

**BEFORE THE COMMISSIONERS
At PALMERSTON NORTH**

UNDER: the resource management Act 1991

IN THE MATTER OF: an application for a **Notice of Requirement** by **New Zealand Transport Agency** to the Palmerston North City Council, Manawatu District Council and Tararua District Council for **E AHU A TŪRANGA MANAWATŪ TARARUA HIGHWAY.**

Statement of evidence of Brent Clothier on behalf of AgResearch Ltd

Dated 15 March 2019

STATEMENT OF EVIDENCE OF Dr Brent Clothier

INTRODUCTION

1. My name is Brent Euan Clothier
2. I hold PhD and DSc degrees from Massey University and I am a Fellow of the Royal Society of New Zealand – Te Aparangi
3. I am currently Principal Scientist with the Crown Research Institute, Plant and Food Research based in Palmerston North

EXPERT WITNESS CODE OF CONDUCT

4. I have read and am familiar with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014. I agree to comply with that Code. Other than where I state that I am relying on the advice of another person, this evidence is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

PURPOSE AND SCOPE OF EVIDENCE

5. I understand that the Project will cut through the long-term phosphorus fertiliser and sheep grazing trial (the 'Trial') established in 1975, which is located on the AgResearch Ballantrae Hill Country Research Station at the intersection of Saddle and Morgans Rd.
6. I believe that this long-term fertiliser and grazing experiment is critical for development of sustainable practices for managing our North Island's hill country and protecting our environment.
7. Here I provide an expert opinion on the impact that the proposed Project, and its construction, will have on the hydrology of the Trial, and the implications for the integrity of future findings from the experiments should the hydrology be disrupted by the Project and its construction.

EXECUTIVE SUMMARY

8. Disruption of these hydrological and hydraulic connections by the Project, and its construction, will destroy the integrity and value of this long-term Trial, with the loss of 44 years of documented history. There will be no ability to use future experimental results, from any of the blocks, for the hydrological connections within and between blocks will have been compromised. The utility of the Trial will have been destroyed.

EVIDENCE

9. The Trial comprises four self-contained farmlets. The fertiliser treatments are: Big Hill (HFHF - High Fertiliser High Fertiliser); Pylon East (HFNF - High Fertiliser No Fertiliser); Pylon West (LFLF – Low Fertiliser Low Fertiliser) and Pylon Centre (LFNF – Low Fertiliser No Fertiliser). The farmlets were established in 1975. I have received, from AgResearch, the following map of the farmlets and the proposed pathway of the Project (Figure 1). The farmlets cover three slope-classes and cover three aspects found in hill country so as to provide a wide range of conditions that are typical of the dissected hill country of the North Island
10. Within the blocks of the Trial there are 72 permanent soil and pasture measurement sites that are used to track the changes of the different fertiliser regimes. These are shown on the map

