BEFORE THE ENVIRONMENT COURT

Decision: [2016] NZEnvC 185

IN THE MATTER	ENV-2016-WLG-000004 of an appeal under section 120 of the Resource Management Act 1991
BETWEEN	HOKIO TRUSTS Appellant
AND	MANAWATU-WANGANUI REGIONAL COUNCIL Respondent
AND	MANAWATU-WANGANUI REGIONAL COUNCIL Applicant

Court	Environment Judge B Dwyer Environment Commissioner I Buchanan Environment Commissioner K Prime
Hearing	At Palmerston North on 23, 24, 25 and 26 May 2016
Appearances:	Ms S Johnston and Ms J Avery for the Council as applicant Mr N Jessen and Ms C McHardy for the Council as respondent Mr L Watson for Hokio Trusts
Date of Decision:	22 SEP 2016
Date of Issue:	22 SEP 2016

DECISION OF THE ENVIRONMENT COURT

A: Appeal declined

B: Costs reserved

THE SEAL OF THE ENVIRONMENT COURT OF NEW ZEALAND

Introduction

[1] In December 2015 independent commissioners for Manawatu-Wanganui Regional Council (the Council) (acting as regulatory authority) granted consents for restoration activities at Lake Horowhenua to the Council's operational division. These involved a fish pass at the lake outlet to the Hokio Stream, a sediment trap on the Arawhata Stream prior to its discharge to the lake and weed harvesting and associated activities within the lake.

[2] Lake Horowhenua is a vital taonga to Muaupoko iwi. It is also a significant recreational asset. Water quality in the 2.9 km^2 lake has been compromised for many years by the discharge of treated sewerage (1960s to 1987) and inputs from the surrounding 61 km^2 catchment, including Levin's stormwater, intensively cropped land and dairy farming. At times toxic cyanobacteria blooms, often referred to as *blue/green algae blooms,* close the lake to recreational use. These blooms are linked to the dense growth of lake-weed generated by the large internal stores of nutrient in lake sediments from past inputs and ongoing contribution from the catchment.

[3] Water quality issues led to the development of He Hikio Rerangi Tahi – the Lake Horowhenua Accord (2013) and its associated Action Plan (2014-2016) by local iwi, District and Regional Councils and the Department of Conservation.

[4] Successful applications to the Government's Freshwater Clean-up Fund and the Te Mana o te Wai Fund to implement projects within the Action Plan umbrella were achieved in 2014 and 2015 respectively. The activities subject to this appeal form part of a suite of eight projects under the Clean-up Fund.

[5] Lake-weed harvesting is proposed as a key action to address toxic conditions for aquatic life from ammonia and cyanobacteria. It is designed to reduce the influence of weed (via photosynthesis) on lake chemistry (particularly pH) and reduce the amount of weed that dies back during the summer, thus limiting the release of phosphorus from lake sediments at a critical time. Boat ramps are proposed at two locations (Lake Domain and Arawhata Stream mouth) to provide access for the weed harvester.

[6] The Arawhata Stream contributes a major portion of the total sediment entering the lake annually. The proposed sediment trap near the Arawhata Stream

mouth is designed to reduce the amount of sediment and associated nutrients, mainly phosphorus, entering the lake.

[7] The fish pass is designed to improve access to the lake for native fish that access the sea as part of their life cycle and for flounder and mullet moving upstream to the lake from the sea. The fish pass is to be constructed adjacent to the lake level controlling weir at the outlet to the Hokio Stream, providing a suitable gradient for fish to pass around the weir.

[8] The suite of consents granted to the Council was appealed by Hokio Trusts. Ms A-M Hunt and Ms C Moriarty (for Hokio Environment and Kaitiaki Alliance - HEKA) provided submissions as s 274 parties in support of the appeal. Dr J N Proctor (a lakeside landowner and trustee of the Lake Trust), Mr M J Sword (Chairman of the Lake Trust) and Mr R P Warrington, (Chairman of the Muaupoko Tribal Authority) provided statements of evidence as s 274 parties in support of the Council's applications.

[9] Primary matters at issue under the appeal emerged from an interchange of memoranda between the parties and the Court prior to the hearing and clarified as the hearing progressed. These were:

- What is the risk of significant adverse ecological effects developing as the result of granting consent?
- Are there adverse effects from the proposals on tangata whenua values?

[10] In a Minute of the Court (20 May 2016) the Court directed:

> [5] I have now had the opportunity of reading the evidence to be advanced at the hearing. Much of the evidence pertains to historical matters, ownership, mandate authority and consultation. These are obviously significant issues for the parties and important background material for the Court. However, I consider that they are diversions from the determinative matter before the Court, namely whether or not the specific proposals under appeal achieve the sustainable management of Lake Horowhenua. I consider that determinative matter is neatly encapsulated in para 18(c) of the evidence of Mr P N Thomas (noting that the Appellants dispute the conclusion in the second sentence of that para).

[6] Accordingly, I consider that evidence on the topics identified in the second sentence of para 5 (above) should form part of the record but should not be subject to cross examination. On that basis I understand that the primary matter in evidential dispute will relate to the scientific/ technical aspects of the weed mowing proposal advanced by Dr Gibbs as opposed to Mr Chisholm's no mowing solution.

[11] Mr Thomas was the Council's planning witness. The relevant passage of his evidence is:

> While there are a range of opinions within hapu on the appropriate strategies for the restoration of the lake, there is agreement that restoration needs to occur. Overall, the scientific evidence on balance supports the proposed restoration activities (and wider Accord strategy) and as a result will help restore the mauri of the Lake.

[12] The hearing followed this protocol, with all evidence related to historical relationships received by the Court without cross-examination. The Court determined at the opening of the hearing that no priority would be given to the evidence from any individual Maori group or groups party to these proceedings. The Court considered that all had a relationship to Lake Horowhenua and its surrounding land as ancestral land and water.

Activity Status

[13] Expert planning witnesses Mr Thomas for the Appellant and Ms C Foster for the Respondent prepared a joint witness statement to assist the hearing.[1] This set out the activity status for the sets of activities within each of the three consent applications and advised that these should be considered on an individually bundled basis.

[14] The planning witnesses agreed that on a bundled basis the fish pass had to be considered as a non-complying activity; land disturbance associated with the construction, maintenance and operation of the Arawhata Stream sediment trap and associated access road was a discretionary activity and activities associated with weed harvesting including vehicle access and boat ramps were to be considered as a non-complying activity. We have accepted the planners' agreed views in that regard.

[1] Joint witness statement recording conferencing of RMA Planners, 16 May 2016 - (JWS Plannning).

Matters to be considered

National Policy Statement–Freshwater Management (NPS–FM).

[15] Policy A2 of the NPS-FM requires that where freshwater objectives set under the provisions of the National Objectives Framework (NOF) by a Regional Council are not being met the Regional Council is to specify targets and implement methods to improve water quality. Application of the Attribute Tables for water quality parameters included in Appendix 2 of the NPS–FM places Lake Horowhenua in Band D for all indicator parameters,[2] which is below the bottom line requiring remedial action by the Council

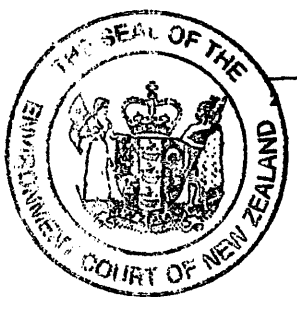
One Plan

[16] Chapter 2 (Te Ao Maori) sets out provisions relevant to the relationship of hapu and iwi to their ancestral lands, water, sites, waahi tapu and other taonga. Objective 2-1 and Policies 2-1 (relationships), 2-2 (wahi tapu) and 2-3 (mauri) have particular relevance in this case. Table 2.1(c) identifies the ongoing degradation of Lake Horowhenua as an issue of significance to hapu and iwi.

[17] Chapter 5 covers the Management of Water. Objectives 5-1 (Water Management Values), 5-2 (Water Quality) and 5-4 (Beds of Lakes and Rivers), together with their implementing policies and methods, are of particular relevance. Policy 5–4 provides for enhancement where water quality targets in Schedule E are not met. Method 5–6 describes how the Regional Council is to approach the protection and enhancement of Lake Horowhenua in collaboration with other agencies.

[18] In Chapter 6 – Indigenous Biodiversity. Objective 6-2(c) promoting rehabilitation and restoration of indigenous habitats is of particular relevance, as are the objectives and policies in Chapter 13 as Lake Horowhenua is defined as a threatened habitat In Schedule F1. Policies 13-4(b) and 13-5 provide assessment and decision making criteria for granting of consents in threatened habitats.

[19] Chapter 16 on water diversion is relevant for the diversion of water through the sediment trap on the Arawhata Stream, and Policy 17-1 in Chapter 17 covering



[2] Water quality parameters in Band D include Total Phosphorus, Total Nitrogen, Total Ammonia Nitrogen (TAN), Chlorophyll *a* and cyanobacteria.

activities in the beds of lakes and rivers sets out consent decision making provisions for the construction and operation of the sediment trap and boat ramps.

RMA

[20] Section 104D is applicable as two of the consents applied for include non-complying activities. We must either be satisfied that any adverse effects are no more than minor or that the proposals are not contrary to the Objectives and Policies of the One Plan. If the Gateway tests of s 104D are achieved, s 104 applies.

[21] Section 104 sets out matters the Court must have regard to when considering an application for a resource consent. Considerations under s 104 are subject to Part 2 of the Act which sets out the purposes and principles of the legislation. The following matters are relevant to this application:

- any actual and potential effects on the environment of allowing the activity - s 104(1)(a);
- any relevant provisions of the National Policy Statement, Freshwater Management - s 104(1)(b)(iii);
- any relevant provisions of the One Plan – s 104(1)(b)(v) and (vi); and
- any other matter considered relevant – s 104(1)(c).

