IN THE MATTER OF	**THE RESOURCE MANAGEMENT ACT 1991**
and	
IN THE MATTER OF	**A SUBMISSION ON THE PROPOSED HURUNUI WAIAU RIVER REGIONAL PLAN**
BETWEEN	**THE ROYAL FOREST AND BIRD PROTECTION SOCIETY OF NEW ZEALAND INCORPORATED (Forest and Bird)**
AND	**CANTERBURY REGIONAL COUNCIL**
EVIDENCE OF	**ALAN F. MARK FRSNZ, KNZM**
FOR	**FOREST AND BIRD**

Qualifications and Experience

I am Emeritus Professor in plant ecology at Otago University. While most of my research has dealt with various aspects of terrestrial ecology and the sustainable management of ecosystems, I have held several appointed positions dealing with the assessment of environmental impacts and research aimed at mitigation of adverse environmental effects.

Most relevant was a government-requested ecological/environmental assessment of the proposed raising of the levels of Lakes Manapouri and Te Anau, Fiordland National Park, for the purpose of increasing water storage for hydro-electric generation. Results were submitted to the government and later published in a series of papers in the 1972 Proceedings of the Ecological Society of New Zealand.

Final resolution of the major debate associated with this proposal came with my appointment in 1973 as Chair, for the first 26 years, of the Government-appointed Guardians of Lakes Manapouri, Monowai and Te Anau.

During this time lake management guidelines were developed, based on the available ecological and geomorphological information to integrate conservation with the hydro-electric development. These guidelines were formally accepted by the government in 1981 and gazetted on 14 April, 1993. Shoreline monitoring of both lakes, established in 1973 and periodically resurveyed, has been valuable in assessing the management guidelines.

These and other contributions have been recognised in several ways by my peers and the government, including the awards of FRSNZ (Fellow of the Royal Society of New Zealand) and KNZM (Knight of the New Zealand Order of Merit).

Scope of Evidence

I have prepared my evidence in accordance with the Code of Conduct for Expert Witnesses. My evidence is within my area of expertise.

My evidence will address issues raised by Forest and Bird relating to the inclusion in Zone C (and exclusion from Zone A) of the Upper Hurunui Catchment which includes Lake Sumner. In particular my evidence will describe:

- The ecological composition and significance of Lake Sumner and Loch Katrine forest margins.
- The potential impacts on vegetation of artificially manipulating lake levels within their natural range.

Background

I was originally asked to visit Lake Sumner and the hydrologically connected Loch Katrine in relation to a proposal by Hurunui Water Project to build a control structure or weir on it. The request was based on my earlier experience with the Fiordland Lakes Manapouri and Te Anau, particularly their shoreline ecology, and subsequently, as the initial Chair of the Government -appointed Fiordland Lake Guardians for the first 26 years and the development of management guidelines for these lakes within their natural ranges of 4.8 and 3.5m, respectively (Mark & Johnson 1985; Mark, et al. 2001).

The Manapouri-Te Anau case was subsequently adopted by the Ministry for the Environment as a model for planning the sustainable management of lake levels (James, Mark & Single 2002).

I have now been asked to consider the potential impact on vegetation of raising the water level of Lake Sumner and Loch Katrine for increased water storage, as I understand could

occur within Zone C in the proposed Hurunui Waiau River Regional Plan. I have limited my analysis to the manipulation of the lake levels within their natural range. The difference between the maximum and minimum recorded levels on Lake Sumner is approximately 3.2 metres.

Lake Sumner and Loch Katrine

Lake Sumner lies partly on the margin of the Lake Sumner Conservation Park of 105,131ha, and is largely surrounded by conservation land and indigenous forest and shrubland. It is the only relatively large lake (~14km^2) in Canterbury (and in the central-eastern South Island) which remains in its natural state, its levels entirely natural; unmanaged.

I spent one full day at the lakes on April 17, 2010 and circumnavigated the shorelines of both Loch Katrine and Lake Sumner with Mr Edward Snowdon. I made brief descriptions of the shoreline vegetation patterns, with more detailed studies at seven locations on Lake Sumner and two on Loch Katrine (see Map).

