BEFORE THE INDEPENDENT COMMISSIONERS

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of the Proposed Waikato Regional Plan Change 1 - Waikato and Waipa River Catchments, and Variation 1 to proposed Plan Change 1

AND

IN THE MATTER of submissions under clause 6 First Schedule

ON BEHALF OF **BEEF + LAMB NEW ZEALAND**
AND
THE HILL COUNTRY GROUP

BRIEF OF EVIDENCE OF RICHMOND BEAUMONT EVAN BEETHAM
15 FEBRUARY 2019

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BACKGROUND

QUALIFICATIONS AND EXPERIENCE

1. My name is Richmond Beaumont Evan Beetham.

2. I am a sheep and beef farm consultant with BakerAg, and have been employed in that capacity since 2015. My main area of expertise is sheep and beef farm systems including financial and physical benchmarking. I have extensive technical and practical knowledge of sheep and beef farm systems.

3. BakerAg is based in the Wairarapa and Feilding with 14 consultants covering dairy, sheep and beef, and rural valuation. Our consultants are active throughout the Lower North Island, Central Plateau, Waikato, North Canterbury, North Otago and Southland and provide a range of consultancy advice. BakerAg have undertaken Financial Analysis Benchmarking (FAB) for 30+ years and this is a cornerstone of our consultancy work.

4. I hold a B.Appl.Sc. (Landscape Management) from Massey University, as well as a Sustainable Nutrient Management certificate from Massey University. I have FARMAX accreditation and I am a member of the New Zealand Institute of Primary Industry Management. I have experience using the farm financial software CASH MANAGER RURAL.

5. I previously worked for Ballance Agri-Nutrients as a technical field representative providing nutrient management advice. Part of this work involved using OVERSEER. I have been involved in numerous OVERSEER and FARMAX modelling projects in my current role.

6. I previously worked for Beef + Lamb New Zealand (B+LNZ) (formerly Meat and Wool New Zealand) in two key roles:

   (a) As an extension manager working with different farmer groups and rural professionals to deliver extension programmes for sheep and beef farmers such as land and environmental planning, ewe body condition scoring workshops, and farm succession workshops; and

   (b) As an Economic Service Manager for five years, carrying out the annual Sheep and Beef Farm Survey for the Economic Service. For each farm, I carried out detailed physical and financial analysis

including the standardisation of multiple sets of accounts and reconciling livestock numbers and revenue. I visited and analysed many farms every year ranging from finishing/cropping farms to large scale hill country breeding farms.

7. I have 12 years' experience with financial and physical benchmarking on sheep and beef farms. Projects of note include financial and physical benchmarking for the Red Meat Profit Partnership (RMPP), Ahuwhenua Sheep and Beef Competition, farm business groups in the Wairarapa, Taranaki and North Otago, and regular benchmarking using the nationally recognised BakerAg FAB system.

8. I have hands-on experience with sheep and beef farming having grown up on my family's sheep and beef farm in the Wairarapa. I spent time shearing, shepherding and managing farms in the Wairarapa. My wife and I currently own a 410-hectare sheep and beef farm in the Wairarapa. I have recently completed a number of fencing projects on the farm including repair work and new fences.

9. I'm part of the Kourarau Sub-Catchment Group formed to understand and protect the water quality in the catchment. The group is carrying out water quality monitoring and identifying the key sources of contaminant discharge. The group have undertaken a number of projects, including stock exclusion and riparian planting around the Kourarau stream and dam, with the Greater Wellington Regional Council and local school.

SCOPE OF EVIDENCE

10. This statement of evidence includes:

    (a) Background to sheep and beef farming in Waikato;

    (b) Description of contaminant losses to water from sheep and beef farming;

    (c) Nitrate (N) leaching on sheep and beef farms compared with other pastoral land use;

    (d) Stocking rates on sheep and beef farms in the Waikato; and

    (e) Nitrogen use on sheep and beef farms in the Waikato;

(f) Key findings and summary of the BakerAg report – *"Implications of the proposed Waikato Regional Plan Change 1" - Waikato and Waipa River catchments, 14th September 2017*. Hereinafter referred to as the "**PC1 Report**":