Finally, the Court must have regard to the commissioners' decision under s 290A RMA.

Issue 1. What are the risks of significant environmental effects from sediment control and weed harvesting?

[22] We heard extensive technical evidence from Dr J K F Roygard (freshwater scientist and project manager), Dr M M Gibbs (water quality scientist), Mr G J McLean (environmental consultant) and Mr L A Brown (ecologist) for the Council as Applicant. Dr D J Kelly (freshwater scientist) provided evidence for the Council as Respondent. We also heard from Mr W P Chisholm (environmental consultant) for Hokio Trusts.

[23] Dr Gibbs usefully described the current degraded state of water quality in the lake. This is summarised as having a mean annual Trophic Level Index (TLI) of 6.42 (hypertrophic) for the 2014 year.[3] The TLI ranged from 4.95 (eutrophic) in

[3] The TLI values are a lake classification assessment system used for comparison of lakes around New Zealand. The TLI value is the average of the logarithmic

winter to 7.55 (hypertrophic) in summer. The winter TLI represents a clear water macrophyte dominated state while the hypertrophic summer TLI represents a highly turbid algal dominated state. In a phenomenon referred to by the experts as *flipping*, Lake Horowhenua naturally flips between the two potentially stable states on an annual basis. The algal dominated state develops in summer and then resets to the macrophyte dominated state in winter.

[24] The exotic species *Potamogeton crispus* is the dominant aquatic macrophyte in the lake with dense beds covering some 30 per cent of the lakebed. *Elodea canadensis* (oxygen weed) is also present. Potamogeton has a unique growth cycle in that it continues to grow during winter and dies down during summer when other plants are in full growth. The collapse of the plant onto the lakebed in early summer causes local anoxia (anaerobic conditions) that allows phosphate phosphorus[4] to be released from the sediment. This creates high phosphate concentrations in the water column in warm weather conditions ideal for cyanobacteria growth. Toxic bloom conditions develop as a result.

[25] As part of a comprehensive long-term strategy for the restoration of the lake, two short-term remediation proposals have been developed to reduce or eliminate the cyanobacteria blooms. These in-lake interventions, weed harvesting and reduction of sediment input by the installation of a sediment trap, are the subject of the applications and appeals in this case.

[26] It is important to note here that these short-term in-lake interventions are designed to have an immediate effect to prevent further degradation of the lake. A range of long-term interventions have also been initiated to address the root cause of the degraded water quality, including catchment management strategies to reduce nitrates entering the lake through groundwater and stream inflows; the introduction of farm management plans to address sediment runoff from crop and horticultural land; and effective management and treatment of stormwater from Levin. These ongoing actions are not part of the subject consents for these appeals.

Sediment Trap

[27] The proposed sediment trap is to be located in the flood plain adjacent to the Arawhata Stream between Hokio Beach Road and Lake Horowhenua. The design of

transformation of the concentrations of Total Nitrogen (TN), Total Phosphorus (TP), Chlorophyll *a* and Water Clarity measured by Secchi depth.
Dissolved Reactive Phosphorus – DRP.

the sediment trap is described in detail in the evidence of Mr J D Bell, a Senior Design Engineer at the Council. In brief, a low flow culvert is to be installed in the Arawhata Stream 100m downstream of Hokio Beach Road to divert flood waters through four cells constructed in the adjacent paddock. Sediment laden floodwater flow is impeded through the trap allowing larger particles to fall out of the water column. Grass lining will enhance the roughness of the trap causing some of the finer sediments to settle out as well. Remaining fine sediments will drain back with the water to the Arawhata Stream and the lake.

[28] Mr Bell calculated that the trap would remove approximately 50 per cent of sediments from the Arawhata Stream catchment from entering the lake. Any phosphorus bound to the sediment particles is also removed. The capacity of the sediment trap is to be maintained by the periodic mechanical removal of the trapped sediment.

[29] Dr Gibbs agreed with Mr Bell's estimate of the efficacy of the trap in reducing sediment inflow by 50 per cent, representing 25 per cent of the total sediment currently entering the lake from all sources. Dr Gibbs further estimated that this sediment would contain more than 30 per cent of the annual phosphorus load to the lake.[5] In his opinion this will significantly reduce replenishment of the legacy phosphorus held in the lake sediments and hence reduce the potential for higher cyanobacteria blooms in the future. Dr Gibbs and Mr Bell considered that the operation of the sediment trap will have no adverse effects on the lake.

[30] The installation and operation of the sediment trap was not considered in expert evidence from the Hokio Trusts. Mr P Taueki (Trusts' Chairman) raised in his evidence the preference for preventing sediments and associated phosphorus from entering the Arawhata Stream drainage system at source. This approach was supported by HEKA and Ms Moriarty in submissions and explored by Mr Watson in cross-examination of Mr Bell, Dr Roygard and Dr Gibbs.

[31] Mr Taueki identified concerns regarding the environmental deficiencies of using sediment traps although he did concede under questioning from Ms Johnston that he:

[5] Gibbs EIC at para 145.

> ... would support the sediment trap because it does reduce 25% of what sediment comes down from the Arawhata Stream, so it does make a – yeah, it does help a bit ... .[6]

[32] Dr Gibbs and Mr Bell agreed that catchment-wide actions to reduce sediment and nutrient runoff were critical to the long-term restoration of Lake Horowhenua. In their opinion strategies developed for the Accord Action Plan supported by provisions in the One Plan, already initiated in the Arawhata catchment, will result in significant reduction in sediment runoff over the long-term.

[33] In the short-term, the installation of the sediment trap at Hokio Beach Road will provide more immediate benefits in reducing sediment inflows, giving the more extensive catchment treatment time to take effect. Over the long-term, both strategies will complement each other in preventing unacceptable levels of sediment and nutrients entering Lake Horowhenua. Dr Gibbs emphasised that this was not a case for either/or strategies. Both projects were required but only one, the sediment trap, was the subject of this hearing.

[34] In his evidence reviewing the design and operation of the sediment trap, Dr Kelly agreed with Dr Gibbs that the management of external phosphorus inputs can influence water quality and cyanobacteria blooms. He considered the inclusion of the sediment trap as a "critical component of the suite of restoration measures proposed in the applications".[7]

[35] Dr Kelly raised two issues where potential adverse effects may result from the operation of the sediment trap. The first of these related to risks of DRP being recycled from settled sediments in the permanently wetted parts of the trap (Cell A) and the second related to fish entrapment in dewatered cells.

[36] On examination of Mr Bell's evidence, including his response to the Respondent covering design solutions to the above issues,[8] we note that the proposed revised design removes an intercept ditch from Cell A ensuring that standing water does not accumulate in this cell.[9] The modified design also ensures that water freely flows back to the Arawhata Stream following flood events. No areas

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6 NOE at page 357.
7 Kelly EIC at para 41.
8 Bell EIC Attachment C.
9 Bell EIC at paras 35-36.

of the sediment trap will remain cut-off from the stream, eliminating the risk of fish being trapped. This view was supported by Mr Brown in his evidence on adverse ecological effects.[10]

Evaluation

[37] We accept the expert evidence of the Council as both Applicant and Respondent that the sediment trap as proposed will have no discernible adverse environmental effects. The operation of the sediment trap by the diversion of water through a series of settling cells is designed to improve habitat conditions in Lake Horowhenua. The proposal does not offend Policy 16-3 of One Plan related to consent decision-making for diversions and drainage and is consistent with relevant objectives and policies in Chapters 2 and 5 of the One Plan. There is no evidence that the proposed site is inappropriate on ecological or other grounds.

[38] We find the installation and operation of the proposed sediment trap on the Arawhata Stream incorporating the design features set out in Mr Bell's evidence and attachments will provide a significant contribution to the short-term management of sediment and nutrient inflow to Lake Horowhenua. The contribution this will make to the reduction or elimination of toxic cyanobacteria blooms in the lake in both the short and long-term will contribute to the sustainable management of the lake.

Weed Harvesting

[39] As noted earlier, the unique lifecycle of Potamogeton is a major contributor to the annual flipping of Lake Horowhenua between a clean (macrophyte dominated) and extremely turbid (algal dominated) state. Annual harvesting of a proportion of this weed biomass is proposed as the most effective way of preventing toxic cyanobacteria blooms.

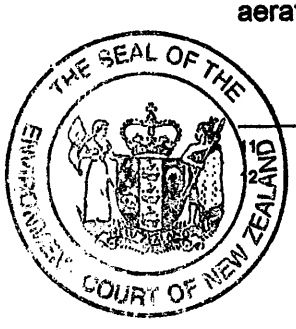
[40] Select areas of Potamogeton weed beds are to be cut at around 30 cm above the lakebed and the cut material conveyed to a barge for transfer to shore and subsequent disposal. A purpose-built HM420 Aquarius Systems Harvester has been purchased for the operation, capable of harvesting around 0.3 ha per hour. Boat ramps are proposed at the domain and at the Arawhata Stream mouth for harvester access and transfer of harvested weed to shore base temporary storage and final removal. We will cover the boat ramps in more detail later.

[10] Brown EIC at para 33.