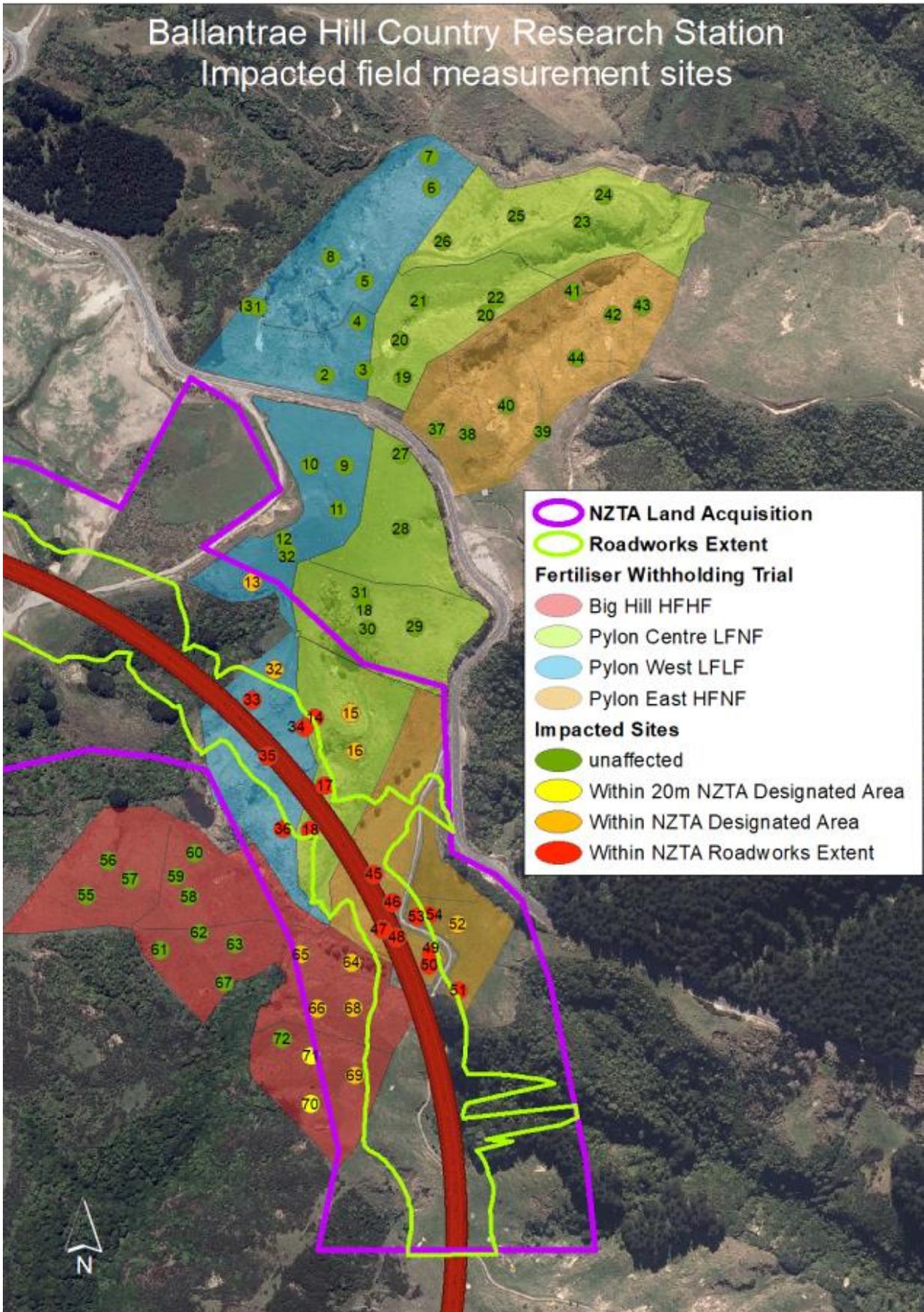


Figure 1: A map of the blocks of the Trial, and the proposed path of the Project

11. The Project and its construction will have a major impact and destroy integrity of the all four farmlets
12. As well, of the 72 permanent measurement sites, 15 permanent sites will disappear, and from a hydrological perspective this will remove virtually all measurement sites with a southerly aspect of Pylon East, Pylon Centre and Pylon West. And another 10 sites will be compromised. This is critical, for these 25 sites are predominantly those with a southerly aspect which face the dominant direction of rainfall.
13. The Trial is a microcosm of the North Island hill country, and hence the results have wide applicability. The farmlets encompass not only the three slope classes and three aspects, but a wide range of soil types, and phases of these types.
14. AgResearch have provided me with the soil map of the Trial (Figure 2), along with J.D. Cowie's 1983 report on "The Soils of Ballantrae Farm Woodville". The soil include the Makara Steepland soil (MkS), the soils and phases of the Mangamahu Steepland soil (Mm), the Ngamoka soils and its phases (Ng), the Raumati silt loam (Rt), and Whetukura soils and its phases (Wt).
15. It is the complexity of the interactions between the slopes, aspects and soils of this long-term experiment seeks to understand in order to develop sustainable practices for managing the North Island's productive hill country

