IN THE MATTER OF	The Resource Management Act 1991
AND	
IN THE MATTER OF	Notices of requirement for designations under section 168 of the Act, in relation to Te Ahu a Turanga; Manawatū Tararua Highway Project
BY	**NEW ZEALAND TRANSPORT AGENCY** Requiring Authority

STATEMENT OF EVIDENCE OF JEFFREY DONALD MORTON (EFFECTS ON THE AGRESEARCH BALLANTRAE SITE) ON BEHALF OF THE NEW ZEALAND TRANSPORT AGENCY

8 March 2019

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TABLE OF CONTENTS

INTRODUCTION

1. My full name is **Jeffrey Donald Morton**.

2. I have the following qualifications and experience relevant to this evidence:

   (a) I hold a Master of Agricultural Science (MAgrSc) in Agronomy from Massey University (1975).

   (b) I have been a senior or co-author on 180 published scientific papers and reports including 90 peer-reviewed science papers.

   (c) I hold certificates on basic and advanced nutrient management and greenhouse gas mitigations from Massey University.

   (d) I was awarded a NRAC Scholarship to research in Scotland in 1983/84 and an AgResearch Grant to work in Ireland in 1996.

   (e) I am a Life Member of the New Zealand Grasslands Association and presented the Levy Oration in 2014.

   (f) I am a registered member of the Nutrient Management Advisors Certification Programme.

   (g) My science career started with the Research Division of the Ministry of Agriculture as a District Scientist on the West Coast, where for 12 years I researched farm issues mainly focused on soil fertility.

   (h) I spent five years based at Lincoln Research Centre where I led the research on mitigating DDT residues in soil and animal products.

   (i) For a further twelve years with AgResearch I led the Soil Fertility Group at Invermay Research Centre and carried out mainly research on soil fertility.

   (j) From 2005 until 2015 I was a Technical Consultant for Ballance Agri-Nutrients in Christchurch, Palmerston North and Hastings. I have also carried out consultancy in Southern Chile.

   (k) I now run MortonAg, a consultancy that operates out of Napier and specialises in Nutrient and Environmental Management. Most of my consultancy is based on the audit of Farm Environmental Plans and writing scientific reviews and new booklets for farm and fertiliser consultants.

3. I have been engaged by the NZ Transport Agency ("Transport Agency") to consider the potential effects of Te Ahu a Turanga; Manawatū Tararua Highway Project ("**the Project**") on the Ballantrae Hill Country Research Station ("**Ballantrae Station**"), which is owned by AgResearch Ltd ("**AgResearch**").

4. In preparing my evidence I have:

   (a) reviewed the submissions of AgResearch, the Fertiliser Association of New Zealand, Beef and Lamb, Ballance Agri-Nutrients and Dr Cory Matthew and Dr Louis Schipper;

   (b) discussed the Project, its effects on Ballantrae Station, and potential measures to address those effects with **Dr David Horne** and Dr Allan Gillingham (as well as the Project team);

   (c) met with Dr Horne, the Project team, AgResearch and other submitters to discuss Ballantrae Station, and the Project, on 1 March 2019. That meeting included a visit to Ballantrae Station.

Code of Conduct

5. I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2014. My evidence has been prepared in compliance with that Code, as if it were evidence being given in Environment Court proceedings. In particular, unless I state otherwise, 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 I express.

Purpose and scope of evidence

6. The purpose of my evidence is to:

   (a) consider the actual and potential effects of the Project on Ballantrae Station. My focus is on the research use of the site in particular, including on the long-term fertiliser trial that has been carried out at Ballantrae Station;

   (b) outline a package of measures that has been designed to address those effects, and to preserve a long term future for the research site at Ballantrae Station;

(c) summarise the discussions I have been involved in with AgResearch and other submitters in respect of the effects of the Project and the proposed package of measures to address those effects; and

(d) respond to the relevant submissions, the Section 42A report, and the questions posed by the Hearing Panel that relate to effects on the research site at Ballantrae Station.

EXECUTIVE SUMMARY

7. The Project will have a direct effect on Ballantrae Station, and in particular on the Ballantrae trial site that forms part of the Station.

8. A long term grazing trial was established in 1975, consisting of farmlets each with a treatment of a different rate of superphosphate, and a differential stocking rate to fully utilise the different levels of pasture production.

9. Continual and detailed research on the results of the trial were carried out between 1975 and 1988. Since that time, there has been significantly less research effort, with continual measurements limited – but the trial treatments themselves have continued to be applied. The four current farmlets are a unique representative range of hill country pastoral ecosystems. As long as the annual fertiliser treatments are continued, an experiment remains viable despite the relative lack of measurements since 1988.