[41] Dr Gibbs summarised the rationale for weed harvesting and proposed methodology set out in detail in a weed harvesting strategy prepared for the Council. We include the summary below:[11]

> ... weed harvesting will:
>
> (a) Maintain a growing layer of weeds across the bed of the Lake where the normal seasonal growth cycle would see the mature Potamogeton die and collapse on the Lake bed causing anoxia and associated release of P from the sediment;
>
> (b) Maintain a growing layer of weeds across the bed of the Lake protecting the sediment from wind wave disturbance and suspension;
>
> (c) Remove the cut weed to prevent decomposition driving anoxia and associated sediment P release;
>
> (d) Reduce the uptake of nitrate during the spring growth phase of the weed leaving higher nitrate concentrations in the Lake while reducing the DRP concentrations. This action raises the N:P ratio to a less favourable growth condition for cyanobacteria;
>
> (e) Reduce the pH from extreme levels >9.2 that result in the formation of unionised ammonia which is toxic to small aquatic biota, including fish and kakahi;
>
> (f) Reduce the weed canopy allowing higher light levels to reach the Lake bed potentially allowing native charophyte aquatic plant species to regenerate;
>
> (g) Provide open water for enhanced mixing of oxygen down to the near bottom of the lake thereby reducing the possibility of anoxia and associated P release from the sediment;
>
> (h) Reduce the number of turions (plant propagules) produced by the Potamogeton weed beds to slowly reduce the size and density of these weed beds and provide opportunities for native macrophyte species to regenerate;
>
> (i) Clear entrainment passages to steer fine sediment-laden water from the Arawhata Stream directly to the Hokio Stream outlet; and
>
> (j) Provide clear-water passage for boating including rowing regattas and Waka Ama championship events through the centre of the Lake.

[42] In developing and settling on this methodology for the management of water quality in the lake a range of alternative options were examined, including lake weed control by mechanical spraying or biomanipulation approaches, stormwater and groundwater treatment, wetlands, buffer zones, diversions, flushing, dredging, aeration and phosphorus inactivation.[12] Dr Gibbs summarised the advantages that



[11] Gibbs EIC at para 61.
[12] Gibbs EIC at para 49.

in his opinion make the weed harvesting proposal the most effective approach. These key advantages as identified by Dr Gibbs are included below:[13]

> Key advantages include:
>
> (a) Weed harvesting does not require any chemical addition to Lake Horowhenua such as sprays to manage weeds or sediment capping to prevent phosphorus release;
>
> (b) Spraying of the weed beds may have little effect on Potamogeton but would remove Elodea, which is susceptible to Diquat herbicide. Weed harvesting does not target Elodea which is important as a marginal fringe plant for protecting the lake shoreline and for channelling water from the Arawhata stream to the Hokio Stream outlet;
>
> (c) The removal of the shading canopy and reduced production of turions by weed harvesting can facilitate the recolonisation and growth of native aquatic plant species on the Lake bed. Native macrophytes have the potential to replace *Potamogeton* as the dominant aquatic macrophyte thereby eliminating the summer weed bed collapse and associated P release because their growth patterns follow a spring growth and autumn collapse. This would provide a sustainable long-term solution for this Lake;
>
> (d) Weed harvesting can reduce the photosynthesis and associated high pH by removing the growing tips from the aquatic weeds in spring, thereby reducing ammonia toxicity. This would be beneficial to the restoration of the fishery in the Lake;
>
> (e) The weed harvester can clear parts of the Lake, such as the rowing course, to facilitate more recreational use of the lake;
>
> (f) The expected reduction or elimination of cyanobacteria blooms will allow the Lake to become swimmable.

[43] In his evidence Mr Chisholm raised a number of issues that challenged the Council's analysis of the effects of the weed harvesting application. These issues related to:

- Increased turbidity during harvesting;
- Sediment disturbance enhancing nutrient recycling and risk of permanent flipping;
- Adverse effects on native fish species;
- Biosecurity risks of using the weed harvester;
- Adverse effects of weed disposal.

[13] Gibbs EIC at para 80.

[44] Following caucusing of the expert witnesses on water quality and ecology,[14] Mr Chisholm submitted a second statement of evidence based on his stated misinterpretation of the purpose of the weed harvesting proposal when preparing his Evidence-in-Chief. He understood following caucusing that the primary purpose of the harvesting was to suppress or eliminate annual toxic cyanobacteria blooms in the lake, not the removal of a nutrient source (plant biomass).

[45] No new issues were introduced by Mr Chisholm in his second statement which focused on the risk of permanent flipping and turbidity effects. He did however introduce the concept of the allelopathic[15] effects of macrophytes on algae being suppressed by the harvesting and the desirability of delaying consideration of in-lake interventions to improve water quality until the efficacy of catchment treatment action has been determined.

[46] Dr Gibbs acknowledged[16] allelopathy as being a "well-known phenomenon, which is often confused with normal growth competition strategies of nutrient removal and shading". He went on to say that Potamogeton exhibits both of these competition strategies and he had found no "definitive statement in the literature that Potamogeton has any allelopathy towards cyanobacteria". Dr Kelly supported this, noting that he believed it to be "highly unlikely" that Potamogeton in Lake Horowhenua is exerting allelopathic influence in suppressing cyanobacteria or phytoplankton growth. On this evidence we are satisfied that the removal of part of the weed biomass will not therefore lessen allelopathic effects and result in an increase in algal growth as there is no suppression effect operating.

Effects on turbidity

[47] Mr Chisholm considered that wind resuspension of sediment following harvest could increase turbidity and shade out macrophytes, thus preventing regrowth and encouraging algal growth.[17] He questioned the basis for the suggested threshold limit for turbidity of 30 per cent from the baseline proposed by the Council, suggesting that a four month elevation of turbidity caused by harvesting could adversely affect the ecosystem of the lake.[18] Mr Chisholm considered an

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14 Joint witness statement recording conferencing of Dr Gibbs, Dr Kelly and Mr Chisholm, 2 May 2016 (JWS water).

15 The release of a toxic chemical by a plant that inhibits the growth of nearby plants of the same or other species thus reducing competition.

16 Gibbs EIC at para 174-177.

17 Chisholm second statement of evidence at para 5.6.

18 Chisholm EIC at para 3.5 and 3.6.

instantaneous turbidity baseline limit of less than 10 NTU[19] was appropriate to prevent wind action from causing resuspension of sediment.

[48] As noted by Dr Kelly,[20] the experts at pre-hearing caucusing agreed that increases in turbidity could result from weed harvesting, associated with increased phytoplankton growth and/or resuspension of sediments by wind action. The experts noted[21] that it was difficult to identify a turbidity threshold at which significant effects on the macrophytes would occur. As a consequence of this concern an adaptive management approach was considered appropriate, including thresholds and monitoring conditions to ensure that aquatic communities were not adversely affected by changes in turbidity.

[49] In a detailed analysis of turbidity data from Lake Horowhenua during the spring growing period, Dr Gibbs demonstrated that turbidity in the lake is highly variable. Weed beds prevented sediment resuspension by wind action but accumulated detritus within the weed beds was dispersed during wind events. The operation of the harvester in his opinion would cause a similar localised increase in turbidity to a wind event.

[50] Dr Gibbs noted that turbidity from natural wind disturbance reaches around 80 NTU across the whole lake. He considered it reasonable to assume that the weed harvester would cause similar turbidity at and adjacent to the operation of the harvester, but detritus on plants will remain undisturbed elsewhere. He considered that any adaptive management baseline limit for harvester induced turbidity should be set at the instantaneous value that plants naturally experience when the winds blow. Any increase over this would indicate that sediment was also being disturbed which was the situation to be guarded against.

[51] Dr Gibbs noted that the retention of the bottom 30 cm of cut plants, the expected regrowth in spring and maintenance of the cut beds through summer would continue to protect the lake from increased turbidity from sediment resuspension by wind action. This was in marked contrast to Mr Chisholm's opinion that sediment generated turbidity increases during the two months between harvest

19 The turbidity level above which light attenuation can occur adversely affecting plant life.
20 Kelly EIC at para 16.
21 JWS water at para 10.

and natural dieback would contribute, along with increased algal growth, to the risk of permanent flipping to a high turbidity (algal dominated) state.

[52] Dr Kelly considered that the most informative statistic for identifying prevalent turbidity levels for macrophytes in the lake were mean turbidity levels for the growth period (June to December). For the 2013-2016 period this has been recorded at 7.56 NTU.

[53] Dr Kelly considered the accurate prediction of quantitative effects of weed harvesting on lake turbidity to be problematic and that the adaptive management approach proposed with its associated monitoring conditions was appropriate for the management of turbidity change risks in the lake. This approach was agreed to by the expert witnesses.[22] The experts agreed that monitoring conditions should be in place to ensure that any water clarity changes resulting from weed harvesting do not cause significant ecological effects.

[54] In revised Conditions provided following the hearing the Council has included a baseline level for mean turbidity of 5.5 NTU during the weed harvest period 1 September to 30 November above which an adaptive management response is to be implemented. This is a conservative approach based on the low range of mean turbidity recorded for this period as described by Dr Kelly[23] and moves away from the 30 per cent increase above baseline level provided in the first instance Commissioners' decision.

Effects on Nutrients

[55] Mr Chisholm accepted that harvesting may reduce or eliminate cyanobacteria blooms but was concerned that the niche vacated by weed removal would then be occupied by green algae (phytoplankton and/or dinoflagellates).[24] Weed harvesting would create ideal conditions for green algae blooms following harvesting and this, together with increased turbidity from the harvesting process and resuspension of sediments by wind action, would result in a green algae dominated lake in summer. In his opinion, there was a moderate risk that this state would persist through the following winter and spring, shading out macrophyte growth and resulting in permanent flipping to the green algae dominant state.[25]

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22 JWS water at para 10.
23 Kelly EIC at Table 1.
24 NOE at page 250.
25 NOE at page 251.

