IN THE ENVIRONMENT COURT AT WELLINGTON

IN THE MATTER	of the Resource Management Act 1991 ("**the Act**")
AND	
IN THE MATTER	of clause 14 of the First Schedule of the Act
BETWEEN	**FEDERATED FARMERS OF NEW ZEALAND** ENV-2010-WLG-000148
AND	**MINISTER OF CONSERVATION** ENV-2010-WLG-000150
AND	**HORTICULTURE NEW ZEALAND** ENV-2010-WLG-000155
AND	**WELLINGTON FISH & GAME COUNCIL** ENV-2010-WLG-000157
	Appellants
AND	**MANAWATU-WANGANUI REGIONAL COUNCIL**
	Respondent

STATEMENT OF EVIDENCE OF LINDSAY EUAN FUNG FOR HORTICULTURE NEW ZEALAND IN RELATION TO THE APPEALS ON THE PROPOSED ONE PLAN FOR MANAWATU WANGANUI REGIONAL COUNCIL ON SURFACE WATER QUALITY

14 MARCH 2012

Helen Atkins
PO Box 1585
Shortland Street
AUCKLAND 1140

ATKINS | HOLM | MAJUREY

Solicitor on the record	Helen Atkins	Helen.Atkins@ahjmlaw.com	(09) 304 0421
Contact solicitor	Helen Atkins	Helen.Atkins@ahjmlaw.com	(09) 304 0421

QUALIFICATIONS AND EXPERIENCE

1 My name is Lindsay Euan Fung. I am the Vegetable Research & Innovation Manager of Horticulture New Zealand. I have a Doctor of Philosophy in tree physiology and genetics from the University of Canterbury.

2 I have spent over 9 years as a scientist/researcher in tree physiology and breeding, and a further 8 years as a science manager for several organisations.

3 In my years as a scientist I was the leader at HortResearch for a FRST and Regional Council funded programme for soil conservation trees – aimed primarily at hill country use, but also for riverbank stabilisation.

4 In my science management roles I was employed by Horizons Regional Council as a Team Leader for the environmental scientists (covering areas of soil management, water quality and quantity, biodiversity, coastal areas and waste management). I was also employed as a Science and Policy Manager at Deer Industry New Zealand and had oversight of research on environmental management in deer farms and involvement in Deer Industry Focus Farms where environmental management was an important component.

5 I am currently employed by Horticulture New Zealand and have similar oversight of a range of research and innovation projects which include soil and nutrient management for vegetable growers.

6 Christopher Keenan, Resource Management and Environment Manager for Horticulture New Zealand and Dr Sonia Whiteman, the previous Vegetable Research & Innovation Manager, provided evidence to the Hearings Panel on the issues in this statement of evidence in February 2010. This earlier evidence is not included in the Technical Evidence Bundle as it was not considered technical evidence by the Hearings Panel because, as I understand it, due to time constraints imposed on the exchange of technical evidence at that time. Copies of Mr Keenan's and Dr Whiteman's statements of evidence are attached as an appendix to my "will say" statement provided for expert witness caucusing for the land use topic.

7 I have been provided with a copy of the Code of Conduct for Expert Witnesses contained in the Environment Court's Consolidated Practice Note dated 1 November 2011. I have

read and agree to comply with that Code. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

CONTEXT AND SCOPE OF MY EVIDENCE

8 The particular issue that my evidence addresses is industry activity in soil and nutrient management. Specifically ongoing work from two completed projects described previously in the submitted evidence of Mr Keenan and Dr Whiteman.

9 The "Supplementary Statement by Jon Roygard and Maree Clark on Nutrient Load Scenarios and Methodology" and "Lake Horowhenua review. Assessment of opportunities to address water quality issues in Lake Horowhenua" are also commented upon.

SUMMARY OF CONCLUSIONS

10 The horticulture industry has been refining tools and processes to aid horticultural growers to manage nutrient inputs and maintain soil on site (i.e. minimise soil loss from paddocks). These refinements are logical progressions from two completed projects covering: i) soil management (Holding It Together or HIT), and ii) nutrient management (Nitrogen Management for Environmental Accountability or NMEA). The development of crop models to estimate crop yields and nutrient losses will also assist nutrient management.

11 The speed at which these refinements are introduced into growers' practices depends upon collaboration between external parties including extension agents and industry organisations, and available funding. But the horticulture industry has already made advances in providing growers with information on best management practices that will allow growers to choose those that are most appropriate for any given situation. Furthermore the industry has invested funds to develop nutrient management training courses for growers that will complement more advanced courses for professional consultants.