10. The effects of the Project on the trial site include:

(a) the loss of about 4.8 ha of land (based on the indicative construction footprint). LiDAR analysis of the Ballantrae trial site was carried out by Dr Horne to more precisely determine the effect of the Project on the area and land slope and aspect of each farmlet;

(b) potential effects in terms of disruption to the management of the site during the construction period (planned for 2020 to 2024); and

(c) potential long-term effects on the management and future credibility of results from the current trial.

11. The LiDAR analysis shows the Project will have a minimal effect on the physical landscape properties of the trial site. Having said that, the loss of part of the site is an effect that needs to be addressed.

12. The flow-on effect arising from altering the underlying environment at the Ballantrae trial site has the potential to have some effect on ongoing utility of the long-term fertiliser trial, and / or the scientific and research use of the site more broadly.

13. Given the lack of research effort over the past 30 years, and the maturity of the information that has come from the trial, a decision to end it there because of perceived disruption would be acceptable. That said, in my view there is no obvious reason why the Ballantrae trial site could not be maintained even with the Project proceeding.

14. The four farmlets areas are invaluable for future smaller scale research projects to address future issues in hill country farming. In my opinion their value can be retained despite the effects of the road.

15. Dr Horne and I have advised on a package of measures to address the potential effects on the Ballantrae trial site outlined above. The measures include:

    (a) a range of practical measures (during construction and beyond as appropriate) to address potential impacts on the management and operation of the Ballantrae trial site; and

    (b) additional measures to address the potential impact on the long-term viability of the trial and research use of the site.

16. The second category of measures includes:

    (a) funding for an intensive (pre-construction) monitoring programme to measure, on a farmlet paddock basis, the important soil and pastoral properties to compare with earlier measurements before;

    (b) funding to monitor the effects of road construction on the site for a 3-5 year period after the Project has been constructed; and

    (c) assuming that the site is still suitable for research, the setting up of a trust fund, with the interest used to provide year-by-year funding for Post-Doctoral students to carry out research on the Ballantrae trial site. After five years of operation of the trust fund, AgResearch would have the option of retaining the capital investment or continuing the trust operation (ie, funding of Post-Doctoral research work).

17. This package of measures will address the mitigation practices required to minimise the practical effects of Project construction, capture the results of the trial to date, and provide a funding source for future research.

BACKGROUND TO THE BALLANTRAE SITE

18. Ballantrae Station was purchased by the Grasslands Division of what was then the Department of Scientific and Industrial Research in 1972 as a run-down, largely undeveloped farm to carry out research on high rainfall, hard hill country.

The long-term grazing trial and research based on that trial

19. In 1975, a long-term grazing trial was established at Ballantrae Station, consisting of several farmlets each with a treatment of a different rate of superphosphate, and a differential stocking rate to fully utilise the different levels of pasture production. I note that the farmlets involved in the trial do not cover the entire Ballantrae Research Station. In the remainder of my evidence I refer to the part of Ballantrae Station that has been subject to the grazing trial as the "Ballantrae trial site".

20. From 1975 to 1988, pasture growth and composition was continually measured from eighteen exclusion cages in each farmlet, and soil testing carried out annually. In addition earthworm counts were carried out on three occasions. Several smaller studies, mainly by University Post-Graduate students, were carried out on the trial site.

21. Most of this work was published in peer-reviewed scientific journals. The trial site was also visited by several farmer groups. As such the trial was an invaluable resource for science, education and extension. It complemented the work done at other hill country research stations, at Whatawhata near Hamilton, and at Te Kuiti.

22. From 1988 to the present day, the annual fertiliser treatment applications have, commendably in my view, been continued, and the farmlets grazed at differential stocking rates that aimed to utilise as much of the pasture grown as possible.

23. The current four farmlets, each of about 8 ha, represent a reverted hill country pasture with different characteristics:

    (a) two farmlets with an increasing presence of woody weeds due to no P or S applied for 39 years (LFNF and HFNF);

(b) a farmlet (LFLF) where the bare minimum of P and S has been applied to maintain a reasonable hill pasture sward that is not fully utilised by stock; and

(c) a farmlet (HFHF) where more than adequate P and S has been applied to produce a biologically optimal system for hill country. This has resulted in a well-utilised pasture sward with maximum presence of high fertility demanding pasture species considering the limited rate of N cycling in steep hill country.

24. Hence these farmlets are a unique representative range of hill country pastoral ecosystems.

25. However, when compared to the initial 1975 – 1988 period, the level of research effort at the Ballantrae trial site has been minimal. Apart from one yearly measurement effort in 2014/2015, one soil sampling in 2012 and two measurements of earthworms, measurements on the trial have been discontinued, mainly due to a lack of funding. There have been many other studies carried out on the Ballantrae trial site which measured treatment effects on other properties such as soil carbon, but even those have been reducing in frequency over time.