[56] Responding to questions in cross-examination on this point Mr Chisholm stated that his opinion was based on his interpretation of the risks from the information available on Lake Horowhenua and established literature. In particular, he referred to a paper by Schallenberg and Sorrell[26] describing factors that affect flipping of lakes in New Zealand to support his view that priority should be given to catchment management strategies to reduce nutrient inputs rather than in-lake strategies such as those proposed.[27] He acknowledged that there were no reported comparable examples of Potamogeton dominated lakes that had flipped.[28]

[57] When questioned at length on the 2013 - 2014 monitoring results as depicted in the document Weed Harvesting Strategy for Lake Horowhenua,[29] Mr Chisholm admitted that he had not studied this information in any detail. This did not prevent him from postulating support from the data for his assertions on the potential for phytoplankton dominance following harvest and this extending through winter and spring. He referred to observations of this phenomenom occurring in Lakes Forsyth and Lake Ellesmere[30] as a result of wind induced turbidity and that this could occur at Lake Horowhenua in spite of the resilience of potamogeton in low light conditions described by Dr Gibbs.

[58] Dr Gibbs noted that the proposed weed harvesting would leave 30 cm of weeds still growing in the cut areas preventing lakebed disturbance and the elevation of nutrient levels in the water column.

[59] Dr Gibbs described the seemingly stable annual cycle observed at Lake Horowhenua since the removal of sewage discharge in the late 1980s as one of annual flipping between macrophyte domination and algal domination. In his opinion, the weight of evidence indicated the availability of phosphorus was the key driver of water quality in Lake Horowhenua.

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26 M Schallenberg and B Sorrell "Regime shifts between clear and turbid water in New Zealand lakes: environmental correlates and implications for management and restoration" New Zealand Journal of Marine and Freshwater Research (2009) 43(3): 701-712

27 NOE at page 305.

28 NOE at page 253.

29 M Gibbs, J Roygard and M Chakraborty "Weed harvesting Strategy for Lake Horowhenua" Horizons Report 2015/EXT/1445. 72pp.

30 NOE at page 267.

[60] A large and sustained increase in DRP input to the lake would, in Dr Gibbs opinion, almost certainly lead to an algal dominated state. He identified that the potential for this was present in the large amount of sequestered phosphorus in soils around the lake which could be released by land use changes that led to anoxic conditions in the groundwater. The subsequent release of DRP to groundwater and the lake would lead to elevated levels of phosphorus available for algal growth throughout the year resulting in a permanent flip to an algal dominated state. The very low risk of these conditions occurring was present now and would not be altered by the proposed weed harvesting.

[61] In Dr Gibbs' opinion, harvesting a proportion of the spring weed growth to reduce DRP release from sediments and hence availability to cyanobacteria would not create conditions conducive to year-round algal dominance. Weed bed growth would continue following removal of the tops of the plants only.

[62] Dr Gibbs considered the integrity of the weed beds would be maintained throughout the year rather than experience the annual collapse that currently occurred. As this was a new technique for management of cyanobacteria blooms in New Zealand, some uncertainty remained as to the extent of regrowth and the level of dieback that would occur in this lake.

[63] An adaptive management approach is proposed that involves trial cutting of areas at 50 cm and 30 cm above the lakebed in the first year and monitoring changes in weed biomass compared with uncut control areas. This would allow for the proposed annual Weed Harvesting Management Plan (WHMP) to be prepared with the advantage of knowledge on the response of weed beds cut at different levels. Monitoring thresholds are proposed to manage the risk of permanent change to the weed beds or the water quality in the lake.

[64] Responding to cross-examination from Mr Jessen, Dr Gibbs described in brief the annual cycle of phosphorus and nitrogen availability in the water column to demonstrate that the concept that a small change in nutrient levels could cause a lake to flip to an algal dominated state was, in his opinion, wrong.[31]

[65] Dr Kelly and Dr Gibbs described the annual cycle of flipping between algal and macrophyte states as a demonstration of the built-in resilience of Potamogeton to

[31] NOE at page 140-141.

changing conditions. Annual plant regeneration is from turions[32] which grow best in the high phosphorus conditions created by the annual dieback of the parent plants. Regenerating plants have the ability to grow in very low light (1 per cent) conditions and the rapid spring growth out-competes algal growth during this period.

[66] Dr Gibbs expanded on this at length,[33] reinforcing his view that Potamogeton would continue to grow following cutting and not die back during summer. He concluded that even if the remaining plants did die back in early summer, less biomass remained on the lakebed with subsequent lower release of DRP. In Dr Gibbs' opinion, annual removal of some of the Potamogeton biomass would reduce the risk of the lake becoming permanently algal dominated compared with the risk of allowing the continued degradation of the lake observed in recent years.

[67] Dr Gibbs acknowledged in evidence and in cross-examination that the proposed weed harvesting was not designed to address the root cause of the degraded water quality in the lake, this being the legacy load of nutrients in the lake from sewage discharge and nutrient runoff from land use intensification in the catchment. Rather, the harvesting was designed to provide for the more immediate need to reduce or eliminate the annual cycle of toxic cyanobacteria blooms in the lake.

[68] Dr Gibbs postulated that under the current land use management strategies it would take 20 to 30 years for lake water quality to return to an acceptable condition. The immediate in-lake interventions (sediment trap and weed harvest) were independent from essential long-term strategies to reduce nutrient inflows to the lake. Dr Gibbs could see *no good reason* why these interventions to achieve stated beneficial outcomes should not proceed at the same time as the wider catchment strategies. In his opinion, the risk of a significant adverse effect (permanent algal dominance) is very low while the potential beneficial effects (permanent macrophyte dominance) are what the entire lake strategy was designed to achieve.

[69] Dr Gibbs described the probable nutrient cycle change somewhat differently to Mr Chisholm in reaching his (Mr Chisholm's) conclusions on the risk of phytoplankton blooms being generated by weed harvesting and continuing throughout the year. In brief, Dr Gibbs described fully growing macrophytes in the

[32] Turions are nodes on the plant stems similar to buds on land plants that can sprout vegetative regrowth when conditions are suitable.
[33] NOE at page 150-151.

lake as outcompeting algal growth in spring with little nitrogen or phosphorus remaining in the water column for algal uptake. Harvesting of some of the macrophyte biomass in early summer would slightly increase nitrogen levels, but phosphorus levels remain limited with little algal growth as a result. It is only the additional phosphorus availability following collapse of the weed bed that leads to increased algal growth.

[70] Dr Gibbs concluded that there was no risk of significant elevation of algal growth during the two month period from harvesting and when the weed would naturally collapse. This is contrary to Mr Chisholm's assertion that the opposite is the more likely outcome.

[71] Dr Kelly acknowledged the research reported by Dr Gibbs as well-founded and an excellent example of how a thorough understanding of lake chemistry can yield information on the design of interventions to improve water quality.[34] Dr Kelly agreed with the approach taken by Dr Gibbs based on this science to recommend the weed harvesting proposal. In doing so he acknowledged the purpose of the proposal was to control cyanobacteria blooms, but that other beneficial outcomes in reducing ammonia toxicity and encouraging the return of native macrophytes to the lake as described by Dr Gibbs are also likely.

[72] Dr Kelly advised that it would be important to carefully manage the amount of biomass removed and the supply of turions in harvested areas in order to maintain the natural resilience of the lake. He emphasised the importance of maintaining the integrity of macrophyte beds in the lake as the key to preventing the already existing low risk of flipping from occurring. Dr Kelly concluded that adaptive management conditions that direct the monitoring of macrophyte survival and turbidity in the water column and provide triggers for management response are appropriate to minimise the risk of the lake flipping.

[73] Dr Kelly was taken through lengthy cross-examination by Mr Watson on the trial nature of the first year of weed harvesting. Dr Kelly clarified this first year would involve cutting 25 ha of the 120 ha total weed beds at 30 cm above the lakebed and 25 ha to be cut at 50 cm. A further 25 ha uncut block would be identified as a control area for monitoring purposes.

[34] Kelly EIC at para 26.

[74] Dr Kelly noted that the cautious approach to year one harvest trials was to confirm or otherwise the understanding gained from similar reported macrophyte harvesting elsewhere. This includes the extent to which plants will continue to grow after cutting, whether the normal die back cycle is interrupted, and whether regrowth of weed beds from turions and rhizomes will continue in the spring following harvest. Monitoring of these factors, together with turbidity effects, will inform design of the subsequent harvesting under the WHMP to achieve control of cyanobacteria blooms and further reduce any risk of permanent flipping.

Effects on Fish

[75] Mr Chisholm raised the issue of fish mortality from the use of the mechanical harvester and that this would adversely affect species rated as "declining" in the Department of Conservation Threat Classification System as well as other common native fish and sport fish such as trout.

[76] Dr Kelly referred to a fish study carried out at Lake Horowhenua in 2013, recording eels (both shortfin and longfin), goldfish, perch, common smelt, common bully, Inanga, grey mullet and koi carp. Inanga and longfin eel are considered at risk in the Department of Conservation system. Both are present in relatively low numbers in the lake. Dr Kelly considered that fish entrapped during harvesting would be of minor conservation significance.

[77] Mr Brown noted that Mr Chisholm's concern seemed to come from a study where the work involved complete removal of macrophytes and some sediment using mechanical diggers. In the Lake Horowhenua proposal cutting the weed above the lakebed would not capture eels that reside on or in the lakebed sediments and that fish in the vicinity of the harvester had the ability to escape in all directions. Mr Brown also pointed out that trout were not present in the lake, Inanga were present in only low numbers and that giant Kokopu were not present in the fish survey but had been recorded in the Patiki Stream.

[78] In recognising that there was some potential for fish entrapment from the harvesting, but considering that any adverse effects were less than minor, Dr Kelly and Mr Brown considered it prudent to include fish capture monitoring in the annual WHMP to verify this.