12 Nutrient load scenarios presented by Roygard and Clark use N loss rates for horticulture that are based on limited studies that are either crop specific or obtained in circumstances that are not reflective of usual growing conditions. Using the results from those studies in this fashion should be treated with caution and

necessitate more research that better reflects commercial horticulture businesses in the region.

SOIL MANAGEMENT INITIATIVES

13 The HIT project has been explained in the evidence of Mr Barber. In this part of my evidence I provide an update of the project since the time evidence was given to the Hearings Panel in February 2010.

14 HIT, a three year project, was recently completed in October 2011. This project covered four main topic areas on soil management:

(i) Surface runoff or ponding.

(ii) Cover cropping and soil amendments.

(iii) Soil compaction.

(iv) Cultivation practices.

15 Soil management practices influence nutrient management by reducing nutrient loss associated with soil loss (principally phosphorus), improving nutrient recycling and reducing fertiliser wastage.

16 During the project the "Code of Practice for Commercial Vegetable Growing in the Horizons Region" was developed using information from the project and previous work in soil management. This code is now operational and referenced in New Zealand GAP[1].

17 As part of the project, eight sediment traps were placed around a range of grower sites in the Horowhenua area. The trial and observations are described in the evidence of Mr Barber at paragraphs 31 and 32.

18 More detailed information from the project has been presented to growers through industry publications and websites, and most recently as a handbook "A Guide to Smart Farming"[2] that

---

[1] NZ GAP was explained in detail to the Hearings Panel by Mr Peter Ensor. A copy of the relevant extracts from Mr Ensor's evidence is contained in the evidence of Mr Keenan

[2] 'A Guide to SMART FARMING', D.J. Bloomer and J. Powrie (eds), LandWISE 2011, ISBN 978-0-473-20374-0

has been provided to all vegetable growers throughout the Horizons region (and the country).

19 Horticulture New Zealand and New Zealand GAP have applied to the Sustainable Farming Fund to develop a web-based soil management risk-assessment module for New Zealand GAP auditing that will provide a standardised process for determining appropriate mitigation measures to minimise soil loss from paddocks.

NUTRIENT MANAGEMENT INITIATIVES

20 The NMEA project described by Dr Whiteman in the previous evidence resulted in the development of horticulture and arable modules for the nutrient model OVERSEER® in 2009 (version 5.4.3). A training programme for OVERSEER® was then developed by the Massey University Fertiliser and Lime Research Centre that is aimed at growers (i.e. non-technical users/experts in fertilisers and soil/plant chemistry).

21 While version 5.4.3 was a useful first step (where previously there had been no consideration of horticultural or arable crops), subsequent testing revealed some significant bugs in the software that compromised modelling outputs. The model was also not able to provide an analysis of a combination of farming systems (i.e., including a pasture phase in a normal cropping rotation as is common in the Ohakune district). As a result OVERSEER® version 6 has attempted to address these shortcomings and is due for release around April 2012. The owners acknowledge that a significant concern around the rate of mineralisation remains unresolved.

22 Horticulture New Zealand and the Foundation for Arable Research formed a working group of growers and industry representatives in 2010 to liaise with OVERSEER® researchers and the fertiliser industry. The working group has signalled that it will trial the new version 6 following its release and will then seek a wider pilot trial using 20 growers from across the country to fully evaluate the new version for use in cropping systems. The trial will evaluate both the model and the training programme. Should the new version and the training programme be easy to adopt by growers, the working group will then discuss with New Zealand GAP how this can be best incorporated into the New Zealand GAP assessment.

23 Horticulture New Zealand does not consider that version 6 will be the definitive model for informing nutrient management and estimating nutrient losses, but does support its ongoing

refinement and recognition as a useful tool for nutrient management in the absence of other tools for horticulture and in particular vegetable production.

24 Recently the New Zealand Fertiliser Manufacturers' Research Association invited Horticulture New Zealand to join an establishment committee to form a governance group for "The Nutrient Management Adviser Certification" programme (meeting held on 24 February 2012). Horticulture New Zealand participated and has nominated the New Zealand GAP Manager for the governance group.

