Hurunui Water Project

Document 2 in a series of 5

Preliminary scoping of potential effects on marginal vegetation of Lake Sumner as a result of the proposed Hurunui Water Project

Report prepared by Boffa Miskell Ltd

for

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North edge of Lake Sumner (BML 2009)

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Executive Summary

1. This document has been prepared to provide a summary of the preliminary assessment of the potential effects on marginal vegetation of Lake Sumner of the proposed Hurunui Water Project (HWP). It supplements a separate report that describes the botanical values and significance of Lake Sumner (Boffa Miskell 2011). The information presented here summarises and updates that was presented in the HWP Assessment of Environmental Effects (AEE). However, this document does not constitute a full assessment of the effects of the proposed lake level regime.

2. With the HWP, the mean lake level is predicted to increase by 0.75 m. The proposed design storage level for the maximum storage of irrigation water is 543.75 m RL, which is 1.4 metres higher than the historical median lake level. With the HWP, Lake Sumner would be held at or above 543.75 for 34.6% of the time, whereas historically it has exceeded this level 0.2% of the time.

3. The ecological investigations and assessment of effects is not complete for Lake Sumner and the control gate construction works. However, a number of potential adverse ecological effects have been identified at this stage. These include:

    a) The likely loss of up to 0.25 ha (8%) of kowhai trees along the lake edge, and the consequent loss of a food resource for birds such as tui, bellbird, and kereru.

    b) Changes in distribution and species composition of turflands along the lake edge.

    c) The loss of between 1 ha and 10 ha of kanuka shrublands from construction of the diversion channel at the lake outlet.

    d) The potential loss of most of southern rata along the lake edge (0.3 ha of 0.4 ha).

    e) The potential changes in the character of the lower slopes of a Schoenus wetland between Lake Sumner and Loch Katrine (1 ha).

    f) A potential for the lower forest edges (e.g. in the Northeast and Rata Bays) to suffer dieback as a result of inundation.

4. Overall, these effects would combine to result in a loss of diversity in the lake and forest-edge ecotone, and a move to a narrower, simpler ecological community.

5. The proposed increases in lake levels could possibly result in some upward movement in the range of aquatic macrophytes over time, but the overall area, distribution and species composition of macrophytes is unlikely to change significantly.

6. A mitigation and monitoring programme has not yet been developed for the project, but some options include:

    a) Implementing a planting and protection programme at both the lake head delta where pasture grasses are dominant, and around Loch Katrine and the lake outlet, with a focus on kowhai and other bird resource species would assist .

    b) Developing a restoration/rehabilitation programme to restore the area where diversion works are undertaken at the lake outlet, along with legal protection to place the area finally rehabilitated into protection.

    c) At the delta, to secure a more complete lake edge, it is recommended that the new 'dry' edge, set back at least 100 m from the lake edge, be legally protected and fenced from grazing and that this margin be used for the establishment of kowhai and the support of the porcupine shrublands as well as securing a new beach edge.

7. If some Southern rata trees die from inundation, it unlikely that this loss of these trees could be mitigated. It may be worth trialling re-planting of rata, but even if successful it would take many decades before the lake edge rata would be re-established. If some trees were lost, this may not constitute a significant adverse effect in its own right, although it would contribute to the overall adverse effects on the lake edge ecotone.

8. Monitoring of the species composition, survival and change in pattern of the Schoenus/ Carex wetland around the channel between Loch Katrine (as well as other areas) would be required to detect any adverse effects. Should adverse effects be detected, remedial actions would be required

9. While some of the various effects could be mitigated, overall, these effects would combine to result in a loss of diversity in the lake and forest-edge ecotone, and a simpler ecological community. The beach would become narrower, and this would entail some loss of plant communities from this habitat. The plant communities of the modified lake edge would eventually become more diverse, although this process would take a very long time (decades at least).