(i) inequities of a grandparenting approach to nitrogen and why a Nitrogen Reference Point (**NRP**) is not an appropriate or fair regulatory tool; and

(ii) the economic impacts of stock exclusion from waterbodies on sheep and beef hill country under the proposed Waikato Regional Plan Change 1, and Variation 1 to the proposed Plan Change 1, Hereinafter referred to as **PC1.**

EXPERT WITNESS CODE OF CONDUCT

11. I have read the Code of Conduct for Expert Witnesses in the Environment Court's 2014 Practice Note and agree to comply with it. I confirm that the opinions I have expressed represent my true and complete professional opinions. The matters addressed by my evidence are within my field of professional expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

REPORTS USED IN PREPARING THIS EVIDENCE

12. To inform and develop this evidence I have referenced the key findings and conclusions from the PC1 Report. See Appendix 1 for the full report.

13. In preparing this evidence I have reviewed the reports and statements of evidence of other experts including:

(a) Officers section 32 report;

(b) Officers section 42A report;

(c) Expert evidence of Mr Andrew Burtt;

(d) Expert evidence of Dr Jane Chrystal;

(e) Expert evidence of Mr Richard Parkes.

EXECUTIVE SUMMARY AND CONCLUSIONS

14. Sheep and beef farm systems are complex and diverse. There is huge variation in topography, soil type, climate, stocking rates and livestock policies. No two sub-catchments are the same and often no two farms are the same. Given the large variation in the drystock sector in Waikato a “one size fits all” or blanket regulatory approach to managing contaminant losses as proposed in PC1 will not achieve the target water quality outcomes.

15. For sheep and beef farms the loss of Phosphorus (**P**), sediment and faecal bacteria are the main concern. Sheep and beef farms are minor contributors to Nitrogen (**N**) loss compared with other pastoral land uses.

16. Waikato has the highest density of dairy cattle in New Zealand. These Dairy farms run higher stocking rates with more Liveweight/ha (**LW/ha**) carried and therefore have more N leaching on average than sheep and beef farms. Sheep and beef farms run lower stocking rates carrying less LW/ha and they use considerably less Nitrogen fertiliser than the dairy sector.

17. Under the NRP system (grandparenting approach - compliance rules based around historical performance) farms with the higher loss and consequent NRP stand to sustain a higher level of productivity, have more flexibility, and will be valued more highly. Farms with a low NRP and potentially better environmental footprint are effectively capped with a ceiling on stock numbers, production, land value and future income earning potential. There is no recognition for the differential in Nitrogen (N) leaching between drystock farms and dairy farms.

18. Implementing the Nitrogen Reference Point (**NRP**) or “Grandparenting” N as proposed in PC1 will impact the ongoing viability of many sheep and beef farms in the Waikato. Sheep and beef farms with a low NRP will not be able to reach their sustainable potential through responsible development particularly subdivision and lifting soil fertility. The biggest impact and most inequitable outcome will be the yearly opportunity cost or loss of potential future income. This yearly opportunity cost ranged from $75,698 ($164/ha) to $256,800 ($285/ha) per farm.

19. Grandparenting nitrogen favours businesses that already have a high environmental impact. This runs counter to a "polluter pays" principle, because those farms with the lowest environmental footprint are bearing a

much larger burden under the proposed PC1 rules. This blunt “one size fits all” mechanism reinforces existing inefficiencies and rewards high intensity farms with high N losses.

20. In my view mitigating N losses through a NRP is unjustified for sheep and beef farms given they are minor contributors to N loss compared with other pastoral land use.

21. The WRC has set more stringent stock exclusion and crossing requirements under the PC1 than those drafted by the previous government. In my view these stringent stock exclusion rules are financially unsustainable on hill country farms. The up-front capital costs to comply with the plan change including compliance with schedule C and schedule 1 ranged from $26,139 ($294/ha) to $541,437 ($1676/ha) per farm in the BakerAg PC1 report. The largest costs were fencing, water reticulation, and livestock crossing structures. The ongoing annual costs associated with compliance ranged from $5,905 ($66/ha) to $70,859 ($219/ha) per farm.