[79] A further consideration related to beneficial effects on fish and small biota was introduced by Dr Gibbs. Photosynthesis by the extensive weed beds in spring resulted in an elevation in pH level which in turn caused non-toxic ammonium ions continuously released from sediment to transform into unionised ammonia, which is toxic to fish. Removal of part of the growing biomass of weed would lower pH and thus reduce ammonia toxicity and fish deaths.

[80] Mr Brown considered that the potential reduction in ammonia levels from weed harvesting could have a positive benefit in improving the recruitment success of Kakahi (freshwater mussels). Kakahi larvae were sensitive to ammonia levels and reduction in this toxicity was important if Kakahi populations were to survive in Lake Horowhenua in his opinion.

[81] Mr Chisholm agreed that high ammonia levels had adverse effects on fish and small biota, as did the anoxic conditions on the lakebed following weed die-off and during the daily respiration cycle of all plants in the lake. In his view the appropriate way to deal with these effects was to reduce nutrient inputs into the lake which would in turn reduce weed and phytoplankton growth, thus managing pH at acceptable levels.

[82] None of the experts disagreed with this longer term strategy. The primary difference on this, and most other technical matters related to water quality, was that the Council's experts considered that during the lag period before catchment strategies become effective, and given the legacy nutrient load in lake sediments, short-term real benefits to the lake's ability to support fish life were achievable and should be implemented.

Disposal of cut weed

[83] The relevant experts agreed[35] that the removal and temporary storage of harvested weed to a suitable area away from the lake edge and daily removal to an appropriate disposal site would deal with any potential for leachate from cut weed disposal from entering the lake. This did not prevent the ultimate disposal of the weed from being traversed at length during the hearing. It is sufficient to note that this disposal is not the subject of the consents applied for and any disposal strategy adopted would need to be lawful.

[35] JWS water at para 12.

Biosecurity

[84] The relevant experts[36] agreed that a new machine used only at Lake Horowhenua posed no biosecurity risk. The application provided for strict biosecurity protocols to be in place if use of the machine was contemplated at any other lakes during the time of the project at Lake Horowhenua. Biosecurity protocols are required by the proposed conditions of consent to be included in the WHMP.

Launching Sites

[85] The primary boat ramp for harvester access to the lake is adjacent to the Arawhata Stream mouth with an additional ramp proposed at Lake Domain for operational efficiency reasons. A small amount of disturbance to the lakebed is anticipated during construction and silt traps are proposed to minimise the effects of this disturbance.

[86] Mr J S Lambie (Science Co-Ordinator at the Council) outlined in evidence and expanded on in cross-examination potential effects on habitats from the proposal including Dabchick nesting and indigenous wetland vegetation and bird disturbance. Removal of a small amount of raupo and flax at the Arawhata site had the potential to disturb possible nesting sites for the New Zealand Dabchick. Conditions were proposed to ensure that any construction effects on nesting Dabchick were avoided. Development and implementation of a planting strategy for the Arawhata site was proposed to restore and improve any lake edge habitat disturbed by ramp construction activity.

[87] No technical evidence was presented to challenge the Council's analysis and proposals regarding the safeguarding of habitats at the margins of the lake affected by the establishment of boat access ramps at the Arawhata Stream and Lake Domain sites.

Evaluation

[88] In his evidence and in response to questions in cross-examination, Mr Chisholm relied on his own knowledge and observation of flipped lakes elsewhere in New Zealand and review of published reports relevant to the topic. His central assertion was that weed harvesting would significantly increase year round turbidity by a combination of resuspension of sediment and increased phytoplankton

[36] JWS water at para 15.

production to a level that creates a moderate risk that the algal dominant summer phase will become permanent.

[89] Dr Gibbs relied on nearly 30 years of water quality investigations and monitoring at Lake Horowhenua and his extensive experience in water quality science to provide the scientific rationale on which the restoration projects are based. This material was reviewed by Dr Kelly as part of the s 42A report for the commissioners' hearing and in evidence for this hearing. He supports the assessment of Dr Gibbs that the risk of weed harvesting causing the lake to flip to a permanent algal dominated state is very low.

[90] Based on the supporting scientific evidence we have accepted Dr Gibbs' assessment that the most likely outcome from the weed harvesting is a significant reduction or elimination of toxic cyanobacteria blooms and a significant reduction in the release of unionised ammonia toxic to fish to the water column. The "worst case" scenario suggested by the evidence is for the annual cycle of summer/autumn dominance by algae and winter/spring dominance by macrophytes to continue, possibly at reduced biomass levels.

[91] The supporting evidence from Mr Bell, Mr McLean (sediment control), Mr Lambie and Mr Brown was that any adverse effects from weed harvesting and its associated infrastructure on fish, bird life and lake margin habitats could be avoided or mitigated by construction and operational procedures set out in the proposed conditions.

[92] We have carefully reviewed these conditions and agree. Adverse effects from the construction of the two boat ramps and operation of the weed harvester as described in the technical evidence will have no adverse environmental effects that are more than minor.

[93] Dr Gibbs and Dr Kelly acknowledged that the continuation of the annual cycle of lake flipping that occurs now has a very low risk of generating a permanent flip to an algal dominated state. In their opinion, this risk is not increased by the intervention of weed harvesting, nor does it go away.

[94] Accordingly, the Council has proposed a cautious adaptive management approach that involves a first year trial to test assumptions on weed regrowth from

cut stems, uncut weed stubble remaining viable through the summer, weed bed regeneration through the following winter/spring and levels of turbidity from cutting and from resuspension of bed sediment following harvest. These parameters are to be monitored and where required baseline information, threshold triggers and adaptive management responses are to be established prior to the preparation of year two and subsequent weed harvest management plans.

[95] In determining whether an adaptive management approach is appropriate in this case we have applied the tests as set out by the Supreme Court in *Sustain Our Sounds.*[37] This directs the assessment of:

(a) The extent of the environmental risk (including the gravity of the consequences if the risk is realised).
(b) The importance of the activity (which could in some circumstances be an activity that is hoped will protect the environment);
(c) The degree of uncertainty; and
(d) The extent to which an adaptive management approach will sufficiently diminish the risk and the uncertainty.

[96] With regards to (a) above, the environmental risk has been assessed as very low by the Council and moderate by Hokio Trusts. It was agreed by the experts that the cultural, ecological and recreational effects of the lake flipping to a state permanently dominated by algae would be disastrous. We have accepted the Council's assessment of very low risk but also their recommendation for caution due to the extreme undesirability of consequences.

[97] Regarding (b) above, the evidence for the Council strongly supported the intervention of weed harvesting as an important short to medium term component of a comprehensive long-term catchment based strategy for the restoration of water quality and hence cultural, ecological and recreational value to the lake. The immediate achievement of reduction or elimination of toxic cyanobacteria blooms and toxic conditions for fish life was acknowledged by all parties as beneficial.

[98] With regards to (c) above, based on the scientific evidence, the level of uncertainty is not high as similar activity reported in scientific literature from overseas studies supported the plant responses to cutting expected in this case. As

[37] *Sustain Our Sounds Inc v New Zealand King Salmon Company Ltd* [2014] NZSC 40, [2014] 1 NZLR 673 at [129].

the technique had not been previously used for Potamogeton management in New Zealand, some caution is required before commencing full scale harvest. Uncertainty remains around the appropriate turbidity baseline and threshold turbidity levels.

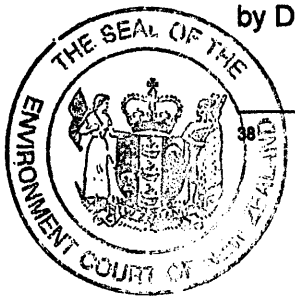
[99] Assessment of (d) above as to whether the adaptive management strategy will achieve the desired reduction in risk and uncertainty requires that:[38]

(a) There will be good baseline information about the receiving environment.
(b) The conditions provide for effective monitoring of adverse effects using appropriate indicators.
(c) Thresholds are set to trigger remedial action before the effects become overly damaging; and
(d) Effects that might arise can be remedied before they become irreversible.

[100] Monitoring of water quality parameters at the lake extends back to the first intensive studies in the late 1980s and continuing as part of the Council's state of the environment monitoring since that time. In July 2013 a water quality monitoring buoy was installed recording water parameters at 15 minute intervals. These include temperature, dissolved oxygen, pH, chlorophyll fluorescence and cyanobacteria fluorescence in the water column.

[101] Weed density and harvest responses are to be established prior to and during the proposed year one trial harvest period. Monitoring of the effects of weed harvesting are provided for in the proposed conditions, including intensive water quality monitoring from the buoy; weed density, survival and regrowth; phytoplankton biomass; and turbidity. Threshold levels for mean turbidity and weed bed cover have been proposed and adaptive responses indicated, including the postponement of harvesting where appropriate.

[102] Following the submission of a revised final set of draft conditions for the consents the Appellant (on Mr Chisholm's advice) sought the addition of Chlorophyll *a* monitoring as part of the adaptive management regime with a threshold for harvest cessation if the Chlorophyll *a* level was above 10 UG per litre. The Council was given leave to respond to this request and this was provided by way of affidavit by Dr Gibbs.



[38] Above n 37 at [133].

[103] Dr Gibbs noted that the level of Chlorophyll *a* has been recorded at 15 minute intervals by the monitoring buoys since 2013. This shows considerable natural variability in Chlorophyll *a* concentrations during the suggested October to November monitoring period which makes setting a baseline condition against which change could be reliably measured extremely difficult, in his opinion.

[104] The data record shows mean levels for October/November varying from 4.13 plus or minus 6.1 UGs per litre to 39.67 plus or minus 60.3 UG per litre between 2013 and 2015. In these circumstances, a baseline of 10 UG per litre would be practically unworkable in Dr Gibbs' opinion. He considered an adaptive response based on a Chlorophyll *a* trigger level to be inappropriate. Any measured change could not be reliably interpreted as resulting from weed harvesting as opposed to a variety of other factors that have the ability to influence Chlorophyll *a* concentration.