1. Introduction

This document has been prepared to provide a summary of the preliminary assessment of the potential effects on marginal vegetation of Lake Sumner of the proposed Hurunui Water Project (HWP). It supplements a separate report that describes the botanical values and significance of Lake Sumner (Boffa Miskell 2011). The information presented here summarises and updates that was presented in the HWP Assessment of Environmental Effects (AEE). In particular, more detailed contour data have been obtained and the proposed storage regime has been modified since the AEE was prepared. These changes enable a more accurate estimate of the areas of various vegetation types that would be affected by the inundation as a result of increased lake levels with the HWP, and this is the primary effect addressed here.

It is important to recognise that this document does not constitute a full assessment of the effects of the proposed lake level regime. Vegetation surveys and mapping have not been completed around the lake, especially within the exposed beaches. Similarly, details of the location and magnitude of construction activities, and the potential effects of earthworks, stormwater discharge and other activities have been considered in general terms, but detailed plans have yet to be developed. Options for mitigation or monitoring have not been fully developed, but this report outlines some of the more obvious mitigation actions that could be made.

2. Hydrological effects

The following summary is based on hydrological investigations conducted by Pattle Delamore Partners (PDP), as summarised in a memorandum from PDP to Amanda Loeffen, dated 15 February 2011. All lakes levels cited here are relative levels (RL). We are aware that the accuracy of the lake level datum and contours has been questioned by some parties in March 2011. We have sought, and received assurances from Riley's Associates that the contour data we have used in preparing vegetation inundation maps is sound, and we have proceeded on the assumption that this is the case. However, should the lake level datum or any other survey data be updated or corrected, our analyses would need to be updated accordingly.

The historical mean level of Lake Sumner is 542.42 m and the median is 542.35 m, based on records from 1956 to 1972 and 1986 to 1992. The recorded range is 3.21 m, from a minimum of 541.78 m on 12 April 1971 to a maximum of 544.99 m on 14 September 1988. Most of the time (88.5%), the lake level has been between 542.0 m and 543.0 m (Table 2, Figure A).

With the HWP, the mean lake level is predicted to increase by 0.75 m, based on hydrological simulations for the period 1972 to 2008 (Table 1). The proposed design storage level for the maximum storage of irrigation water is 543.75 m RL, which is 1.4 metres higher than the historical median lake level. With the HWP, Lake Sumner would be held at or above 543.75 for 34.6% of the time, whereas historically it has exceeded this level 0.2% of the time (Table 2, Figure A).

Table 1. Natural and modified modelled average monthly lake levels (1972-2008)			
Month	**Natural (estimated) RL (m)**	**Modified RL (m)**	**Estimated increase in average monthly water level (m)**
January	542.39	543.04	0.65
February	542.22	542.73	0.50
March	542.18	542.73	0.55
April	542.26	543.15	0.89
May	542.32	543.45	1.14
June	542.40	542.62	0.22
July	542.32	542.33	0.01
August	542.36	543.23	0.87
September	542.44	543.58	1.14
October	542.60	543.65	1.05
November	542.56	543.59	1.03
December	542.47	543.38	0.92
Year	542.38*	543.13	0.75

* The modelled lake level mean differs slightly from the historical record (542.42 m) because the two statistics are based on different periods.

Table 2: Lake Sumner level duration and volumes (1972-2008)			
RL (m)	**Volume (Million m³) of storage**	**% of time level exceeded**	
		Unmodified (estimated)	**With storage**
544.5	37.1	0.008%	0.1%
544.25	33.75	0.03%	0.3%
544.00	30.4	0.1%	0.6%
543.75	27.0	0.2%	34.6%
543.50	23.6	0.6%	48.8%
543.25	20.2	1.7%	54.2%
543.00	16.7	4.7%	58.7%
542.75	13.3	11.6%	64.8%
542.50	9.9	28.8%	71.9%
542.25	6.4	60.1%	83.7%
542.00	3.0	93.2%	96.1%