Mr Snowdon used a surveyor's level and staff to determine elevations of the prevailing water level, of a number of plant species and communities and of some beach profiles. Mr Snowdon recorded the prevailing lake level as being 2.875m below the official bench mark located above the southern shoreline near the Lake outlet, and 0.619m above the historical minimum of the Lake.

The lowest ever recorded lake level (12 April 1971) was 0.64 metres below the historical mean. The highest ever recorded lake level (14 September 1988) was 2.57 metres above the historical mean (Ward and Veendrick 2009). However such extreme lake levels occur naturally only occasionally and for short durations.

Many of the plants surveyed could be inundated should the lake level be raised within the natural range, which will be shown in more detail shortly.

Ecological composition and significance of Lake Sumner forest margins and potential impacts of artificially raising the lake levels.

The lake margin of Lake Sumner is a naturally (or historically) rare ecosystem type. The WERI (1978) database identified Lake Sumner as being of 'high national value'. Chadderton et al's (2004) classification of water bodies identified the Lake Sumner catchment as 'Type I': the majority of the catchment is 'nationally significant'.

In terms of the Hurunui District Plan criteria for assessing ecologically significant natural areas, in my opinion Lake Sumner and its margins are ecologically significant with the possible exception of small localised areas with a history of modification (between Shoal Bay and Home Bay; grasslands on the south side of the outlet and smaller areas at Charlies Point).

The zonation of the shoreline vegetation was generally distinct on both lakes, but more so on Lake Sumner and this is generally as described by Head (2011).

A distinctive ecological feature of Lake Sumner is the presence of two prominent lakeshore fringing stands of southern rata (*Metrosideros umbellata*) along the steep rocky faces to the east of Pinafore Bay and to the northwest of Breaksea Bay. The rata trees are relatively large (60cm dbh where measured on the rock face near Breaksea Bay) with typical dark green rounded canopies which were essentially touching the water surface and rooted only ~1.0m above the water level where measured. At least two adult (20cm dbh) kamahi (*Weinmannia racemosa*) trees were also seen associated with the rata near Breaksea Bay.

The presence of rata at Lake Sumner is notable as one of the relatively few in Canterbury, away from the main headwaters, as has been noted in the draft "Canterbury Crimson Trail" brochure produced by Dr Philip Simpson, an authority on trees of the genus *Metrosideros.* He cites the Lake Sumner rata stands as one of "four small isolated stands" in North Canterbury.

The presence of kamahi on the Lake Sumner shoreline, by contrast, was not well known (it generally has a much more restricted distribution east of the Southern Alps) and is an even more notable ecological and floristic feature of the Sumner lakeshore vegetation. As Peter Wardle states in the "Vegetation of New Zealand" (1991; p. 132) "several important drought- or frost-sensitive species are rare or absent in the east of the South Island, notably kamahi, southern rata, …". Like the rata, kamahi is confined to the lakeshore forest margin (two trees seen at Breaksea Bay) and would be threatened if the lake were raised to the extent of its natural range.

Head (2011) describes a lake-edge rata community on the northern edge of Breaksea Bay containing kamahi and several other more common forest species, which Keesing (2011b) for Boffa Miskell Ltd also considered "distinctive" (4.3.1).

Other forest species in this Breaksea Bay stand; Hall's totara (*Podocarpus cunninghamii*) lancewood (*Pseudopanax crassifolius*) and *Olearia avicenniaefolia* were also growing at an elevation (~1.4m above the lake level) where they would be inundated for extended periods, and probably killed if the lakes were managed for unnaturally long periods at or near the upper extent of their natural range.

Details of the Manapouri-Te Anau lakeshore studies (Mark et al. 1972) and plant mortality associated with guideline exceedence through unnatural flooding of Lake Te Anau in 1975 (Mark et al. 1977), confirmed the vulnerability of mountain beech, kamahi, Hall's totara and lancewood, among several other lakeshore species, to root submergence in excess of 14-125 continuous days. No such information was obtained for rata due to its restriction on those lakes to rocky bluffs well above the lakes.