[105] We have accepted Dr Gibbs' advice on this based as it is on intensive monitoring data and his explanation of the science around the Chlorophyll *a* concentration influences in the lake. No additional conditions are added to the adaptive management regime proposed for weed harvest.

[106] The Council's experts are satisfied that in the very low risk conditions that apply in this case, irreversible significant adverse effects from the lake permanently flipping will be avoided by the adaptive regime proposed. This view is reinforced by the considerable resilience demonstrated by the annual cycle of flipping between macrophyte and cyanobacteria dominance as occurs now. Dr Gibbs and Dr Kelly consider that it will take a significant change in water column nutrient availability to phytoplankton year round to cause permanent flipping, given the robust life cycle of the predominant macrophyte Potamogeton. This includes its regrowth from turions and ability to grow in extremely low light conditions.

[107] We have accepted the proposed adaptive management approach set out in the draft conditions as adequately addressing the tests set out in *Sustain our Sounds*. The uncertainties around plant response to harvest and sediment resuspension will largely be eliminated through monitoring during the trial year and the ongoing very low risk of permanent flipping minimised by the conditions set.

Section 104D RMA

[108] Section 104D requires that:

- We are satisfied that either the adverse effects of the activity on the environment are minor; or
- The activity will not be contrary to the objectives and policies of the relevant plan.

[109] Our evaluation set out earlier concludes that the adverse effects of weed harvesting and its associated infrastructure will be no more than minor if operated under the conditions proposed. We are satisfied that the application for a non-complying activity passes the threshold set out in s 104D(1)(a) RMA. It is left to us to determine the application on its merits under s 104 RMA.

[110] Our earlier examination of the effects of the proposal for s 104D purposes establishes for the reasons set out that the adverse effects are no more than minor and that the adaptive management regime proposed will manage the risk of the lake flipping at an acceptable level.

One Plan

[111] The management of macrophytes, in particular Potamogeton crispus, in Lake Horowhenua is designed specifically to achieve the outcome sought by the objectives and policies in Chapter 5 of the One Plan. These provisions direct the safeguarding of the life-supporting capacity of the lake and the enhancement of water quality where it is degraded.

[112] Water quality targets are established for the Lake Horowhenua Water Management Hokio 1 and Hokio 2 sub-zones under Policy 5.2 as required by the NPS–FM for degraded water bodies. Weed harvesting is proposed as a means of meeting some of these water quality targets in the short-term, particularly in relation to Chlorophyll *a* and cyanobacteria.

[113] Policy 5.4 is particularly relevant in directing the Council to manage water quality that does not meet sub-zone targets in a manner that enhances water quality to meet those targets. Activities proposed consistent with Method 5-6 of the One Plan will achieve partial implementation of Policy 5.4 and are complementary to the nutrient management framework of the Plan that calls for management intervention. Method 5-6 involves the Council working with other parties to carry out enhancement measures and to monitor the effectiveness of these measures.

[114] The weed harvesting proposal implements Action 9 of the Horowhenua Accord Management Plan and is an obligation of the Council in accordance with Method 5.6 of the One Plan. The evidence establishes that the project will have significant benefits through the reduction in the weed's capacity to change the chemistry of the lake that results in cyanobacteria blooms and ammonia toxicity.

[115] We find that the suite of applications required to authorise the weed harvesting project are consistent with the objectives and policies of the One Plan which in turn gives effect to the relevant provisions of the NPS-FM and its NOF.

Fish Pass

[116] During the course of the hearing, witnesses for Hokio Trusts, Mr Taueki and Ms V Taueki advised us that they were not opposed to the installation of the proposed fish pass at the weir control on the lake outlet. The commissioners' decision considered this application in detail and granted consent with conditions as a non-complying activity.

[117] We have considered the evidence for this hearing from Mr Bell, Mr McLean and Mr Brown supporting the commissioners' decision, none of which was challenged. We confirm the grant of the water permit and land use consents with the attached conditions authorising the construction and operation of the fish pass adjacent to the outlet weir between Lake Horowhenua and the Hokio Stream as set out in the commissioners' decision dated 9 December 2015.

Are there adverse effects from the proposals on tangata whenua values?

[118] More than 12 distinct iwi and several hapu are found partly or wholly within the Manawatu region. These include Muaupoko, Ngati Maniapoto, Nga Rauru, Ngati Apa, Ngati Hauiti, Ngati Kahungunu, Ngati Maru, Ngati Raukawa, Ngati Tuwharetoa, Rangitane, Whanganui (also known as Te Atihaunui-a-Paparangi including Ngati Rangi, Tamaupoko, Hinengakau, Tupoho, Tamahaki) and Te Iwi Morehu at Ratana an amalgam of which most of the country's iwi are represented.

[119] Lake Horowhenua (also known as Waipunahau) is of high physical, spiritual and cultural significance to both Muaupoko and Ngati Pareraukawa. All parties to the appeals attest to the lake and its surrounds historically being the food basket of Muaupoko. The cultural food available to local iwi and hapu pre-European included kereru (native wood pigeon), kaka (native parrot), kakahi (freshwater mussels),

patiki (flounder), koura (freshwater crayfish), tuna (eels), inanga (adult whitebait) and ngaore (immature whitebait).

[120] Ms Taueki in her evidence for Hokio Trusts gave her genealogy from Te Mou and Puakiteao to Te Potangotango to herself adding that none of Potangotango's siblings lived at Lake Horowhenua. The evidence was prepared for a Treaty of Waitangi claim (WAI 1629) which covered a great deal of the history pertaining to the Lake Horowhenua area and surrounds plus disputed ownership with the Crown and other iwi. The information was useful where it related specifically to the appeal.

[121] Ms Taueki gave the approximate location of Te Potangotango Pa adjacent to the wetlands at the shore and Te Kapa where Ihaia Taueki had his village. She described how Taueki often shared the lake and its resources with Whatanui, explaining the Ngati Raukawa presence around the Hokio stream. This alliance is recognised in the Ngatokowaru Marae carvings.

[122] Ms Taueki expressed her disgust at the historic and current discharges into the lake that did not have consents and criticised consultation as only being with the Lake Trustees, rather than *greater Muaupoko.* She lamented the fact that once the lake was used as their *food basket*, but is now "used as a toilet and rubbish bin for Levin ... and used as a repository for sewerage and stormwater since the 1940s" [39]plus other discharges from a wool scouring plant and a rendering plant.

[123] Mr Taueki stated that Muaupoko's tribal homeland was from Hokio beach along the stream to Lake Horowhenua, their most valuable commodity being kaimoana such as eels, whitebait and toheroa which they traded with other iwi.

[124] Mr Taueki held the view that because Hokio Trusts' beneficiaries are also owners and beneficiaries in Lake Horowhenua and the Hokio stream, they should be recognised in any consultation involving major projects that affect the lake. He questioned the authority of the Lake Trustees to govern or speak for Muaupoko claiming that they did not have the mandate nor had they "been acknowledged by Mua-Upoko descendants and certainly not by us who are kaitiaki of Lake Horowhenua".[40]

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[39] Ms Taueki, Brief of Evidence to Waitangi Tribunal submitted with EIC for this hearing, at para77-78.

[40] EIC at para 4.1.

[125] Mr Taueki was adamant that his whanau had always maintained ahi kaa over Muaupoko lands and reiterated Ms Taueki's evidence pertaining to the agreement between Taueki and Whatanui of Pareraukawa to share the coastline. He regarded the lake as waahi tapu:

> It was a traditional food basket for our Iwi and a place of sustenance, but also the resting place of many of our ancestors. Those two facts can sit comfortably alongside each other. There is no conflict. That is, there are "layers" of association and use of our Lake over many hundreds of years. To deny the waahi tapu status of our Lake because we gathered kai from the Lake is to fundamentally misunderstand the nature of our long connection and dependence on the Lake.[41]

[126] Mr Taueki's evidence related primarily to his whanau and their relationship to the lake as tangata whenua, ahi ka and kaitiaki. He described his whanau values pertaining to Lake Horowhenua and surrounding waters as: mauri; the right to manage and control the Lake in accordance with tikanga; their obligation as kaitiaki by virtue of their whakapapa to care for the taonga; respect for waahi tapu; and the importance of ahi ka in the area.

[127] Mr Taueki asserted that the infrastructure required for access to the lake for weed harvesting would be offensive to the whanau kaitiakitanga values and impact on waahi tapu at the Lake Domain and Arawhata Stream sites. Weed harvesting had the potential to impact native fish, which are taonga, and the nesting of birds using the lake. Mr Taueki considered the risk of the lake permanently changing to an undesirable algal dominated state identified by Mr Chisholm as having the potential to have very significant effects on the environmental and cultural health of the lake. We have considered this risk in detail earlier in this decision.

[128] Mr Taueki offered alternative options for the removal of nutrients from the lake without giving any specifics or providing any credible technical evidence as to how these could be achieved.

[129] Mr M J Sword is a trustee and Chairman of the Lake Horowhenua Trust and chairs the Lake Horowhenua Accord. He identifies as a member of the Muaupoko tribe, chairs Ngati Pariri Hapu, sits on a number of other whanau land Trusts, has sat on the paepae for two Muaupoko Marae (Kohuturoa and Kawiu) and has been a

[41] EIC at para 5.7.

lead negotiator for Muaupoko tribal authority. He has a legal background, having held several governance roles in New Zealand.

