BEFORE THE ENVIRONMENT COURT
AT LEVIN

ENV-2016-WLG-0004

IN THE MATTER OF an appeal against a resource consent under section 120 of the Resource Management Act

BETWEEN **HOKIO TRUSTS**
Appellant

AND **HORIZONS REGIONAL COUNCIL**
Respondent

Statement of Evidence of William Patrick Chisholm

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Lw16183

Statement of Evidence of William Patrick Chisholm

1. Introduction

1.1 My name is William Patrick Chisholm.

1.2 I am an Environmental Consultant residing in Leeston, Canterbury. I have run my own environmental consultancy business, Chisholm Associates, since April 1991. I am the sole owner and manager of Aquatic Weed Control Ltd, a company which retails aquatic weed control products. Prior to this I have held ecological survey and management positions with the New Zealand Forest Service (three years) and Department of Conservation (four years).

1.3 I hold a Masters degree with Honours in Zoology from Victoria University of Wellington. I am a member of the New Zealand Ecological Society and the New Zealand Freshwater Sciences Society. I am currently registered as a Certified Environmental Practitioner (CENVP). The CENVP programme is run by the Environment Institute of Australian and New Zealand (EIANZ) and requires its members to act in a professional manner at all times.

1.4 Over the past 15 years, I have worked on a wide variety of environmental projects throughout New Zealand involving forest, grassland and animal surveys. For 7 years, I worked for the Electricity Corporation of New Zealand (ECNZ) on renewal of consents for their existing power stations. This included the Manapouri Power Scheme, Coleridge Power Scheme, Highbank Power Station, Waikaremoana Power Scheme and Tongariro Power Scheme. I was a member of the Waitaki Working Party, which in 1993 won a Resource Management Special Award from the Canterbury Regional Council.

1.5 A copy of my curriculum vitae is attached as **Appendix A**.

1.6 I have written and researched extensively in the area of aquatic weed removal and attach as one example my summary article entitled "*Review of Aquatic Weed Control Methods in New Zealand*" (**Appendix B**).

1.7 I have been asked to assess the application for resource consents the subject of this appeal and provide an expert opinion on behalf of the appellants. In so doing, I am bound by the provisions of the Code of Conduct for Expert Witnesses and I agree to adhere to those provisions.

1.8 This evidence is within my area of expertise except where otherwise stated herein. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

2. Summary of Evidence

2.1 In preparing my evidence I have reviewed:

2.1.1 The Commissioners' Decision (the Decision);

2.1.2 Reports by Dr Max Gibbs and Dr Kate Arthur from 2012;

2.1.3 The section 42A Report by Council staff;

2.1.4 Various scientific reports and papers referred to in this evidence, and in particular (but not limited to), the report by Clayton and Wells in 2005 relating to aquatic weed removal, which is attached as **Appendix C**;[1]

2.1.5 Evidence filed on behalf of the applicant before the Commissioners, and in particular that of Dr Max Gibbs.

2.2 I have visited Lake Horowhenua personally and assessed the site.

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1 Wells, R.D.S., Clayton, J.S. (2005). 'Mechanical and Chemical Control of Aquatic Weeds: Costs and Benefits'. *In*: Encyclopedia of Pest Management DOI: 10.1081/E-EPM-120024643 (Taylor & Francis).

2.3 I have also drawn on my previous discussions and association with Philip Taueki who has explained to me his perspective on Maori values associated with the Lake. I do not purport to provide expert evidence on Maori values, but I can conclude that my assessment of adverse environment effects of the weed harvester proposal are entirely consistent with the adverse effects which Mr Taueki has expressed to me from the perspective of tangata whenua values.

2.4 In my evidence, I provide an analysis of the mechanical weed harvester proposal and:

2.4.1 The likely adverse effects of the applicant's proposal on the distribution and growth of invasive aquatic weeds in Lake Horowhenua;

2.4.2 The adverse effects of the applicant's proposal on the water quality and ecology of the lake;

2.4.3 The alternatives to mechanical weed control which are preferable to the current proposal.

3. Adverse environment effects of using a weed harvester:

- **turbidity**
- **nutrients and**
- **fish species**

3.1 In this section, I consider the effects of using a mechanical weed harvester on **turbidity**. The Decision states: *there is no more than 30% increase in baseline turbidity levels for the months of September through December.*

3.2 It is not apparent what basis the limit of 30% from "the baseline" comes from. Turbidity limits should be defined as Nephalometric Turbidity Units (NTU) or Mg/L (preferably NTU), as these can then be directly linked to known adverse effects. For example, water turbidty of >10 NTU can cause light attenuation and thus adversely affect plant growth.