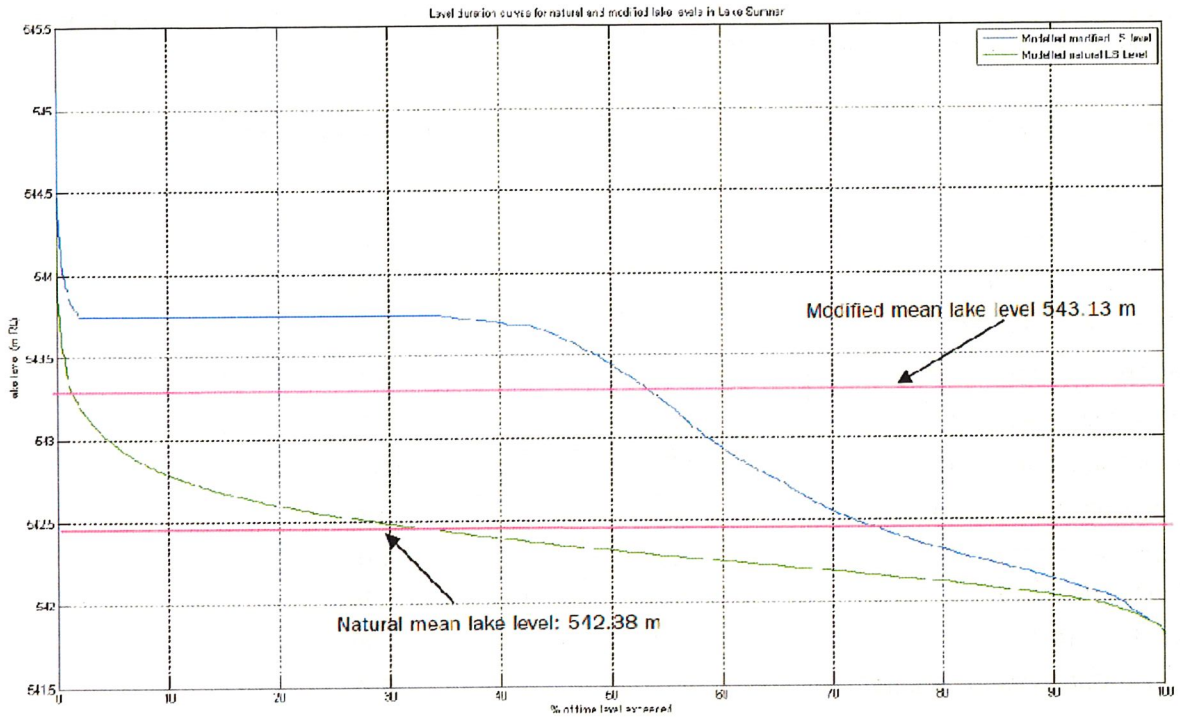

Figure A. Lake level duration curve for natural and modified Lake Sumner Levels.

Lake levels in all months except July are predicted to be greater with the HWP than historically. PDP summarised the seasonal effects as follows:

a) *June and July: The control gate is open and lake levels are similar to the natural levels.*

b) *August – December: The control gate is closed from 1st of August and inflows into the lake are high and irrigation demand is moderate relative to the availability of run of river water. Average lake levels in this period are approximately 1 m higher than in the natural situation.*

c) *January – March: Lake levels are only 0.5 to 0.6 m higher than the natural situation due to large irrigation releases coupled with low inflow into the lake.*

d) *April – May: Lake levels are approximately 1m higher than the natural situation due to irrigation demand being lower and inflow into the lake being higher than in the peak summer months.*

3. Vegetation Inundation

Figures 1 to 11 (Appendix 1) show locations of vegetation survey transects, cross sections of vegetation at these transect, and the area that would be inundated at the design storage level, which is 1.4 m higher that the historical median lake level. These maps are based on vegetation surveys, and current aerial photography, and are mapped using 1 m contours.

We have used the proposed design storage level in the inundation maps to provide an indication of the areas of various vegetation types that could potentially be affected as a result of the HWP. However, it is important to recognise that the precise relationship between plant community composition and the timing, duration, magnitude and frequency of inundation is complex and poorly-understood. Thus, inundation maps provide only a broad indication of the potential effects of the proposed lake level changes.