22. PC1 should be amended to reflect the same stock exclusion and stock crossing requirements as drafted in the Clean Water Consultation document dated February 2017. The Government at that time, was proposing to exclude stock on flat and rolling land (less than 15° slope), but due to the practicalities of fencing on steep hill country and the high costs relative to the environmental benefits, along with the recognition that fencing is not an effective mitigation for hill country, the government had excluded hill country from the proposed mandatory fencing requirements.

23. Mitigation of contaminant losses from sheep and beef farms needs to occur at the individual farm scale using tailored Land Environment Plans (LEP) or Farm Environment Plans (FEP). The most effective and efficient approaches to managing the environmental impacts of sheep and beef farms is accomplished through a tailored approach to farm and farm system management, rather than a ‘one size fits all approach’.

24. The management of critical source areas (CSAs) is one of the best ways to mitigate environmental risks associated with sheep and beef farming.

25. The policy framework proposed in PC1 does not provide sufficient certainty for investors, or facilitate the adaptive management that may be necessary

to address environmental risk, and the costs of those adaptive management measures.

26. PC1 will affect how sheep and beef farmers can operate in the catchment and the choices they can make around land use and land management, however these impacts on farmers are unlikely to achieve the best environmental outcomes including for aquatic ecosystem health, nor to promote the sustainable management of natural resources.

27. PC1 will limit the earning potential of the land and reduce the flexibility in enterprise selection that farmers currently have. This in turn will alter what the market is prepared to pay for land, impacting land values and the equity of some businesses. The impact on land values and income-earning potential will be largest on undeveloped sheep and beef properties and conservatively stocked properties that would be given a low NRP. The scale of these impacts are not commensurate with the environmental benefits that would be achieved through application of PC1.

EVIDENCE

BACKGROUND TO SHEEP AND BEEF FARMING IN WAIKATO

28. Firstly, I note that the terms “Drystock Sector” and “Sheep and Beef Farms” represent the same farming activities.

29. The 2012 Agricultural Production Census (APC) concluded there were around 1,150 commercial sheep and beef farms in Waikato. The region’s beef and sheep industry is traditionally characterised by pasture-based, dry-land activities (that is not irrigated) and is a major land use.

30. Commercial sheep and beef farms in the Waikato are categorised by Beef + Lamb New Zealand (B+LNZ) into three farm classes. Farm Class 3 is described as North Island Hard Hill Country, Farm Class 4 is North Island Hill Country, and Farm Class 5 is North Island Intensive Finishing Farms. This is further explained in the expert evidence of Mr Burtt.

31. The case study farms presented in this evidence and the **PC1 Report**, include five representative drystock hill country farms, located in the Lower Waikato River Freshwater Management Unit (FMU) Catchment, are set out in Table 1.

Table 1: Description of the five Waikato drystock case study farms

Farm name	Area (ha)	Description	B+LNZ Farm Class
Farm A	461	Sheep breeding/ finishing, cattle trading, dairy grazers	4
Farm B	323	Beef cattle backgrounding operation	4
Farm C	900	Sheep and beef breeding/ finishing and cattle trading	4
Farm D	550	Sheep and beef breeding/ finishing and cattle trading	5
Farm E	89	Beef finishing and cattle backgrounding operation	5

32. BakerAg's brief for the **PC1 Report** was to:

(a) Gain a thorough understanding of the implications of PC1;

(b) Visit five farms and build a physical profile of the properties, with specific consideration to stock policies, soil types, topography, and rainfall;

(c) Complete a nutrient budget for each property to determine their NRP;

(d) Identify all waterways that fall under schedule C of PC1;

(e) Measure these waterways and estimate costs to:

i. comply with schedule C (fence off waterways); and

ii. supply stock water to paddocks affected due to removing natural water supply;

(f) Use recognised industry benchmark figures to quantify the effects of this compliance on the financial viability of the businesses;

(g) Comment on the balance sheet impacts of compliance – debt associated with compliance and change in land value due to land use change restrictions and the NRP;

(h) Identify potential mitigation options for land greater than 25° and assess cost of these strategies; and

(i) Compile the above in a detailed report to help with submissions on PC1.