The potential ongoing use of the Ballantrae trial site

26. As long as the annual fertiliser treatments are continued at the Ballantrae trial site, an experiment is still viable despite the relative lack of measurements since 1988. Farmer groups and Post-Graduate students have still utilised the site from 1988 to the present day, albeit in decreasing numbers.

27. In my opinion the greatest value in the site is as a resource for smaller scale component studies on current (greenhouse gases, water quality) and unknown future issues, as it is the only still existing hill country research site with a known, long term history which has resulted in the development of four separate sets of soil and pastoral conditions.

28. But it is of little use maintaining this resource if there is not funding to carry out the necessary research. In the current funding environment where there is little Crown funding of applied research, a dedicated funding source would be required for this.

THE ACTUAL AND POTENTIAL EFFECTS OF THE PROJECT ON THE BALLANTRAE TRIAL SITE

29. The Project designation corridor, and the indicative construction footprint, traverse the southern part of the Ballantrae trial site (including all four farmlets). The relationship of the Project (designation corridor, and indicative construction footprint) to the Ballantrae trial site is shown on the plan attached as Attachment 1 to Dr Horne's evidence.

30. This raises a number of actual and potential effects for the Ballantrae trial site and its future (both in terms of the ability to continue the current fertiliser trial, and to retain the site for future research).

31. Most fundamentally, the indicative construction footprint would result in the loss of about 4.8 ha of land. There are also potential effects in terms of disruption to the management of the site during the construction period (planned for 2020 to 2024), and potential long-term effects on the management and future credibility of results from the current trial.

Relevance of the Public Works Act 1981 compensation scheme

32. I understand that the Public Work Act 1981 provides for AgResearch to be compensated for the value of the land that is to be acquired for the Project. I am not an expert in Public Works Act matters and as such do not seek to draw any distinction between effects that will or will not be compensated for under that legislation.

33. My task has been to consider the potential impacts of the Project on the operation of the Ballantrae trial site, in a practical sense (covering matters such as movement around the site) and in terms of the scientific value of the site and the activities carried out on it. I recognise that there might be overlap between the measures I recommend to address those effects, and compensation that might be payable under the Public Works Act scheme, but make no further comment on that. **Lonnie Dalzell** addresses that potential overlap in his evidence.

The physical loss of part of the trial site

34. LiDAR analysis (satellite mapping) of the Ballantrae trial site was carried out by Dr Horne, in order to more precisely determine the effect of the Project

on the area and land slope and aspect of each farmlet.[1] As explained by Dr Horne in his analysis:

(a) the areas of 7.7, 9.6, 6.9 and 6.9 ha for the LFLF, LFNF, HFNF and HFHF farmlets would decrease to 5.7, 8.8, 5.6 and 6.3 ha respectively after the road extent area has been removed;

(b) that would result in only small changes to the proportion of the total area of the site that each farmlet makes up; and

(c) similarly, there would only be minor changes to the proportion of each slope class, and each aspect, in the individual farmlets.

35. So, while the Project will reduce the overall area of land within the Ballantrae trial site, it will have a minimal effect on the physical landscape properties of the trial site. These properties, such as slope and aspect, are important because they influence pasture growth and grazing behaviour. That being said, there is a potential impact here that needs to be addressed, which I discuss below.

Potential impacts on the management and operation of the Ballantrae trial site

36. Project construction activities have the potential to disrupt the operation and management of the Ballantrae trial site during construction. I have discussed with the Project team that the following potential day-to-day issues will need to be considered and managed as appropriate during construction:

(a) the ability to move stock around the site, including between and within farmlets, and to the yards and sheds at the southern extent of the site. In particular, a part of the site (HFHF farmlet) will be to the south of the Project construction zone, while most of the site will be to the north;

(b) the potential for machinery noise causing animals to avoid grazing near the construction site;

(c) the need for adequate construction site security to prevent any increased risk of stock rustling through the public having easier access through the construction site;

[1] Dr Horne explains that the analysis was based on the impact of the indicative construction footprint, as opposed to the entire designation corridor.

(d) potential dust contamination of pasture, which could potentially in turn cause lower and variable animal feed intakes;

(e) addressing any risks to AgResearch farm staff travelling in farm vehicles near the edge of the Project site;

(f) the importance of avoiding any dumping of spoil from Project construction on any part of the grazing trial outside the road extent; and

(g) any possible contamination of water causing animal health problems in the stock.

37. Many of the above-listed issues also need to be considered and appropriately managed in terms of longer-term impacts of the Project on the Ballantrae trial site. Of particular relevance are the ease of stock movement, potential traffic noise impacts, any ongoing heightened risk of stock rustling, the potential for ongoing dust and other contaminant issues arising from the operation of the State highway, and the health and safety of staff operating in close proximity to the State highway.