Table 3: Estimated areas of various vegetation types that would be inundated at the proposed design storage level of 543.75.

Vegetation type	Total area measured	Area inundated (ha)
Agrostis grassland	105	27
Mixed beech forest	*	0.9
Red beech forest	*	0.05
Mountain beech forest	*	2.4
Mixed hardwood scrub	4.5	0.7
Divaricating shrubland	16.8	0.1
Kanuka/manuka scrub	16.4	<0.001
Manuka/kowhai scrub	6.1	0.2
Schoenus sedgeland	2.3	1.0
Juncus rushland	21.7	0.02
Kowhai forest	1.1	0.05
Leptinella/Gunnera turfland**	1	0.7
Rata forest	0.4	0.3
	175.3	33.4
Gravels	20	16.5

*Total area of beech forest is not presented because it forms extensive cover up the valley sides.
** Not mapped in detail.

An estimated 33.4 ha of vegetation and 16.5 ha of cobble beach would be inundated at the design storage level (Table 3).

Most (80%) of the cobble beaches that are currently periodically exposed would be inundated. These beaches also support scattered turf communities, which, although not yet been mapped in detail, would also mostly be inundated at the design lake level. These turf communities will already experience some level of inundation, although it is likely that the changed lake level regime would result in some shifts in their distribution and species composition.

Some or all of the kowhai-Coprosma communities found on the lower beaches, would probably be lost. Whilst these communities may be able to tolerate inundation for over 90 days (Johnston 1972), it is likely that most in the current beach vegetation fragments would eventually die because of the longer duration of inundation with the HWP. The majority of the lower-beach community lies on the northern edges of the lake and particularly at the north-western and north-eastern corners. Other kowhai are scattered along the northern and southern shores and are also often found on the forest edge along the upper beach. The kowhai along the upper beach are more likely to survive because they would be inundated for less of the time.

In addition to the 1.1 ha of mapped kowhai forest, we estimate that a further 2 ha of kowhai are scattered around the lake, making a total of approximately 3 ha of kowhai around the lake margins. Of these 3 ha of kowhai, we estimate that up to 0.25 ha (8%) would be inundated at the design storage level. Note that these estimates update those in the AEE, which estimated a loss of 40% of a total of 3.75 ha. The updated figures are based on a boat-based survey and more detailed aerial photographic analysis.

Most of the Southern rata on the lake margin (0.3 ha of 0.4 ha) could potentially be affected by lake level increases, although it is unclear to what extent their root zone, would be affected.

Thus, the lake water level increase under the proposed storage regime would adversely affect turf vegetation on the beaches (a band 1 – 2 m wide in some locations), kowhai and broadleaf near the lake edge, browntop-dominated grasslands, 1.0 ha of *Schoenus* wetland in Loch Katrine, and potentially a narrow band of lower slope beech forest and Southern rata near the lake-edge.

4. The proposed Lake Sumner control gate

The effects of constructing a temporary diversion passage to allow the construction of a control gate would result in the loss of approximately 1 ha of relatively diverse indigenous-dominated divaricating shrublands on the north side of the Hurunui River at the lake outlet. An area of mixed mountain and red beech forest vegetation on the flat land near the lake outlet is significant in terms of Section 6c of the RMA (using the Hurunui District Plan criteria). It is recommended in the draft AEE that those areas be avoided by the construction works.

5. Submerged vegetation

Submerged aquatic macrophytes have been surveyed and described in detail for Lake Sumner, Lake Sheppard and Lake Marion, by De Winton *et al.* (1991). We have had no opportunity to verify the persistence of the pattern of those surveys or to whether the recorded weed, *Elodea*, has expanded its range over the native species. However, from near-shore surveys by boat we have observed beds of *Elodea*, *Myriophyllum*, *Glossostigma* and *Ranunculus*. *Elodea* is most prominent in the western-northern area. The proposed increases in lake levels could possibly result in some upward movement in the range of these species over time, but the overall area, distribution and species composition of macrophytes is unlikely to change significantly.