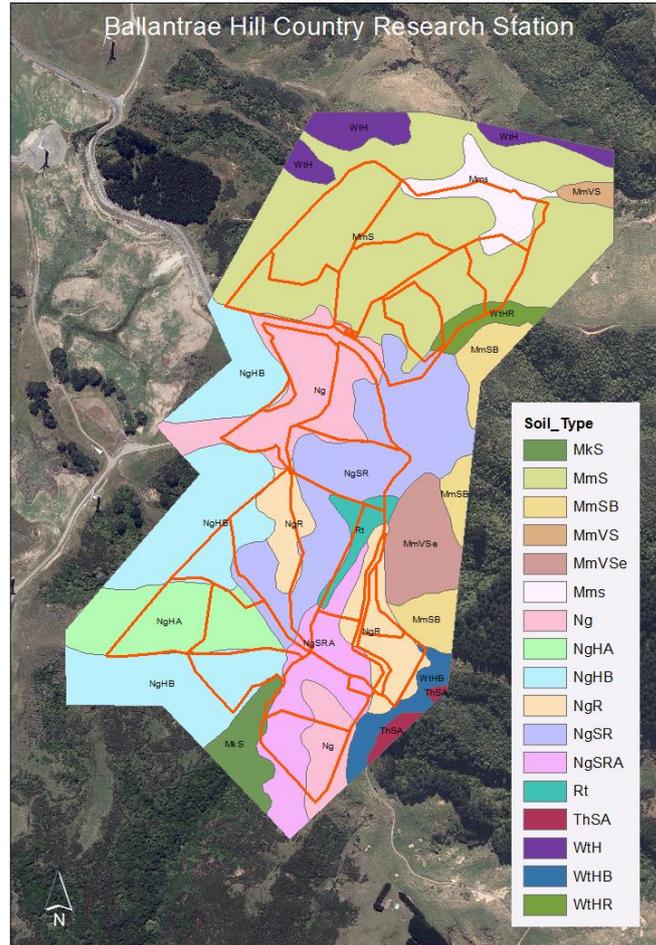


Figure 2. The soils of the Trial

16. The complex interactions between slope, aspect and soil type are to a large extent governed by the large-scale hydrology of the Trial. At the smaller scale this involves the local pattern and timing of rainfall, infiltration of water into the soil, surface runoff processes, drainage and leaching through the profile, plus sub-surface lateral exchanges of water and dissolved fertiliser and animal excreta.
17. The farmlets are self-contained systems managed independently with a separate livestock mob in each farmlet. But in the sense of the larger scale hydrology, they are all hydraulically connected. The experimental results that come from the Trial reflect these interactions between self-contained management and hydrological and hydraulic connections.
18. The hydrology of these sloping lands is further complicated by the ephemerally hydrophobic nature of these hill country soil (Clothier et al. 2000). In other

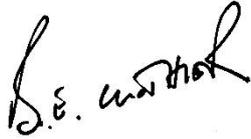
words, when these soils become dry, they do not spontaneously rewet upon rainfall. They are said to be water repellent. So runoff occurs and there is surface redistribution of water over the scale of over 10s of metres. This runoff connects the hydrology of these sloping lands and gullies. The ‘flashiness’ in the hydrographs of the ephemeral streams, permanent water courses, and primary rivers reflect this water repellency. Runoff connects the diverse landscape units. The Trial encompasses the breadth of these hydraulically connected landscape units. Any disruption would break this connectedness, and alter the nutrient dynamics of the various slope and aspect elements.

19. The paper by Sakadevan et al. (1994) quantified the nutrient losses by leaching through the soil profile from the Trial. They gained understanding of the effects of landslope, fertiliser history and the return of animal excreta of the nutrient leaching dynamics in hill country pastures.
20. Sakadevan et al. (1994) used the soil-water model of Scotter et al. (1979), and I was a co-author on that paper.
21. I well understand the hydrological connectedness of this hill country landscape with its range of slope classes, aspects and soil types. This involves both surface runoff processes, plus drainage and leaching through the profile. These hydrological processes connect the landscape units of this hill country Tr

CONCLUSIONS

22. The Trial is unique for it provides a long-term record of the impact of fertiliser and livestock management on the sustainability of North Island’s productive hill country. Through this Trial new understanding is being gained so that management of these landscapes can address contemporary production and environmental issues and provide a beacon for how to manage hill country under future climates.
23. The Trial must continue

Dated: 15th March 2019.



References:

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Scotter, D.R., B.E. Clothier and M.A. Turner, 1979. The soil water balance in a fragiaqualf and its effects on pasture growth in Central New Zealand. *Australian Journal of Soil Research* 17: 455-465.