[130] The Lake Horowhenua Trust is made up of 11 Trustees representing 2000 plus beneficial owners whose purpose is to administer Lake Horowhenua, Hokio Stream and associated lands (including the lake bed). Mr Sword's evidence was that the Trust was fully committed to the restoration of the ecological and cultural values of Lake Horowhenua as set out in the Lake Accord and its associated Action Plan and that there was demonstrated support for this from the beneficial owners.

[131] Mr Sword outlined the Trust's long term plan which included the process leading up to the appointment of the Lake Trustees, consultation with the beneficiaries, signing of the Lake Accord and the focus of the Trust to restore the lake. This entailed securing funding, further consultation with beneficial owners and repatriation of native fish. Their Te Mana o Te Wai Project was successful in securing $1.2 Million for their Te Kakapa Manawa o Muaupoko - the beating heart of Muaupoko, to undertake projects that would protect and enhance their natural water resources.

[132] The consultation practices and information sharing adopted by the Lake Trust began in 2012. It had been comprehensive, with several publications giving updates in news media, their website and Facebook page, regular updates on lake restoration initiatives at Annual General and Special general meetings plus in hard copy form in the mail. Their ongoing consultation would include programmes of planting days and planned wananga to further articulate the Muaupoko association with the lake and to update on the latest science available.

[133] Mr Sword accepted that restoration of the lake will take a long time and the relationship with the owners and Accord partners must endure to enhance and restore the lake to how it used to be:[42]

> Overall the cultural and spiritual benefits to Muaupoko, to be derived from the ecological improvements to the Lake expected from these interventions, cannot be underestimated. It has long been the desire of Muaupoko to regain access to a significantly valuable resource to sustain families and marae. Improved Lake conditions means improved access by Muaupoko to their fishery and their cultural sites of significance. Muaupoko will be able to swim in the Lake, gather

[42] EIC at para 58.

kai and be able to host events more easily and more regularly for example using Kurahaupo waka to celebrate events. Hapu will be able to enhance their mana through access to kai from the Lake as part of undertaking their manaaki toward their manuhiri and to enhance and support gatherings on the marae.[43]

[134] Mr R P Warrington is chairman of the Muaupoko Tribal Authority (MTA) and a trustee of the Lake Horowhenua Trust. He is also an owner in the three Hokio Trusts that Mr Taueki represents. He is of Muaupoko, Ngati Kuia, Rangitane, Tuwharetoa, Taranaki, Maniapoto, Ngati Apa, and Ngati Raukawa descent and one of a few Muaupoko who have a formal qualification in Muaupoko tikanga.

[135] The MTA manages Treaty claims, RMA issues and relationships with key agencies and is the mandated authority for Muaupoko regarding consultation with local authorities and applicants under the RMA. The MTA charter has provision for their seven hapu, namely Ngai Te Ao, Ngarue, Ngati Hine, Ngati Pariri, Ngati, Ngati Whanokirangi and Punahau.[44]

[136] Mr Warrington confirmed Lake Horowhenua as historically being the Muaupoko food basket. Because of the poor state of the lake they, as Muaupoko, were unable to interact with the lake as their ancestors did, using it for sustenance which met the needs of the people and maintained the mana of Muaupoko. While accepting that their current relationship with the lake was predominantly focused on restoration, the ultimate intention is for the lake to once again be the provider of food and sustenance physically and spiritually for Muaupoko similar to their ancestors. For this reason the MTA supported the Lake Horowhenua Accord 2013 and the implementation of the Action Plan, including the activities subject to these consents.

[137] The key cultural values identified by MTA as relevant include:

(a) Taonga - The lake and its surrounds (once about 400,000 acres of wetlands) being a special treasure to Muaupoko to provide food for visitors which was so important to the mana of iwi.

(b) Waahi tapu - Mr Warrington does not consider the whole Lake waahi tapu though accepts that some parts may be, such as the man-made islands within the lake or when a rahui is placed on the lake to restrict human actions that may have an adverse impact.

[43] EIC at para 59.
[44] R Warrington EIC at 15.

(c) Recognising Manawhenua - this lies entirely within Muaupoko and the MTA is the representative voice to the Crown or local government.

(d) Kaitiakitanga - through consultation with iwi, marae, hapu and individuals Muaupoko will be involved in the tangata tiaki roles where possible.[45]

[138] Dr J N Proctor's tribal affiliations include Muaupoko, Ngati Apa and Ngai Tahu. He was appointed as a trustee of the Lake Horowhenua Trust in 2009, 2012 and 2016. His family own and have occupied Te Hou Pa on the western shores of Lake Horowhenua *since humans have occupied this land* and for many years have maintained, used and managed the tauranga waka.

[139] Dr Proctor noted that Section 18 of the Reserves and Other Lands Disposal Act 1956 recognised the partnership between the Lake Trustees and the Crown in co-managing Lake Horowhenua. For this reason Dr Proctor's personal view was that the Lake Trustees should not have to apply for resource consents for works on the lake but in the spirit of collaboration and respect for the role of other parties the Lake Trust had decided to support and participate in the process.

[140] The Proctor family had offered the waka landing sites on their property as access for the weed harvester as they saw this as a positive activity for the health of the lake. The family view was that the benefits gained from the proposed weed harvesting activity far outweigh the impacts of modification of the access sites, noting that their ancestors had *sustainably modified our environment* creating waka landings to ensure better access to resources.

[141] Dr Proctor considered it *beyond dispute* that the lake is a taonga, owned by Muaupoko, and it is the owners that make the decisions on management of the Lake.[46] Some of the cultural, spiritual, traditional sites of significance to Muaupoko include urupa, kainga, tauranga waka, waahi tapu, mahinga kai, pa tuna and battle grounds which hold the collective memories of the mana of Muaupoko:

> The important point here is that individual whanau and hapu over time have numerous differing values and associations to different parts of the Lake. The Lake has never been classified by a single attribute or managed by a single set of tikanga from one person.[47]

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45 EIC at para 38.
46 EIC at para 15.
47 EIC at para 21.

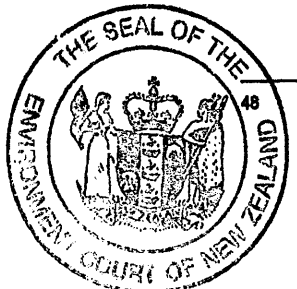
[142] Dr Proctor considered that the most significant aspect of Lake Horowhenua is its mauri:

> It is the mauri which binds the physical, traditional and spiritual elements of all things together, generating, nurturing and upholding all life. That mauri is the most crucial element that binds Muaupoko throughout time with Lake Horowhenua/Punahau, a relationship that spans hundreds of years of unbroken occupation and use. The use of the Lake and the way Muaupoko has treated it has changed and developed over time to ensure that it sustainably supports the Iwi. The mauri of the Lake has also been managed to ensure the wairua or the health of Muaupoko and the people was maintained.[48]

[143] Dr Proctor maintained that throughout history modifications were made to the lake but in a manner that did not degrade the mauri. The proposed activities are intended to resolve some of the ecological issues in an attempt to protect and promote the mauri of the lake. He stated that though the lake is a source of mauri for Muaupoko it is in a degraded state and the beneficial owners want the negative impacts lessened or removed. This has been supported by resolutions at Lake Trust AGMs and in the signing of the Accord.

[144] It was Dr Proctor's view that the Accord partnership between Muaupoko, Lake Trustees and other parties was an exemplar of how matauranga Maori can guide scientific and technological methods to solve issues. The Accord partners have recognised the rangatiratanga of the Lake Trust and beneficial owners by including them as decision makers, including designing the wider programme of interventions, without limiting or interfering with customary rights or having a detrimental effect on customary native species.

[145] Dr Proctor was confident that the proposed activities will contribute significantly to halting ecological decline resulting in cultural benefits for Muaupoko such as: improved fisheries to sustain iwi; spiritual practices that use Wai Maori can be sourced year round; the ability to host events that involve feeding guests with kai from the lake; waka ama; becoming a place of pride for Muaupoko and the wider community; and restoring their emotional, spiritual and cultural relationship with the lake.



[48] EIC at para 22.

[146] The Lake Trust has in place an Accidental Discovery Protocol (ADP) to manage and protect any archaeological sites or kakahi beds from accidental disturbance in or around the lake during construction or monitoring. This protocol has been agreed between the relevant parties, with the presence of tangata tiaki as required.

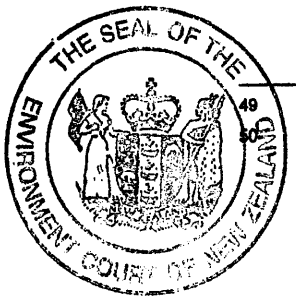
[147] Dr Proctor dismissed Mr Taueki's claim that the whole of the lake is waahi tapu as something that has only been recently raised. There was no consensus amongst Muaupoko to view the lake in that manner. He disputed the area where "blood was spilt in the Lake between the Islands of Waikiekie to Waipata" as having been embellished in an interview 80 years after the event, not from a first-hand account and added that it was rare for a water body to be considered waahi tapu because "usually water is used to cleanse us of the tapu".[49]

[148] He acknowledged many significant sites or waahi tapu such as urupa around the lake, adding that:

> ... they do not form a coherent connection in both time and space across the entire area to constitute a single waahi tapu area. They are instead discrete, individually managed sites.[50]

[149] Responding to questions from Mr Jessen on how the proposals would be treated if the whole of the lake was a waahi tapu site Dr Proctor stated:

> I think there's plenty of cultural experts around the country that could provide a better opinion than me, or a better definition than I would, but essentially because an area is waahi tapu there are certain protocols and procedures which occur around that site and will limit certain activities, but then again, it's up for the iwi itself, or those that have mana over that area to decide what those protocols and what the uses around that site are. I mean, there's no doubt that urupa are considered tapu or waahi tapu in certain circumstances, but we still access those, we still go in there to bury our dead, it's just the way we go about doing it is guided by a set of principles and protocols dictated by the mana whenua of that urupa, so – and there have been cases throughout the country where waahi tapu have been lifted, so to speak. There has been a consensus amongst the mana whenua or the iwi that manage that waahi tapu and they've



[49] EIC at para 47.
[50] EIC at paras 49.

decided, right, the waahi tapu will be lifted and we'll carry on with our activities.[51]

[150] Dr Proctor considered it *difficult to comprehend* how the activities supported by the Lake Trustees did not provide for the relevant statutory provisions of ss 6(e), 7(a) and 8 of the Act. The proposed activities would, in his opinion, contribute to the ecological health of the lake which would in turn make a significant contribution to Muaupoko relationship with this taonga. They would aid the Lake Trust in its role as tangata tiaki, consistent with s 7(a) and that the collaborative approach to the restoration of Lake Horowhenua is *the embodiment of the Treaty of Waitangi.*

Evaluation

[151] We accept that Lake Horowhenua has historically been the food basket of Muaupoko and that the current degraded state of the lake diminishes the strong cultural values associated with it. We also accept that there are a number of groups within Muaupoko (including all those represented at this hearing) that have close cultural and historical ties to the lake. Each of these groups has a common strong desire to see the ecology and mauri of Lake Horowhenua restored to an acceptable state.