33. A full farm tour was undertaken, identifying and mapping all water bodies from which cattle, horses, deer and pigs must be excluded (Compliance with schedule C and schedule 1). Physical and financial information was gathered for the 2015 and 2016 financial years.

34. Areas with a slope exceeding 25° and where stream fencing was impracticable were identified and alternate mitigation measures were investigated and costed (Compliance with schedule 1).

35. Currently within PC1 there is no explanation of how to measure slope, including the appropriate use of tools. While farmers or consultants can obtain digital elevation information, as well as topographic maps, these are often inaccurate and not sufficient to accurately determine slope at the paddock scale. The WRC indicated that LIDAR information would likely be required if slope mapping is to be done with any accuracy.

36. After conversations with WRC staff, the following approach was used: Slope was measured using the "Angle Meter Pro App" with an iPhone placed on a board along several points of the slope to get an average slope (see Appendix 1 to the **PC1 Report**). The slopes measured were on the catchment hills perpendicular to the stream bed. Contour lines on the maps were also used as part of the assessment of the slope. There was an element of qualitative assessment due to the variable nature of hill country terrain.

37. In a number of cases there were gullies where the slope on one side was over 25° but on the other side the slope was less. There were also situations where some parts of a valley fell under the 25° slope rule and other parts didn't. In most of these situations it was not practical to fence half way up a stream so the fence was run to the nearest fence or the area excluded. The consultant made his best assessment based on his interpretation of the rules, practical knowledge of farming, and using the tools above.

38. Some of the main critical source areas from which sediment, nitrogen, phosphorus and microbial pathogens could be lost were identified.

39. The number of poplars needed for planting was estimated based on the size of the property and erosion status

40. Google Earth and QGIS mapping software were used to design the water reticulation system and estimate associated costs. Key reticulation costs such as additional pumps, power, header tanks, break tanks, source dams and main lines were calculated for the properties. Recent costings from a local hill country water reticulation system were used, aided by discussions with a natural resource engineer, to estimate the full costs for each property.

41. The NRP was calculated for each property by Stefan Bryant of BakerAg. This was done using OVERSEER version 6.2.3 and adhering to the best practice data input standards 2016 and data input methodology as set out by Waikato Regional Council in the proposed Plan Change 1 for the Waikato and Waipa River Catchments (as at Nov 2016). Soil order for each property was determined using S-map Online and information from Landcare. This was overlaid on individual farm maps.

42. Environment Waikato's "Best Practice Guidelines for Waterway Crossings" was used to determine appropriate livestock crossing structures for each situation. These crossing structures were then priced using a local building contractor. WRC was consulted on what the consent costs would be and these were included in the calculations. A number of crossings needed an engineer involved and several companies were contacted to get an estimate of the engineering costs. For smaller culvert crossings not needing consent, prices were obtained from local rural supply firms.

43. Based on each property's contour, soil fertility, current stock policies and climate, an assessment was made as to what farm class they would be (see the **PC1 Report**). For the three farms on which PC1 will have the biggest impact in terms of potential loss of future income, current financial performance was analysed using annual accounts and Cash Manager information. This was then used as the status quo and the status quo was then compared to similar properties in the farm class for those financial years to determine the opportunity costs. One-off policies such as leasing land for maize and dairy support were also investigated. A change of policy

on the property was then modelled in OVERSEER to see the impact this would have on the property's NRP. Specific policies such as growing maize were also modelled. For example, on Farm D leasing 80ha of maize was modelled. Stocking rate was adjusted accordingly and the resulting N leaching on the whole farm went from 15 kg N/ha/yr to 18 kg N/ha/yr.

44. A full description of the methodology including assumptions and any limitations, along with the results of the case studies are set out in full in Appendix 1 **PC1 Report**. The main findings and conclusions from the case studies are discussed under the following sections.

CONTAMINANT LOSSES TO WATER FROM SHEEP AND BEEF FARMING

45. It is clear that managing water quality is a significant issue confronting agriculture. In terms of water quality, the main contaminants of concern are sediment, Nitrogen (N), Phosphorus (P) and faecal bacteria. For sheep and beef farms the loss of P, sediment and faecal bacteria are the main concern. Sheep and beef farms are minor contributors to N loss, generally. That means for sheep and beef farms the main issues are in relation to contaminants which flow over the land (P, sediment, faecal bacteria), rather than those that flow through the soil profile such as N. As discussed in the evidence of Mr Parkes, therefore the most efficient and effective approach to managing the impacts of sheep and beef farming on the environment are through tailored farm environment planning and the identification and management of critical source areas (CSA).

