwater mussels or for activities such as weed clearance. Schedule 5 should be applied to address the effects of temporary activities. For other activities in the tailraces or close to the power stations I support the use of "mixing zones" in the mapped exclusion areas as proposed in the evidence of Mr Feierabend.

- 49 The issue of fish passage and alternative methods, such as trap and transfer, is addressed above and I would agree with an exclusion for existing hydro-electric generation structures, as suggested in the report.

SUMMARY AND RELIEF SOUGHT

- 50 Degrading water quality and resulting loss of biodiversity are key concerns in the Waitaki Catchment. At present the upper catchment lakes and rivers generally have high water quality but this declines as the water travels down the catchment to the coast and is increasingly influenced by sediment and nutrients derived from land use practices in particular.
- 51 Of interest to Meridian is the state of water bodies which it may have an impact on through its activities. This includes the upper catchment lakes, mid-lakes and rivers and the Lower Waitaki River. These water bodies are subject to natural processes such as glacial flour that can impact on water quality, periphyton and macroinvertebrates. The invasion by *Didymosphenia geminata* has also affected the biological values and must be taken into account when setting outcomes and limits as it has special properties that do not follow usual nutrient-periphyton relationships.
- 52 The diverted Pukaki and Lower Ohau rivers are consented as part of the operation of the Waitaki Power Scheme and have little, if any residual flow. These are special cases where region-wide outcomes and limits in Table 1a, Table 1b and Schedule 8 should not apply. They have already been dealt with appropriately in the Waitaki Catchment section (eg table 15B (a)). At present there is no clarity on whether Schedule 8 prevails over the outcomes and limits in the Waitaki section.
- 53 Fish passage past structures is critical for obligate diadromous fish if they are found in the upper catchment. However, altering structures may be impractical or is not necessarily the best way to address the matter as has been shown with trap and transfer of tuna in the Waitaki, Waiau and elsewhere. These options should also be available.
- 54 The current CLWP allows for up to 40 hours of temporary discharge for sediment laden water but PC7 to the CLWP replaces this with limits on suspended sediment, anywhere in the receiving water body. This does not allow for periods when the bed of a lake or river may be disturbed temporarily as part of the Waitaki Power Scheme operations eg weed

control and activities in the tailraces. It also does not allow for any mixing zone to apply.

55 The relief sought by Meridian is as follows:

- (a) Provide for mapping in the area potentially impacted by activities to ensure large populations of threatened species are protected. The presence of freshwater mussels in limited locations in Lakes Benmore and Aviemore should not change the activity status for the whole lake.
- (b) Water quality limits for the Waitaki Catchment should prevail over the region-wide limits in Schedule 8 and this should be explicitly stated.
- (c) Fish passage mitigation should not be restricted to allowing natural passage and should allow for other means for obligate diadromous species, such as trap and transfer.
- (d) Changes to Rules 5.141 to specify limits for sediment concentrations that apply past the first 4 hours do not take account of temporary activities that Meridian may need to undertake as part of its operations. I support the recommendation in the Section 42A report that the current conditions regarding periods of activity should be reinstated and allow for an appropriate mixing zone, as documented in Schedule 5.

A handwritten signature in blue ink, appearing to read 'M. James', is written over a light blue grid background.

Dr Mark James

Director, Aquatic Environmental Sciences Ltd

17 July 2020

References:

Dunn, N.R.; Allibone, R.A.; Closs, G.P.; Crow, S.K.; David, B.O.; Goodman, M.J.; Griffiths, M.; Jack, D.C.; Ling, N.; Waters, J.M.; Rolfe, J.R. (2018). Conservation status of New Zealand Freshwater Fishes, 2017. New Zealand Threat Classification Series 24, Department of Conservation, Wellington.