[152] We acknowledge that there are differing views on how restoration should be achieved and these have been articulated by the parties. This case involves applications for activities designed to improve the ecological and cultural health of the ecosystem that is Lake Horowhenua and our evaluation is directed to determining whether this aim is achieved within the sustainable management purpose of the RMA.

[153] The weight of expert evidence supports a conclusion that the proposed activities will have no adverse effects on the Lake Horowhenua that are more than minor. We have found earlier that any residual low risk of a permanent shift in trophic status to one dominated by algae or cyanobacteria will be further reduced by the cautious adaptive management approach proposed through the conditions of consent.

[154] No adverse effect on tangata whenua values has been substantiated in evidence from the Hokio Trusts witnesses. The Lake Trust and other s 274 parties

[51] NOE at page 120.

presented cultural evidence that fully supported the proposed restoration activities and advised that the positive effects will be beneficial to the re-establishment of strong tangata whenua relationships with Lake Horowhenua.

[155] The water quality and subsequent ecological benefits of the proposals will contribute to the restoration of the mauri of Lake Horowhenua consistent with Objective 2-1 and Policy 2-3 of the One Plan. The ongoing involvement of Muaupoko as tangata tiaki through the offices of the Lake Trust fosters the relationship of iwi with their ancestral land and water and the taonga that is Lake Horowhenua. Waahi tapu sites identified at the lake are not affected by the construction of the access boat ramps or the weed harvesting operation and an Accidental Discovery Protocol involving the Lake Trust on behalf of the beneficial owners of the lake will ensure that adequate procedures are in place in the event waahi tapu or wahi tupuna are discovered consistent with Policy 2.2 of the One Plan.

Conditions

[156] At the conclusion of the hearing the Court directed the Council to circulate and file with the Court a revised set of proposed conditions, taking into account matters raised during the course of the hearing, particularly those associated with adaptive management conditions for the weed harvesting proposal and the appointment of tangata tiaki. Revised proposed conditions were circulated by the Respondent to all parties to the appeal on 10 June 2016. Submissions in response were filed with the Court by Hokio Trusts, Mrs Hunt, Mr Sword, Dr Proctor and the Applicant.

[157] Hokio Trusts sought further consideration of conditions related to weed harvesting and the ongoing involvement in the implementation of the projects. We have dealt with the weed harvesting conditions requested earlier in this decision.

[158] With regard to the tangata tiaki condition, the Respondent has amended the original decision to include Hokio Trusts' involvement in the appointment of tangata tiaki, on the recommendation of the planners.[52] This amendment was supported by the Hokio Trusts and by Ms Hunt.

[159] The proposed amendment was opposed in submissions from Mr Sword for the Lake Trust. He submitted that the Lake Trust had vested title to the lake, and as the

[52] JWS planning at para 15.3.

representative body for the beneficial owners is the only entity that can provide permission for the Council to enter its land and carry out the works authorised by the consents applied for. Consequently, the Lake Trust is the only body to be consulted on the appointment of tangata tiaki in relation to the exercise of those consents.

[160] Mr Sword submitted that it would be inappropriate for any other party to impose an alternative tangata tiaki appointment process. The opportunity is available for the Hokio Trust or any other Muaupoko tribal entity to approach the Lake Trust to discuss matters of relationship and ongoing involvement with these projects. In Mr Sword's submission it was not appropriate for this involvement to be directed by an order from the Court through consent conditions.

[161] Dr Proctor in his submission agreed with Mr Sword, reinforcing that the culturally appropriate avenue to deal with the issue of tangata tiaki and ongoing involvement was on the marae, not through conditions of consent imposed by the Court.

[162] In closing submissions the Applicant supported the submissions of Mr Sword and Dr Proctor, opposing any amendments to the tangata tiaki conditions or any amendment of the ADP to include Hokio Trusts representatives as requested. On this latter point Mr Jessen submitted that any changes to the ADP must involve all of the signatories to the protocol, which involved entities that were not parties to this appeal. Inclusion of Hokio Trusts representatives in the ADP would require consent of all those involved and was not a matter for the Court, in his submission.

[163] We accept the submission of Mr Sword in this matter. Inter-tribal/hapu relationships are a matter for the tribe to determine, not the Court. We are satisfied that the ADP is robust for the purpose it is designed for and entirely appropriate for these consents. The implementation of the ADP on Lake Trust land is a matter for the Lake Trust. We consider that the involvement of any other party must be at the discretion of the Lake Trust with the agreement of all other signatories to the protocol.

[164] Accordingly we direct that the wording of:

- Condition 17 for consent ATH-2015200304.00 (weed harvesting)
- Condition 22 for consent ATH-2015200297.00 (sediment trap)
- Condition 31 for consent ATH-2015200303.00 (fish pass)

revert to the wording set out in the commissioner's decision.

[165] For certainty, the above conditions are to read:

> The Consent Holder shall appoint a tangata tiaki in consultation with the Horowhenua 11 (Lake) Part Reservation Trust. The tangata tiaki shall be present on site during all construction earthworks.

[166] We are satisfied that all other proposed conditions of consent as set out by the Respondent and circulated to the parties on 10 June 2016 are appropriate.

Section 290A

[167] We have considered the decision of the hearing commissioners for the first instance hearing in light of the additional technical evidence provided by the Appellant with regard to the weed harvesting component of the consents applied for. Our evaluation of this evidence against the technical evidence from the Applicant provides us with no compelling reason to move away from that decision, apart from some rewording of conditions for clarification purposes.

Part 2 RMA

[168] We are satisfied that the proposed suite of activities will achieve the benefits identified in expert evidence from the Applicant and make a significant contribution to short and medium term restoration of water quality and ecological values at the lake, including an improvement in fisheries values. We are also satisfied that this will assist in the long-term restoration of cultural values associated with Lake Horowhenua as a taonga of Muaupoko. Any potential adverse effect on these values is avoided or mitigated by the design of the activities and the ongoing involvement of Muaupoko as kaitiaki during construction and implementation of the projects.

[169] The restoration of water quality to acceptable levels and the enhancement of fish access to the lake provides for the preservation of natural character (s 6(a)), protection of indigenous vegetation and habitats (s 6(c)), enhancement of public access (s 6(d)) the relationship of Maori with the lake (s 6(e)) and the protection of heritage (s 6(f)).

[170] In considering the relevant provisions of s 7 RMA, we accept that the design and implementation of the projects includes full consideration of kaitiakitanga through the ongoing involvement of the Lake Trust in particular and Muaupoko generally. Amenity value, particularly recreational amenity, will be significantly enhanced by the management of water quality and weed growth. The overall quality of the Lake Horowhenua environment will be enhanced.

[171] For these reasons we are satisfied the proposed activities are consistent with the purpose of the RMA as set out in Section 5 and will make a significant contribution to the sustainable management of Lake Horowhenua.

Result

[172] The appeal is denied. Consents granted by the commissioners on 15 December 2015 are confirmed subject to conditions in accordance with para's [156]-[166] of this decision. The Respondent is directed to submit consents in final form for execution under seal by the Court as soon as reasonably practicable.g

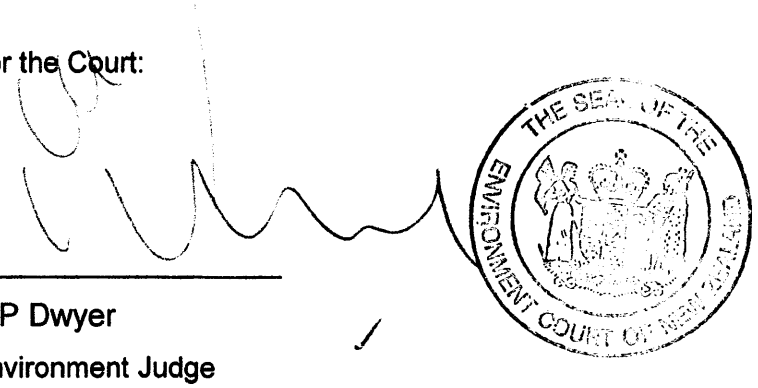
Costs

[173] Costs are reserved in favour of the successful parties in these proceedings. Any costs applications to be made and responded to in accordance with the Environment Court Practice Note 2014.

Authorship

[174] Commissioners Prime and Buchanan are the primary authors of this decision which represents the unanimous views of the Court.

For the Court:



B P Dwyer
Environment Judge