38. Saddle Road traverses the northern end of the Ballantrae trial site. As such AgResearch has some experience of working around active roads. As discussed by **David Dunlop** in his evidence, Saddle Road has been heavily trafficked since the closure of the Gorge road; its usage will effectively revert back to the much lower pre-Gorge closure levels once the Project is complete.

Potential impact on the long-term viability of the trial and research use of the Ballantrae trial site

39. The Project will alter the underlying environment at the Ballantrae trial site (most obviously by removing part of the site). That has the potential to have some effect on ongoing utility of the long-term fertiliser trial, and / or the scientific and research use of the site more broadly.

40. In this respect one potential concern is the impact of the Project footprint (in effect, the cutting required to provide for the road as it traverses the Ballantrae site) on hydrology and wind run. With the research site having such a high natural wind run it is difficult to imagine the effect of one cutting being significant. The potential changes in hydrology would be very difficult to measure in such a complex soil environment.

41. The impact of removing part of the Ballantrae trial site, and in particular how that effects the ongoing operation of the trial and any future research, is a difficult question to assess conclusively. I acknowledge that part of the site will be lost, and that this is an adverse impact.

42. Those works have also had some impact on the physical characteristics of the Ballantrae trial site.

43. In any event, about 85% of the Ballantrae trial site will be retained.

44. I would also emphasise that the current farmlets are not balanced for area, slope or aspect. That is understandable when the difficult nature of the terrain is considered. This has been adjusted for by altering the total amount of superphosphate applied to each farmlet to give the desired application rate, and the number of stock grazing each farmlet to give the desired stocking rate. This adjustment could also be carried out on the smaller areas.

45. The LiDAR analysis demonstrates that the fundamental existing balance of the farmlets, and the site overall, will be largely retained after the construction of the Project. There is no reason why the existing fertiliser application and stocking adjustment policy could not be continued for the slightly modified farmlets.

46. In short, therefore, in my view there is no obvious reason why the long-term Ballantrae trial site could not be maintained even with the Project proceeding.

47. Nor is it necessarily essential that the trial does continue. In saying that I note that:

    (a) after 43 years of application of the treatments, the key parameters (pasture growth and composition and soil nutrient analysis) are in steady state for the LFLF and HFHF farmlets and to a slightly lesser extent for the LFNF and HFNF farmlets. This means that there will be little change over time in the future, and there is a stable environment for further small-scale research;

    (b) the value of superphosphate application in increasing and maintaining pasture growth and stocking rate as demonstrated by the trial results is long established and accepted by the farming community, and has been reinforced by the results from other long-term grazing trials;

(c) as discussed above, measurements to determine the results of the trial have been largely discontinued for the last 30 odd years, due mainly to lack of funding; and

(d) the results from the trials up to 1988 have been well published in the scientific literature.

48. The real long-term value is in having a unique long-term trial resource where future issues around land, water and animals can be investigated in component trials.

PROPOSED MEASURES TO ADDRESS THE EFFECTS OF THE PROJECT

49. At the request of the NZ Transport Agency, Dr Horne and I have advised on a package of measures to address each of the potential effects on the Ballantrae trial site outlined above. That package of measures is summarised below.

Addressing potential impacts on the management and operation of the Ballantrae site

50. Mitigation measures are proposed for each of the above-noted issues that could arise during the Project construction period, as follows:

(a) Stock movement: the animals are set-stocked at a largely constant stocking rate in each farmlet, and most of the existing area of each farmlet will be retained. If it is necessary to adjust stock numbers between farmlets, the Transport Agency should fund small temporary yards to load stock on to trucks, to be transported by farm tracks and via Saddle Road. These facilities would also be available to facilitate stock movement for animal husbandry (eg. shearing, weaning etc).

(b) Machinery noise: the potential issue here relates to any impact on pasture utilisation across the site (particularly near the construction site). General measures to address construction noise are discussed in the evidence of **Dr Stephen Chiles**. I would add that any effects on pasture utilisation are likely to be small compared with the (already existing) effects of wind and aspect.

(c) Dust: I understand that standard dust management techniques will be put in place across the construction site through a Construction Environmental Management Plan. More specifically, I have recommended that the Transport Agency fund pasture monitoring, on

several sampling sites at the Ballantrae trial site, on a monthly basis during the relevant construction period. Samples would be measured for Titanium concentrations to assess the extent of ingested soil. If the levels were to rise above a set threshold, then extra watering of the construction site would be carried out.

(d) Water contamination: The Transport Agency should carry out monitoring of permanent and ephemeral waterways on the Ballantrae trial site before, during and after construction. Results should be provided to AgResearch and corrective action carried out if feasible.