25 Horticulture New Zealand is also actively involved in extension work for the Land Use Change & Intensification II research programme (LUCI II) which will develop specific horticulture crop models to more accurately determine water and nutrient usage in relation to yields. While the focus of the research programme is in the Canterbury region, these models will be applicable to crops grown in the Horizons region. Part of this work will include production of new yield models for carrots and onions to better model those crops within the rotational framework. Currently these models do not exist for New Zealand.

NUTRIENT LOAD SCENARIOS AND LAKE HOROWHENUA

26 In relation to the "Supplementary Statement by Jon Roygard and Maree Clark on Nutrient Load Scenarios and Methodology" I will confine my comments to the section "*Determining the nutrient loss rates for the 'Horticulture' land use type*" (paragraphs 80 – 89, Table 23).

27 The authors note that horticulture is a minor land use component in all the study areas but imply that the area recorded may be an under estimate. This is speculation – the main conclusion that can be drawn from the data is that horticulture is a *very* minor land use throughout the region (and in the later Lake Horowhenua review which has a concentration of horticulture land use – this still only totals 2.9 % of the total land area).

28 The authors also cite nitrogen loss rates for horticulture in the order of 100 – 300 kg N ha^{-1} $year^{-1}$ from the Clothier *et al.* (2007) report[3] (paragraph 83). It is important to note that these figures

[3] Clothier, B., Mackay, A., Carran, A., Gray, R., Parfitt, R., Francis, G., Manning, M., Duerer, M. & Green, S. (2007) Farm strategies for contaminant management: a

themselves are derived from four earlier studies. Of these, one reference (Painter *et al.*, 1997) was unable to be found[4], one was based in Pukekohe (Francis *et al.*, 2003), one examined the use of compost (Spiers *et al.*, 1996), and one reported on a study in Horowhenua that was considered unrepresentative of good management practice (Snow *et al.*, 2004), due to excessive use of compost, higher than usual rainfall and crop failure. This study has previously been covered in evidence submitted by Mr Keenan[5].

29 Other figures cited include individual crop loss rates from a study based on a fictitious farm in Ohakune ranging from 18 - 58 kg N ha^{-1} $year^{-1}$ (paragraph 83). However the authors omit the balance of the fictitious farm being in pasture with a loss rate of 10 kg N ha^{-1} $year^{-1}$.

30 The authors then proceed to use these crop loss rates to estimate horticultural contributions to the study catchment loads and refer to a high rate from Clothier *et al.* (2007) to demonstrate that horticulture could have a disproportionate effect on catchment load, relative to land area (paragraphs 84 – 86).

31 This use of the data from the studies above and specific crop loss rates raises some concerns:

(i) Horticultural businesses do not tend to grow single crops continuously on any given paddock. The concept of crop rotations, including use of fallow or cover crops within a paddock, and a mix of crops and land use within a business in any given year was presented in Mr Keenan's evidence. However the authors appear to have applied a simplistic and arbitrary loss rate of 80 kg N ha^{-1} $year^{-1}$ as indicative of horticulture as a whole.

(ii) There is a real paucity of data concerning horticulture in the Horizons region, which has also been referred to by a range of parties. The Snow *et al.* (2004) study for example

---

report by SLURI, the Sustainable Land Use Initiative, for Horizons Regional Council. PalmerstonNorth, New Zealand: AgResearch

[4] This reference may be a typographical error and instead refer to Parminter et al., 1977.

[5] Statement of Evidence of Christopher Martin Keenan on Behalf of Horticulture New Zealand – Water Quality, 26 February 2010, paragraph 138.

highlights how a set of unforeseen external circumstances coupled with a lack of nutrient management planning can result in high loss rates, but does not in itself suggest that they are typical of horticulture (and in fact demonstrates that nutrient management can play a role in reducing likely loss rates).

(iii) Clothier *et al.* (2007) report on rate losses from previous studies, and also refer to simulations for potatoes (and barley) using OVERSEER and LUCI models (Table 9, pages 19 and 20). These yield much lower loss rates but are seemingly dismissed by the authors as they are not consistent with the reported studies and that planting times differed from these earlier studies. There is no indication as to which of the studies or the simulations best reflect commercial horticultural practice, so it is difficult to judge if the simulations are under-estimations or the studies are over-estimations of loss rates from horticultural businesses.

32 By alluding to greater land use than what is recorded and high leaching rates, the authors give the impression that horticulture has a disproportionately greater effect on catchment load, relative to land area. In my opinion this is misleading at worst and at best demonstrates the need for further research to provide greater understanding of the range and distribution of rate losses from horticultural activities.