Table 2: Typical Industry Parameters

Industry	**N leaching (kg N/ha/yr)**	**P loss risk (kg P/ha/yr)**
Dairy	29–49	0.8–2.1
Sheep and Beef	8–18	0.1–0.5
Forestry	2	0.1

Source: AgResearch (Kaye – Blake et al 2013)

46. In the drystock sector there is huge variation in topography, soil type, climate, stocking rates and livestock policies. No two sub-catchments are the same and often no two farms are the same. In terms of water quality in these catchments one might have a problem with P loss or sediment, while

in more intensively farmed areas and in areas where soil may be coarse textured and free draining the main issue could be N.

47. This variation across the dry stock sector is well summarised below:

- *"The large variation in the micro-climates, parent materials, soil types and vegetation resources inherent in hill country is the major driver of spatial and temporal dynamics of contaminant losses[1]".*
- *"An outstanding feature of the drystock sector, in comparison with other agricultural land uses, is the high degree of spatial and temporal variation in both landscape structure and in system processes[2]".*

48. Given the large variation in the drystock sector in Waikato a "one size fits all" or blanket regulatory approach to managing contaminant losses is fraught with difficulty. Managing P loss is a very good example of this. It has been recognised that P loss from agricultural systems is highly variable in both space and time. McDowell found that "*Mitigation of P losses requires a good understanding of the sources and transport mechanisms involved in order to mix and match the right on farm management and mitigation strategy. In my view, effective mitigation of P losses needs to occur at the farm scale and is not a case of one size fits all[3]"*.

49. Given this large variation a prescriptive regulatory approach to managing contaminant losses is not a cost effective or fair approach. Mitigation measures need to be implemented at a farm scale (matched to the farm system) and be the most cost effective available.

50. A sub-catchment approach empowers individual landowners to understand the current water quality and sources of contaminant losses. Mitigation measures on a farm scale can then be prioritised where they have the biggest effect on improving water quality and how cost effective they are.

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[1] Dodd, M.B.; McDowell, R.W.; Quinn, J.M. 2016. A review of contaminant losses to water from pastoral hill lands and mitigation options. Hill Country, Grassland Research and Practice Series 16: 137-148.
[2] Mr.McFarlane Evidence in Chief. Before the Southland Regional Council. In the matter of Southland water and land plan.May 2017. Page 5
[3] Mr. McDowell Evidence in Chief. Before the Board of Inquiry Tukituki Catchment Proposal. In the matter of the Resource Management Act 1991.

Summary

For sheep and beef farms the loss of P, sediment and faecal bacteria are the main concern. Sheep and beef farms are minor contributors to N loss.

In the drystock sector there is significant variation in topography, soil type, climate, stocking rates and livestock policies. No two sub-catchments are the same and often no two farms are the same.

Given this large variation a prescriptive regulatory approach to managing contaminant losses is not a cost effective or fair approach. Mitigation measures need to be implemented at a farm scale (matched to the farm system) and be the most cost effective available.

NITRATE (N) LEACHING ON SHEEP AND BEEF FARMS COMPARED WITH OTHER PASTORAL LAND USE

51. Nitrate leaching is the main pathway of nitrogen loss in soils. One of the major sources of nitrate leaching is from urine patches. Typically, the higher the stocking rate the more urine patches per unit area and the more N leaching. Intensive farming on vulnerable soils (coarse textured free draining) results in an increased amount of N making its way to our water ways[4]. High rainfall and irrigation on these free draining soils further amplifies the risk of N leaching.

52. Nitrogen losses from sheep and beef farm systems are typically much lower than other pastoral land uses. Nitrogen leaching from dairy farms is higher than from sheep and beef farms. Analysis of catchment loads for specific land uses and stock types by McDowell and Wilcock[5] found that "*significantly more N was lost from dairy catchments than catchments with other land uses*". Figure 1 compares N, P and sediment contaminant losses by agricultural land use at a national scale.