(e) Spoil disposal: the evidence of **Andrew Whaley** addresses spoil removal and disposal. I understand all spoil will be removed from the AgResearch site (and there will be no disposal site there). I support that outcome.

(f) Construction site security: the construction site should be secured as per standard practice, including to prevent access to the Ballantrae site. I have recommended that the Transport Agency consult specifically with AgResearch about any specific site security measures that might be necessary.

(g) Ballantrae site staff health and safety: the Project construction site should be appropriately fenced (with immoveable barriers at the boundaries to the Ballantrae trial site) to address health and safety requirements.

51. To the extent that the above-mentioned issues remain relevant once the Project is complete, the mitigation measures should be continued for an appropriate period. Physical facilities can be left in place permanently as appropriate.

52. In addition, a stock underpass beneath the Project should be installed to facilitate stock movement between and within farmlets.

53. In respect of the potential impact of noise once the Project is open, I note that analysis by **Dr Chiles** has shown that traffic noise from the new highway around the 30 m deep cutting through the trial site will be less than from the existing traffic noise on the Saddle Rd where it intersects the trial now. As such I do not consider any specific mitigation is required. In addition, I note that traffic noise will be a minor factor in sheep grazing and

camping compared to the established more significant effect of wind causing animals to shelter on the opposite aspect to the wind direction.

Addressing the potential impact on the long-term viability of the trial and research use of the site

54. On the recommendation of **Dr Horne** and myself, the Transport Agency is proposing three key measures to address the potential effect on the long term viability of the trial.

55. The first is that the Transport Agency will fund an intensive monitoring programme to measure, on a farmlet paddock basis, the important soil and pastoral properties to compare with earlier measurements before construction (that would affect the Ballantrae trial site) commences. These would be published in a peer reviewed scientific journal. This measure will:

    (a) fill the gap created by the lack of measurements carried out over the last 30 years; and

    (b) provide an up to date and complete picture of the results of the trial and state of the Ballantrae trial site as at the commencement of the Project. This is an important and valuable safeguard against the effects of the Project on the trial site environment.

56. The second key measure is that the NZ Transport Agency will provide funding to monitor the effects of road construction on the site for a 3-5 year period after the Project has been constructed. This will be carried out to measure the significance of any effects caused by the Project.

57. The third key measure is that, after the monitoring phase and assuming that the site is still suitable for research, the Transport Agency will work with AgResearch to set up a trust fund, using Transport Agency funding. The intention is that the interest from the trust fund will be used to provide year-by-year funding for a Post-Doctoral student to carry out component research on the Ballantrae site. If the site is unsuitable for further research it would be abandoned for this role in the future.

58. Other organisations (for example, the institutional submitters: AgResearch, the Fertiliser Association of New Zealand, Beef and Lamb, and Ballance Agri-Nutrients) could also contribute to the trust fund to cover more research that is of interest to them.

59. After five years of operation of the trust fund, AgResearch would have the option of retaining the capital investment or continuing the trust operation (ie, funding of Post-Doctoral research work). The rationale for this is that if investment is made to preserve the Ballantrae trial site then funding needs to be carried over for research to be carried out. I note that there has been a drop-off in the number of Post Graduate students using this site in recent years so the trust funding would provide an incentive.

60. This third key measure will in effect provide funding for the trial resource to be used for further research. As discussed above, there has been less and less research carried out over the past thirty years.

My overall conclusions on the measures to address the effects of the Project

61. Although the trial site will be affected by the road construction it is still possible to preserve most of it in a state where it will be suitable for essential research on future hill country farming issues, especially if the work is incentivised through providing dedicated funding.

62. The package of measures outlined above will address the mitigation practices required to minimise the practical effects of Project construction, capture the results of the trial to date, and provide a funding source for future research. In my opinion although there will be some negative effects of the road on the future operation of the Ballantrae trial site, provided that they are not significant, the existence of a potential funding source will enable the conduct of much more research in total to be carried out than is carried out currently.

DISCUSSIONS WITH AGRESEARCH AND OTHER SUBMITTERS

63. The results of the LiDAR analysis, and an outline of the measures proposed to address the potential effects of the Project, was put to AgResearch (and the supporting submittters) by the Transport Agency in February 2019.

64. I subsequently attended a meeting on 1 March with AgResearch, Fertiliser NZ and Dr Matthew to discuss the Project and the material put to them.[2] The meeting included a visit to Ballantrae Station (and in particular the Ballantrae trial site).

65. Overall I felt that the 1 March meeting was productive, and a good opportunity to share ideas. The submitters discussed the potential

[2] I understand that the Project team invited all the relevant submitters to attend the meeting.

detrimental effects of Project construction on continual operation of the site, for example dust, noise and contaminants.