33 It should be noted that scientific knowledge in this area is limited and that ongoing work can add greater clarity. For example, Dr Brent Clothier gave evidence for Horticulture New Zealand on the proposed Bay of Plenty Regional Policy Statement in late 2009, citing new knowledge as a reason for his revised lesser predictions of kiwifruit leaching figures, compared to those he presented for Horizons Regional Council in evidence prepared for the proposed One Plan.

34 The report prepared for Horizons Regional Council by NIWA and referred to in paragraph 9, (the Lake Horowhenua review), states that vegetable production is 2.9% of the land use area in the Horowhenua catchment (Table 2-1, page 18). Vegetable production is predominantly centred around the Arawhata Stream, with a lesser area adjacent to Levin by the Queen Street Drain. Small, isolated pockets of production are also near Mangaroa and Patiki streams (Figure 2, page 19).

35 The report states that: "About 80% of the external P load on the lake from the catchment is a single point source: Queen Street drain." (page 10) and that it "currently the largest external source of phosphorus (P) nutrient to the lake (see Table 3-1)." (page 18).

36 While the report cannot definitively demonstrate origins of nutrients, urban stormwater appears to be a significant source of P. As noted[6] a lesser area of vegetable production occurs adjacent to the Queen Street Drain. On face value, given the observations from the Horowhenua sediment loss trials[7] regarding sediment loss (and associated P), and that vegetable growing is more concentrated around the Arawhata Stream, vegetable production does not appear to be a major contributor to P entering into Lake Horowhenua.

37 The report also identifies the Arawhata Stream as being the largest source of surface water N (Table 3-2, page 40), with a large increase over time that aligns with land use change to intensive dairy farming (page 34). Interestingly the authors consider that dissolved reactive P concentrations were low in 1988/89 (when horticulture was more prevalent), but have since increased.

38 While it is uncertain whether particulate P comes from land runoff or stream bed erosion, the authors suggest that the source is "*more likely to be stream bed sediment rather than fresh top soil, unless there are effluent ponds that can be flushed into the stream*" (page 34). This reasoning suggests that horticultural land in the Arawhata Stream catchment is not the major contributor to current inflows of N and P.

39 It is noted that Clothier *et al.* (2007) provides some suggestions for reducing N and P losses from horticultural operations in the form of good crop, soil and nutrient management practices (pages 20, 21). Many of these recommendations are incorporated into industry initiatives (soil management Code of Practice, nutrient management and OVERSEER® training, and further investment into development of crop models to estimate yield and nutrient loss). Similarly the Lake Horowhenua review suggests that a general reduction in the use of fertiliser across all land uses will reduce nutrient loading into the lake.

---

[6] Paragraph 34 of this evidence

[7] Paragraph 17 of this evidence and the evidence of Mr Barber

Better modelling and nutrient management planning will assist in reducing nutrient losses from paddocks.

CONCLUSIONS AND RECOMMENDATIONS

40 In the areas of soil and nutrient management, Horticulture New Zealand and its associated vegetable product groups are continuing activities to promote best management practices via New Zealand GAP. There is also ongoing commitment to improving the existing tools and processes and development of new tools where there are currently information gaps.

41 The horticulture industry is already investing in research and development of tools and management practices that will help address some of these knowledge gaps and researcher recommendations and expects that these will be incorporated into normal grower business decisions over time.

42 Some tool development and knowledge transfer will be dependent upon other parties (e.g. the release of OVERSEER® version 6, development of onion and carrot models as part of LUCI II), and it is expected that ongoing refinements and addition to scientific knowledge will also occur.

43 Reports and researchers have consistently mentioned paucity of accurate data or typical practices for horticulture in the Horizons region, those that are undertaken have tended to report on crop specific nutrient rate losses rather than the horticulture business overall (i.e. the mix of crops and non-crops that are grown in any given year). As a result these nutrient rate losses from horticulture should be treated with caution until further work that better reflects commercial horticulture businesses and their practices in the region can be undertaken.

44 While the "Supplementary Statement by Jon Roygard and Maree Clark on Nutrient Load Scenarios and Methodology" suggests that horticulture appears to have a disproportionately greater effect on catchment nutrient loads, this is not evident in the "Lake Horowhenua review" where there is little evidence to suggest that commercial vegetable production is a major contributor of phosphorous (via soil loss from paddocks to waterways) or nitrogen to Lake Horowhenua.

Lindsay Euan Fung

14 March 2012