Mountain beech (*Nothofagus solandri* var. *cliffortioides*) is the common dominant of the surrounding forest, with red beech (*N. fusca*) somewhat more localised where the margins are forested, essentially continuous along the northern side of Lake Sumner and more scattered elsewhere. In most of the seven places studied, several trees of both beech

species predictably would succumb to artificially prolonged high lake levels or raised lake levels, based on the Manapouri-Te Anau information for mountain and silver beech (*N. menziesii*).

At all seven sites studied on Lake Sumner and the two on Loch Katrine, shrubs of *Coprosma propinqua*, often with kowhai (*Sophora microphylla*) trees upslope, were a feature of the sandy beaches fronting the forest, and at all but one location, these were growing at elevations which could be inundated by the lake levels in the upper third of their natural range. Neither of these species would likely tolerate such partial inundation for long periods, based on the Manapouri-Te Anau information.

Manuka (*Leptospermum scoparium*), which is common along the Loch Katrine shore and more locally on Lake Sumner, is relatively tolerant of inundation but would likely succumb to extended inundation near the maximum level, while kanuka (*Kunzea ericoides*), which is common along the southern shore of Lake Sumner, is much less flood tolerant than manuka (Cook, et al. 1980) and would very likely sustain considerable losses if its roots were inundated for more than a few days.

The herbaceous species of the generally sparsely vegetated turf and sedge zones on the outer edges of the lakeshores, are considerably more flood tolerant than the woody species further back from the lake edge, and many might survive extended periods (>350 days) of inundation based on the Manapouri-Te Anau records. However, most are likely to have tolerance limits to inundation and most may only reproduce when exposed. Lake raising may therefore also impair the species of these lower zones where at least one threatened species, *Carex tenuiculmis*, resides (according to Keesing (2011b)).

The occurrence of at least one well defined storm beach at Breaksea Bay is an important geomorphic feature of the Sumner lakeshore, which indicates the dynamic nature of the lakeshore within its natural regime of lake levels. This gently-sloping beach reached a height 2.53 m above the prevailing lake level some 11m back from the lake margin before lowering 63 cm over the next 5m and then rising very gradually by 96cm over the

next 15m, and with a similarly gentle upslope beyond. A sizeable kowhai tree, 28cm dbh, fronted the forest, with a large red beech tree, 80cm dbh, among several others near the crest, and mountain beech, broadleaf (*Griselinia littoralis*) and *Coprosma linariifolia* prominent on the back face. Such beaches are a natural lakeshore feature which develop in equilibrium with the lake's dynamics and fetch, as with the Fiordland lakes, which would likely be lost if lake levels were manipulated.

I should emphasise that the shoreline vegetation zonation pattern of plant communities on Lake Sumner and Loch Katrine margins, described above, are an integral part of their distinctive and ecologically significant lakeshores. Taken cumulatively, the effect of losing this vegetation component would constitute a very significant environmental impact

Conclusions

My professional assessment as outlined above, leads me to conclude that artificially prolonging the natural levels within the upper range for Lake Sumner and Loch Katrine to increase water storage, could have adverse effects on the distinctive lake edge vegetation and its zonation pattern. In particular it could:

- Adversely affect two prominent and ecologically significant lakeshore fringing stands of southern rata (*Metrosideros umbellata*) along the steep rocky faces to the east of Pinafore Bay and to the northwest of Breaksea Bay.
- Cause other forest species in this Breaksea Bay stand; notably Halls totara (*Podocarpus cunninghamii*), lancewood (*Pseudopanax crassifolius*) and *Olearia avicenniaefolia* to die.
- Cause mountain beech (*Nothofagus solandri* var. *cliffortioides*) and red beech (*N. fusca*), which are almost continuous along the northern side of Lake Sumner and scattered elsewhere, to die.
- Cause fringing kowhai (*Sophora microphylla*) and shrubs of *Coprosma propinqua* to die at multiple locations around both lakes.

- Cause considerable mortality of lake-margin manuka (*Leptospermum scoparium*) and kanuka (*Kunzea ericoides*).
- Cumulatively, cause the loss of a very distinctive and significant element of the natural zonation of indigenous vegetation surrounding Lake Sumner.

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