6. Potential Mitigation

The ecological investigations and assessment of effects are not complete for Lake Sumner and the control gate construction works. However, a number of potential adverse ecological effects have been identified at this stage.

1. The likely loss of up to 0.25 ha (8%) of kowhai trees along the lake edge, and the consequent loss of a food resource for birds such as tui, bellbird, and kereru.
2. Changes in distribution and species composition of turflands along the lake edge.
3. The loss of between 1 ha and 10 ha of kanuka shrublands from construction of the diversion channel at the lake outlet.
4. The potential loss of most of the southern rata along the lake edge (0.3 ha of 0.4 ha).
5. The potential changes in the character of the lower slopes of the Schoenus wetland between Lake Sumner and Loch Katrine (1 ha).
6. A potential for the lower forest edges (e.g. in the Northeast and Rata Bays) to suffer dieback as a result of inundation.

It is may be possible to mitigate for the loss of kowhai trees by re-planting. It is possible to improve the two more modified lake marginal areas (the delta and lower outlet area) as a form of off-setting for general losses and changes. It is also possible to restore vegetation affected by the construction works.

Implementing a planting and protection programme at both the lake head delta where pasture grasses are dominant, and around Loch Katrine and the lake outlet, with a focus on kowhai and other bird

resource species would be a beneficial action and in total may be accepted as an off-set to for the overall changes in the lake-edge ecotone changes. Kowhai as a food source for birds would not be satisfactorily re-established for many years (perhaps 20), but given the relatively small proportion of the total amount of kowhai that would be affected, this is unlikely to cause significant adverse effects on birds.

In regard to the diversion works, a full restoration / rehabilitation programme would be recommended (assuming the more valued areas within that site are avoided) along with a legal protection mechanism to place the area finally rehabilitated into protection (it is our understanding that it is currently private land). That area would require planting of specific species including kowhai. Weed control and monitoring of planting success and natural re-establishment would be required for at least 10 years.

A restoration programme would be required to be drawn up by a suitable qualified and experienced practitioner, in consultation with DOC. It should be possible to return the same or better habitat to the outlet area following works (so long as the tall forest elements are avoided).

At the delta, to secure a more complete lake edge, it is recommended that the new 'dry' edge, set back at least 100 m from the lake edge, be legally protected and fenced from grazing and that this margin be used for the establishment of kowhai and the support of the porcupine shrublands as well as securing a new "beach" edge.

If some Southern rata trees die from inundation, it unlikely that this loss could be mitigated. Rata are large, slow-growing trees that cling onto rocky shores, and we are not aware of any examples of replanting of this species in this environment. It may be worth trialling re-planting of rata, but even if successful it would take many decades before the lake edge rata would be established. If some rata trees were lost, this may not constitute a significant adverse effect in its own right, although it would contribute to the overall effects on the lake edge ecotone.

The changed lake level regime might result in some dead trees around the lake edge, but the presence of such dead trees would not present an ecological problem.

Monitoring of the species composition, survival and change in pattern of the *Schoenus/Carex* wetland around the channel between Loch Katrine (as well as other areas) would be required to detect any adverse effects. Should adverse effects be detected, remedial actions would be required

While some of the various effects could be mitigated , overall, these effects would combine to result in a loss of diversity in the lake and forest-edge ecotone, and a simpler ecological community. The beach would become narrower, and this would entail some loss of plant communities from this habitat. The plant communities of the modified lake edge would eventually become more diverse, although this process would take a very long time (decades, at least).

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01.04.2011

7. Literature cited

Boffa Miskell, 2011 Hurunui: Lake Sumner and its margins preliminary description and assessment of ecological value and significance. Prepared by Boffa Miskell Ltd for HWP.

Burrows, L and Johnson, P. 2008/2009. Assessment of effects on shoreline vegetation of proposed Manapouri tailrace amended discharge (MTAD) Final report. Landcare contract report LC0708/107.

APPENDIX 1. Figures 1 – 11.

Note that, due to the scale of the printed maps, the forested margins and beaches, especially along the northern side of the lake, are difficult to discern. Overhanging tree canopy often obscures the beach.