66. As discussed above, **Dr Horne** and I have recommended that the Transport Agency monitor these potential effects during the construction period, and for a 3-5 year period following construction. The latter measure has been added to the overall package in response to our meeting (and as such I note the submitters have not yet had the opportunity to comment on this particular proposal).

DISCUSSION WITH AND REVIEW BY DR ALLAN GILLINGHAM

67. On the recommendation of **Dr Horne** and myself, the Transport Agency has also engaged Dr Allan Gillingham to consider the submissions related to effects on the Ballantrae trial site, and the work being done in response to those submissions.

68. Dr Gillingham has long experience running hill country trial sites (of a similar type to the Ballantrae trial site). As such his insight is of particular value. I discussed the Project and our proposed package of measures with Dr Gillingham. He provided feedback, and ultimately the formal letter setting out his views that I attach as **Attachment 1** to my evidence.

COMMENTS ON SUBMISSIONS

69. I have read the submissions that address the potential effects of the Project on the Ballantrae site, including:

    (a) AgResearch Ltd (submitter 312);

    (b) Ballance Agri-Nutrients Ltd (submitter 359);

    (c) Fertiliser Association of New Zealand (submitter 361);

    (d) Beef and Lamb New Zealand Ltd (submitter 364);

    (e) Dr Louis Schipper (submitter 171); and

    (f) Dr Matthew (submitter 372).

70. I have sought in the main body of my evidence to respond to these submitters' concerns about the effect of the Project on the Ballantrae site, and how those effects might be addressed. As such I do not provide a point-by-point response to these submissions here.

71. However, I do wish to make the following general comments in response to the submissions:

    (a) The submissions (including the AgResearch submission) assume that the Project will automatically result in the closing of the Ballantrae research site. As explained above, I do not think that needs to be the case.

    (b) In my evidence above I have sought to address each of the individual potential effects raised by AgResearch in part 3 of its submission.

    (c) The draft conditions put forward by **Ainsley McLeod** have been updated in light of the package of measures set out in my evidence.

72. Dr Matthew raised the point that future publication of the current trial results in a peer-reviewed journal will be compromised because of the extra uncontrolled variables caused by the construction of the road. Since the results from 1975-1988 have already been published, there are no results available to publish since then due to lack of continual measurements. Any future publication would require future funding. In the event of this current farmlet trial continuing or another trial starting, in my opinion the results would still be able to be published in a peer-reviewed scientific journal.

RESPONSE TO THE HEARING PANEL'S QUESTIONS

73. I respond below to the Hearing Panel's questions that relate to my evidence.

To what extent (in terms of ha and % coverage of trial sites) will the earthworks footprint impact on land actively used for fertiliser trials (as opposed to AgResearch farm land not actively used for fertiliser trials) within the Ballantrae Hill Country Research Station?

74. The section of my evidence on the physical loss of part of the Ballantrae trial site refers to Dr Horne's analysis. Dr Horne provides a response to this question in his evidence.

What remediation or mitigation does NZTA offer for any possible forced cessation of the long-standing fertiliser trials?

75. As discussed above, in my view there is no obvious reason why the long-term fertiliser trial site could not be preserved even with the Project proceeding.

76. The package of measures to address the potential effects of the Project on the Ballantrae trial site, set out in my evidence above, factors in the

possibility that AgResearch will decide to discontinue the trial. In that respect I note the proposal to fund the work necessary to capture and publish the results of the trial to date.

What, in your view, would be an appropriate treatment for [the Ballantrae site] it in future in terms either rehabilitation or abandonment?

77. The package of measures set out above represents my view as to the appropriate response to the Project's effects on the Ballantrae trial site. As noted above, I consider that continuing the research use of the site would be appropriate (but recognise ultimately that is a decision for AgResearch).

Have you considered the 'social impacts' of the possible cessation of the Ballantrae Hill Country Research Station fertiliser trials, particularly in light of concerns raised by submitters including AgResearch, Fertiliser NZ, Ballance, Beef and Lamb and various individuals?

78. I have approached my consideration of the potential impacts of the Project on the Ballantrae trial site from a science and operational perspective. **Amelia Linzey** responds to this question in respect of any 'social impacts'.

COMMENTS ON COUNCIL SECTION 42A REPORTS

79. The Planners' Section 42A Report includes a section on effects on property, land use and network utilities – including comment on the potential effects on the Ballantrae trial site. I have reviewed that commentary, including the conclusions that the planners are "*not in a position to determine the degree of that effect, and whether there are mitigation options available*" and "*anticipate further information from both parties at the hearing*".[3]

80. The evidence **Dr Horne** and I present is intended to provide further information about the potential effects, and to present a package of measures to address those effects.