3.3 The length of time exposed to higher turbidity is a factor. Many aquatic plant and animal species can withstand short-term increases in turbidity (as occurs during a flood), but longer-term exposure to elevated turbidity can adversely affect the instream biota. A four-month long elevation of turbidity during the springtime (September through December) is likely to adversely affect the instream ecosystem of Lake Horowhenua.

3.4 It is not possible to design or operate a weed harvester which does not cause an increase in baseline NTU turbidity of less than 30%.

3.4.1 There is no information in the Decision on where turbidity is measured (i.e. the radius of "reasonable mixing" from the weed harvester).

3.4.2 The Decision does not state what the radius of "reasonable mixing" is going to be.

3.4.3 The Decision does not provide for limits on nutrient re-suspension.

3.5 The above factors all need to be assessed before using such machinery on a relatively shallow lake such as Lake Horowhenua.

3.6 Next, I consider the effects of using a mechanical weed harvester on **nutrients**.

3.7 Large growths of the lakeweed *Potamogeton crispus* indicate that Lake Horowhenua has excessively high levels of nitrates. The reports by Dr Max Gibbs and Dr Kate Arthur both refer to declining water quality as a significant threat to the lake's aquatic values.

3.8 The lake is currently hypertrophic (i.e. highly polluted), which significantly increases the risk of the plant communities in the lake changing from macrophyte-dominated to algal-dominated.

3.9 This would destroy the aquatic plants in the lake, severely reduce water clarity, and change the colour of the lake to a grey-green. This phenomenon is commonly known as lake "flipping". An example of a lake that has "flipped" is Te Waihora/Lake Ellesmere just south of Christchurch.

3.10 Once "flipped" it is very difficult and expensive to get a lake to change back and regain its weed beds, water clarity and colour. For example, Te Waihora/Lake Ellesmere "flipped" in 1968 and remains in its degraded state to this day. I am aware that approximately $10.5 million is being spent by Christchurch local and central government, along with iwi, to try and rectify this, but it unlikely to succeed for many years.

3.11 The most effective and cost efficient remedy is to prevent the lake from "flipping" before it actually happens.

3.12 Dr Gibbs reports a Trophic Lake Index (TLI) of 6.7 for Lake Horowhenua, and he also reports on incidents of algal blooms dominating the lake on occasions. A TLI of 6.7 indicates a very high level of pollution, and it is scientifically anomalous that the lake has not "flipped" yet. At these TLI levels, it will not take much more addition of nutrients to the water column to trigger this lake into "flipping".

3.13 The potential to elevate nutrient levels through the use of a weed harvester has been described by Wells and Clayton (2005):

> Weed harvesting removes nutrients from the water body (via plant biomass) but in most cases the quantity of nutrients removed is of little consequence as it is less than the inputs from the catchment, and often much less than the nutrients released from the sediments during periods of anoxia or disturbance (Wells and Clayton 2005).

3.14 It is apparent that Lake Horowhenua is on a knife-edge of "flipping" and only requires a trigger such as a slight elevation in nutrients. The mobilisation of substrate sediments by a weed harvester could be such a trigger.

3.15 I now consider the effects of using a mechanical weed harvester on **native fish**.

3.16 The loss of in-stream species through mechanical weed removal, including macroinvertebrates and native fish, has been documented by Young *et al* (2004).

3.17 This study looked at the use of a mechanical digger for drain clearance, and found that eels were particularly vulnerable to being caught up in the removed weed masses, and subsequently dumped on land to perish. Koura and other macroinvertebrates were also vulnerable to this effect.

3.18 The Decision states: *"We accept the evidence of Dr Kelly who indicated that any such losses would be minor in the context of the conservation status of the fish species considered."*

3.19 Wells and Clayton (2005) studied the effects of mechanical weed harvesters on freshwater fauna, and concluded:

> Weed harvesting may have to be repeated several times in a growing season and usually results in capture of a wide range of aquatic organisms (including many small fish) that inhabit or take refuge in the weed.