53. Low nitrogen losses from sheep and beef farm systems was evidenced in the OVERSEER nutrient loss modelling conducted by BakerAg as part of the **PC1 Report**. The report found that across the five case study farms in

[4] Ms. Dewes, Evidence in Chief. Before the Board of Inquiry Tukituki Catchment Proposal. In the matter of the Resource Management Act. 1991. October 2013.Paragraph 21, page 6.

[5] McDowell, R.W.; Wilcock, R.J. 2008. Water quality and the effects of different pastoral animals. New Zealand Veterinary Journal 56(6): 296.

Waikato the average N loss was 13kg/N/ha/yr and the range was 7 to 17kg/N/ha/yr. It must be noted that this sample was not a statistical representation of Waikato sheep and beef farms. However, these results are in line with typical industry parameters and line up with recent OVERSEER modelling on 38 sheep and beef farms in the Waikato carried out by Dr Chrystal. Which found that average N loss for class 3 farms[6] was 14 kg N/ha/yr, while the average for class 4 farms[7] was 18 kg N/ha/yr. Overall for all farm classes (class 3, 4, and 5[8]) the average N loss was 17 kg N/ha/yr.

54. These findings are further backed up by The Southland Economic Project[9], which found that:

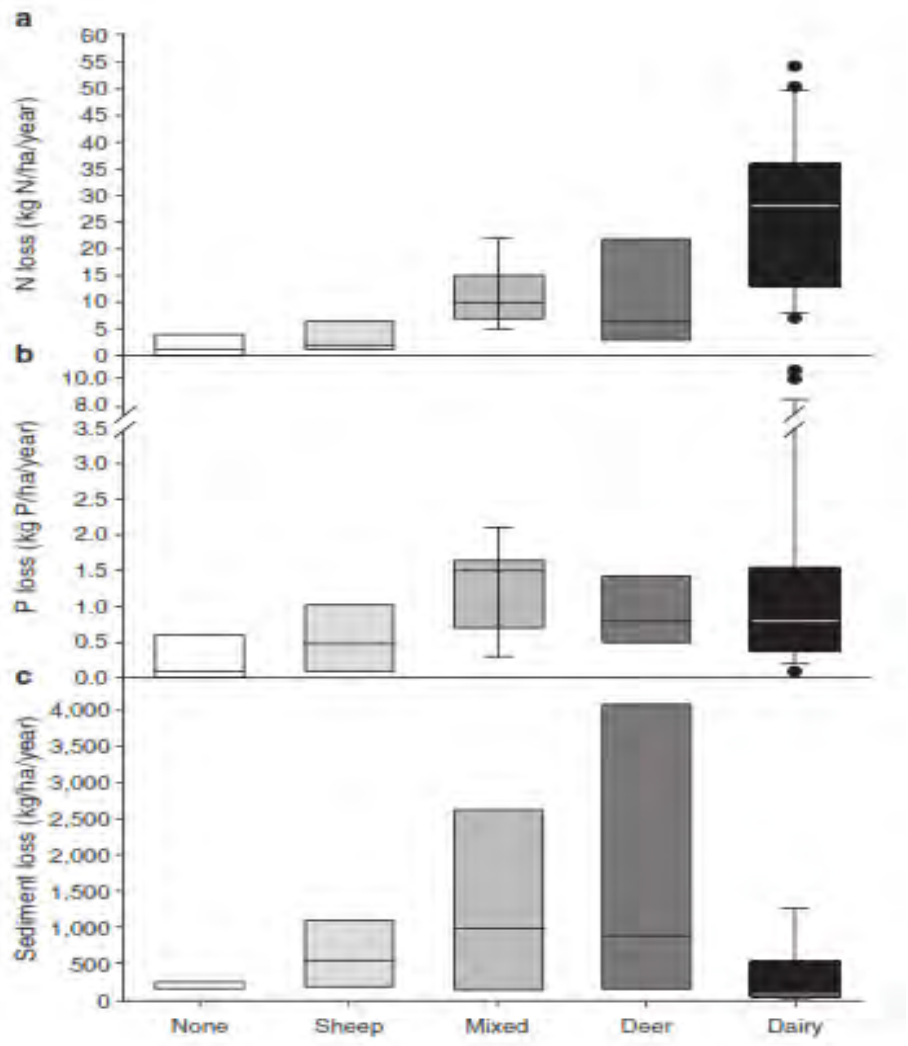
- in comparison Nitrogen (N) losses from sheep and beef farm systems are regualarly lower than that of other agricultural sectors; and
- sheep and beef farms tend to be minor contributors to N loss compared with the other sectors.