Jeffrey Donald Morton

8 March 2019

[3] At paragraph 656.

ATTACHMENT 1: LETTER SUPPLIED BY DR ALLAN GILLINGHAM

Provided separately

8 March 2019

To: Lonnie Dalzell, NZ Transport Agency

From: Dr Allan Gillingham

Te Ahu a Turanga: Manawatū Tararua Highway Project : potential impact on Ballantrae research station

1.0 Introduction

I understand that this Project traverses land that forms part of the AgResearch Ballantrae research station, and in particular the land used for the long-term fertilizer trial at the station.

You have asked me to provide comment on this issue, bearing in mind my professional qualifications and experience, which are as follows:

University qualifications

- Master of Agricultural Science at Lincoln University.
- PhD at Massey University titled "Phosphorus Cycling in steep, grazed hill country".

Ministry of Agriculture and Fisheries and AgResearch career experience

- 40 years research experience in South Island tussock grassland and North Island hill country pastoral systems. This included assessment of microclimatic and soil fertility factors affecting pasture growth and water runoff quality from hill pastures.
- Management of a long-term grazed hill country trial at Whatawhata (Waikato) Hill country Research Station evaluating the effects of phosphorus (P) fertilizer rate on pasture responses on easy and steep slopes.
- Management of a long term grazed trial on seasonally dry hill country at Waipawa (East Coast North Island) evaluating effects of nitrogen (N) and P fertilisers on pasture growth on contrasting north and south aspects.
- Initiated the first grazed agroforestry field trial at Whatawhata in conjunction with Forest Research.
- Management of a series of small plot trials down the east coast of North and South Islands measuring the effects of N and P fertilisers in contrasting climatic and soil situations.
- Measurements of fertilizer distribution from helicopter and fixed wing aircraft.
- Measurements of water runoff quality using a range of techniques on the Waipawa and Ballantrae trial sites.
- Acting Director Whatawhata Hill Country Research Station 1984-85.
- Science Manager for 5 years for 40 staff in MAFTech in southern North Island (Gisborne to Taranaki) and including Flock House Manager including technical training for overseas technicians.
- Three visits to Iran to assess potential for rangeland development based on NZ technology, and also to scope potential for new agricultural product trade (especially sheep milk) with UAE.

- Trade Mission Chairman for the Agriculture, Forestry and Fisheries commissions in Teheran during trade talks led by Overseas Trade Minister Burton.
- Invited papers to conferences in Corvallis, Oregon, USA, in Belfast, Northern Ireland, and presented at International Grasslands Congress in Canada.
- One month AgResearch fellowship to Champagne Urbana University of Illinois, USA to investigate precision agriculture techniques of relevance to NZ.
- Funded other overseas travel to USA, UK, Australia.

Post retirement career as agricultural research consultant

- Two year term as Editor for the Settled Landscape (Agriculture, horticulture and forestry) Theme in Te Ara, the online revamp of the Encyclopedia of NZ.
- Managed national trials evaluating the effects of di-cyan diamide (DCD) on reduction of N leaching and presented summary paper.
- Chaired a group to develop technology to allow variable rate topdressing from fixed wing aircraft for Ballance Agri-Nutrients which is now operational.
- A range of other smaller scale contracts still continuing.

Publications

- Published in excess of 150 scientific papers and conference presentations on all aspects of the above research and more recently with emphasis on the relevance of precision agriculture management for hill country.

I have been asked in particular to comment on:

- The submissions presented in relation to the Project and its potential effects on the long-term fertilizer trial.
- The work done in assessing those potential effects by Dr David Horne and Jeff Morton.
- The package of measures put together by Dr Horne and Mr Morton to address those potential effects.

I have been provided with relevant background information, and have discussed the issues with Mr Morton and Dr Horne.

2.0 Comments on submissions

I have reviewed the submissions from:

- AgResearch
- Ballance Agri-Nutrients
- Beef and Lamb NZ Ltd
- Dr Cory Matthew
- NZ Fertiliser Association
- Louis Schipper

AgResearch and their supporting submitters refer to the importance of the trial site (and the ongoing trial). They base their objections on the assumption that the new road will 'bisect' the trial, and that as a result the trial will have to be concluded.

There are no details that have been provided with the AgResearch submission as to the proportion of measurement sites that will be affected to support the above assumption, or how operating the trial on a reduced number of sampling sites in each farmlet may distort results.

I note that the submissions make no comment on any possible compromise in accepting the Project.

In his submission, Dr Matthew makes a number of specific points of interest, which I address below.