3.20 Longfin eels (*Anguilla dieffenbachia*) are found in Lake Horowhenua. This species is currently classified as "declining" by the Department of Conservation Threat Classification System (Goodman *et al* 2013).

3.21 Two other native fish species which are likely to inhabit the lake is the inanga (*Galaxias maculatus*) and the giant kokupu (*Galaxia argenteus*). These two species have the same "declining" rating as longfin eels.

3.22 These three species, as well as the other common native fish (e.g. bullies) and recreational sportsfish (e.g. trout) are all under threat from the use of a mechanical weed harvester.

3.23 I disagree that such losses would be minor in the light of the conservation status of longfin eels, inanga and giant kokopu.

4. Biosecurity risks of using the weed harvester

4.1 In my expert opinion, the weed harvester proposal means that there is a significant biosecurity risk of the invasion of aquatic weed species which would be highly detrimental to the health of the Lake. Weed harvesters are known to be a major agent of aquatic weed spread (Wells and Clayton 2005). The threat includes the harvester, the machinery and the trailers. Weed fragments can easily lodge in unseen and hard-to-reach corners of such complex machinery, such as water intakes, screen meshes and under trailers.

4.2 The Decision recognises that there is some risk because the Commissioners state: "*it was agreed that an operational biosecurity strategy for using the weed harvester boat (including dealing with harvested plant fragments not getting into other waterways) was appropriate.*"

4.3 While on paper, a "biosecurity strategy" might seem appropriate, previous experience demonstrates that any "strategy" employed to address the biosecurity risk of mechanical weed harvesters has not prevented contamination.

4.4 It only takes a 1cm fragment of hornwort, *Lagarosiphon* or *Egeria* to be attached to the machinery, to cause the lake to be infected. "Wash down" and "dry down" is nowhere near enough to mitigate this risk.

4.5 The entire machinery and supporting equipment (boats, trailers etc) would need to be dismantled and fully steam-cleaned, with all pumps, hoses, nets, bags etc to be disinfected. This has previously been done when using mechanical weed harvesters on the Waikato lakes, but aquatic weeds were still introduced to these lakes despite these precautions.

4.6 Once introduced to the lake, eradication of these weed species would be virtually impossible. The high risk and serious adverse effects of introducing new aquatic weed species to Lake Horowhenua remains whenever this machinery is used.

4.7 There are three species of invasive aquatic weed which could find their way into Lake Horowhenua:

- *Lagarosiphon major* (known as "Lagarosiphon")
- *Ceratophyllum demersum* (known as "Hornwort")
- *Egeria densa* (known as "Egeria")

4.8 I am aware that the second of those listed, Hornwort, has been recorded in nearby Horowhenua waterways. Generally, if an infected waterway is within 120 kilometres of an uninfected waterway, then the potential for any of these three invasive species to spread to the uninfected lake is high. This is because, over this distance, most weed fragments attached to boat trailers or outboard propellers will not dehydrate and die before they reach the new lake.

4.9 All three of the above species are highly invasive, with only a small fragment being needed to infect an area which will then spread rapidly throughout the entire lake, and downstream waterways. Once infected, it is extremely difficult and prohibitively expensive to eradicate these aquatic weed species from the lake, even if the infection is localised to a small area.

4.10 The ramifications of having any (or all) of these three aquatic weed species in the lake are very serious. These weeds can double their biomass every three months, forming continuous surface-reaching growths and "rafts" of matted weed on the surface of the lake, making recreational use on the lake, such as boating, virtually impossible.

4.11 Periodic decomposition of these weed mats can cause catastrophic de-oxygenation of the lake, causing fish deaths and overall reduced fisheries in the lake.

4.12 There is a real threat that if any (or all) of these three aquatic weeds infected Lake Horowhenua then any recreational or utility value of the lake would essentially be destroyed.

5. Adverse Effects of Weed Disposal

5.1 The Decision states: *"The harvester will return to shore approximately once per day to unload weed onto hardstand for drying and then removal by truck to landfill (other end uses for the weed continue to be explored)"*

5.2 In my view, there will be a discharge of contaminants as leachates seep out of the "hardstand". "Drying" can take up to 6 months, so the area required for drying would be considerable. The large amount of weed harvested would exceed any landfill's ability to hold it, so additional landfill space will be required. Weed-rotting will also occur during drying, causing more leachates.