- Dr Matthew mentions bi-section of two treatments by the Project, which is shown on the map that I have seen. However, the new road cuts through 3 treatments (LFNF, LFLF and HFNF). The sections of LFNF and HFNF that will be to the west of the Project are very small (that section is larger in LFLF). I consider those small sections might best be included in the areas lost from these two farmlets since trying to include them in the farmlets would impose considerable practical management difficulties. This is the approach Dr Horne has taken in providing his LiDAR analysis.

- Dr Matthew also comments on the future value of the trial area for environmental related studies such as fertilizer effects on soil carbon status. This is an important consideration. However, there has been relatively little government or industry interest in utilizing the trial area over the last 30 years, and presumably no imminent plans for any further research. Nevertheless, the possible future use of the trial treatments as a background for studying effects on soil microflora or microbia and associated runoff water quality could provide an important, unique opportunity.

- Dr Matthew comments that '*significantly, even though the area falling in the road corridor for HFNF is not such a large proportion of the trial, about half the long term sampling sites will be lost as they are within the road corridor*.' This is very surprising since the area involved comprises only 18.035% of the farmlet and suggests a disproportionate distribution of sampling sites in the area. I cannot comment further on the location of sampling points as I have no information on that. However this aspect is critical to the discussion in relation to the parts of the farmlets to be excluded. More so than area, slope or aspect percentages.
    - If there was a cluster of sampling points in a small area of one farmlet then this means that the previous sampling strategy has already adopted an approach based on specific slope/aspect or soil characteristics. This is the approach that is being suggested for future trials.

- Dr Matthew (and AgResearch) also make comments that relate to the possible influence of vehicle traffic noise and emissions on the grazing and resting behavior patterns of domestic stock. Some references are quoted. However, I note that this same question could be raised in relation to the effects of traffic on the present Saddle Road, which in parts traverses the trial.
    - That begs the question - have these influences been assessed and incorporated into interpretation of results to date?

- I would add that the development of shrub and tree vegetation on either side of the new road could be expected to reduce the effects of any noise and emissions.

3.0 Comments on the work done by Dr Horne and Mr Morton

I make the following comments having reviewed the work done by Dr Horne and Mr Morton.

Background to the trial site

Mr Morton explains the history and condition of the trial is in some detail, pointing out that there are in effect only three treatments: Low or High P fertilizer initially and then no further fertilizer over the last 43 years; Low rate of P fertilizer applied annually; and a High rate of P fertilizer annually.

Grazing management is described in detail including options for adjusting stocking rates if necessary by installing small sets of temporary yards to aid management and husbandry.

Nevertheless, the main factor affecting the existing soil P status and any associated soil factors, will be the historic rate of P fertilizer applied annually.

Proposed ongoing use of the trial site

With this background Mr Morton and Dr Horne explore the possibilities associated with continuing utilization of the trial site in conjunction with the establishment of the Project through the site.

It is obvious that the initial aims of the trial have been achieved, i.e. to provide useful advice to hill country farmers on the appropriate P fertilizer programme for their farms. The question widely posed now relates to environmental implications of the soil conditions that have been generated. Can these questions be answered from a modified trial site with smaller areas in each farmlet?

Initially the trial farmlets were not established as exact replicas in terms of area, aspect or slope. Morton and Horne (including Morton in his evidence) conclude that they see no reason why the basic trial management could not continue following the establishment of the new road - which will result in some further amendments to those factors across the farmlets.

A new research programme would target specific slope and aspect sites within each farmlet, and so the total area of each will be of less importance so long as the basic fertilizer and pasture control managements can be applied.

In addition to the proposal for new research, Morton and Horne propose a comprehensive list of back up measures to monitor any side effects of the project and provide appropriate health and safety protection, as well as NZTA research funding to ensure that the results from proposed preliminary studies have the opportunity to be followed up.

In suggesting that the site has potential value for examining environmental related aspects of soil and perhaps water runoff quality we must accept one fact. For more than 30 years neither government or industry has contributed significant funding to explore these factors. In light of this, the proposal by Mr Morton and Dr Horne to establish a research fund to enable some environmental related research to commence as soon as possible could conceivably be the only funding that will be available in the foreseeable future.

4.0 Conclusions

I make the following overall conclusion:

- The submissions opposing the installation of a new road though the Ballantrae trial site because it would result in closure of the trial are recognized, but this is not what is being proposed. Perhaps the submitters might express a different view if they understood that only a small part of each farmlet would be affected by the new road. The analysis completed by Dr Horne and Mr Morton provides the information to allow the submitters to consider that point.

- Although there are some unknowns relating to the effects of road construction, and subsequent traffic effects on domestic stock, I consider that these are likely to be of less importance in the overall scheme than the benefits offered to obtain up to date information on soil and related environmental characteristics by the establishment of a research programme funded by NZTA.

- This new research programme could provide the stimulus for new government funded research and so re-enliven this research site as one of national importance.

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