5.3 Use of weed for compost and/or stockfeed would merely re-introduce the nutrients back into the lake catchment, unless they were trucked out of the catchment (a very expensive exercise), but even then, raising the prospect of contamination of other waterways.

5.4 Wells and Clayton (2005) state:

> The potential for weed-cutting machines to spread invasive weeds to new sites since they produce a lot of cut fragments that are not collected and they are very difficult to decontaminate before entering a new water body.

5.5 Weed collection and disposal is perhaps the most logistically difficult part of a mechanical weed harvesting operation. The application does not describe how nearby water bodies will be protected from invasion from the disposal of these cut weed fragments.

6. The proposal will not achieve its stated purpose

6.1 The Decision states:

> The technical evidence provided in the Applicant's proposal, and the expert evidence of Dr Gibbs (for the Applicant), went into some detail about how the proposed weed harvesting would break the cycle of cyanobacterial blooms and benefit the water quality of the lake.

6.2 I am unfamiliar with any concept of weed harvesting to 300mm in order to "break the cycle of cyanobacterial blooms." Neither do I know of any study or information which supports this conclusion.

6.3 Indeed, I doubt that this is possible, as cyanobacterial blooms are the result of temperature and suspended nutrient levels in the lake, rather than the presence/absence of submerged aquatic weeds.

6.4 The re-suspension of sediments from the use of the weed harvester is more likely to exacerbate cyanobacterial blooms, as nutrients will be mobilised from lakebed sediments into the water column, and hence will be more available for the development of these cyanobacterial blooms.

6.5 I again refer to the report of Wells and Clayton (2005). This report reviewed the use of weed harvesters versus chemical control of aquatic weeds. The report states that the key benefits of mechanical harvesting include a rapid removal of weed from a sensitive site, and a common public perception that mechanical harvesting is environmentally preferable to adding chemicals to water.

6.6 However, the report lists the adverse (negative) effects which I have already discussed, as well as the following:

> Harvesters are generally suitable for use in only sheltered water where weeds in amenity areas are commonly mowed to a depth of 2m and where the risk of further weed spread is not relevant.
>
> Some sites are unsuited for cutting because of uneven bottom contours, obstacles or high flows, and low water clarity that can make it difficult to view cutting lines.

6.7 Wells and Clayton (2005) also mention that, in some cases, repetitive harvesting can result in reduced regrowth rates, and when exotic weed beds are cut close to the sediment level a change to a more desirable species can occur.

6.8 They do not state how repetitive the harvesting needs to be to achieve this positive result. I would expect that it would need to be at least every 6 months, as aquatic weeds can double their biomass every three months.

6.9 As such, mechanical weed harvesting would be a short-term exercise in weed suppression only, but come with significant adverse effects.

7. Conclusion

7.1 The proposal for the weed harvester will likely produce significant adverse effects on the environment, and will not achieve the stated purpose of supressing the aquatic weeds in Lake Horowhenua.

7.2 I have been asked to consider whether the adverse effects I have described above would be considered "significant" adverse effects on the environment. The answer is yes, I consider those impacts to be significant.

7.3 As such, I am of the view that a prudent environment step is to consider alternatives to the weed harvester.

7.4 In my opinion, the best way to suppress the submerged aquatic weeds in Lake Horowhenua is to:

7.4.1 reduce the amount of nitrates in the water column;

7.4.2 reduce the amounts of other nutrients (especially phosphorous); and

7.4.3 reduce the overall TLI of the lake.

7.5 The main aquatic plant present in the lake, *Potamogeton crispus,* is highly sensitive to nitrate levels, so improvements to lake water quality is the best and most effective means to naturally reduce the presence of this aquatic plant.

7.6 How is this achieved? The primary and fundamental step is to prevent the extraordinary leaching that is occurring at present into the Lake from a variety of sources, namely the stormwater drains and the run-off. There will then be a process of natural recovery of water quality. From there, I would recommend a programme of targeted weed control by way of chemical methods, using a well-respected product **diquat/gel**. This method is described in my paper which is appended to this evidence.

7.7 In my experience with aquatic weed removal, these steps would be more cost-efficient, but most importantly would be considerably less risky than the introduction of a mechanical weed harvester into this environment.

William Chisholm
15 April 2016