55. During the regional planning process many Regional councils have been guilty of applying a "one size fits all" approach to managing contaminant losses with an over-emphasis on reducing nitrate leaching.

56. Figures 1 and 2 below demonstrate that sheep and beef farms are minor contributors to N loss compared with other pastoral land use. It is important to note that there is always a range of N losses across the different sectors

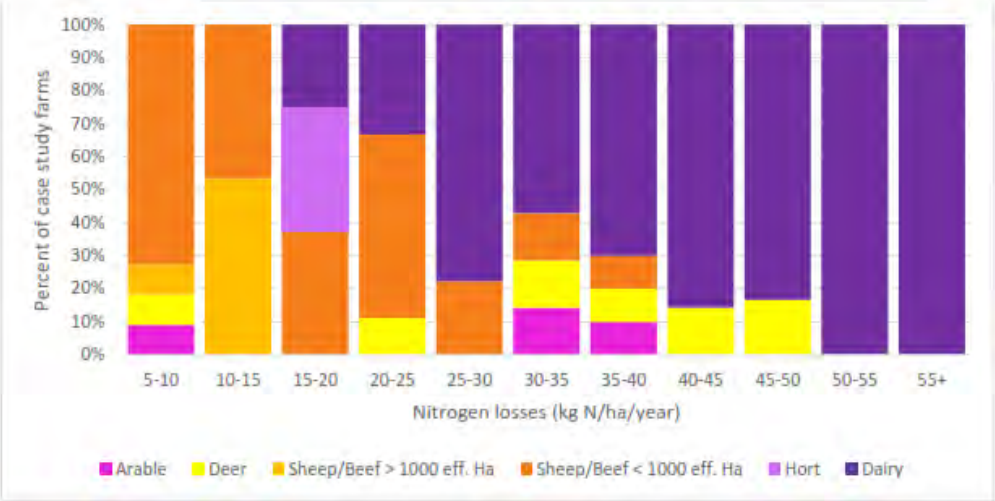
[6] Farm Class 3 is described as North Island Hard Hill Country
[7] Farm Class 4 is North Island Hill Country
[8] Farm Class 5 is North Island Intensive Finishing Farms
[9] Moran, E., Pearson, L., Couldrey, M., and Eyre, K. 2017. The Southland Economic Project: Agriculture and Forestry. Technical Report. Publication no. 2017-02. Environment Southland, Invercargill, New Zealand. 340pp.

Figure 1: Box plots showing the median concentration, bounded by the 25th and 75th percentiles, the 10th and 90th percentiles as whiskers, and any outliers, for (a) N, (b) P, and (c) sediment annual loads for each stock class of land use. 'None' refers to non-agricultural rural land uses, such as exotic plantation and native forest, while 'mixed' refers to a catchment with more than one stock land-use class [10]



[10] Wilcock, 2012. Review of water quality impacts of sheep and beef land uses in New Zealand

Figure 2: Baseline Nitrogen losses for Southland case study farms[11]



57. Care must be taken when comparing exact N leaching figures between the studies as different OVERSEER versions have been used in some cases. The studies do consistently show that Nitrogen losses from sheep and beef farm systems are typically much lower than other pastoral land uses.

Summary

Typically, sheep and beef farms are minor contributors to N loss compared with other pastoral land use.

STOCKING RATES ON SHEEP AND BEEF FARMS IN THE WAIKATO

58. Sheep numbers have declined in catchments for Waikato and Waipa[12], decreasing from 2,143,000 to 847,000 head for the period 1990-91 to 2016-17. Similarly, beef cattle numbers decreased from 405,000 to 292,000 head for the same period.

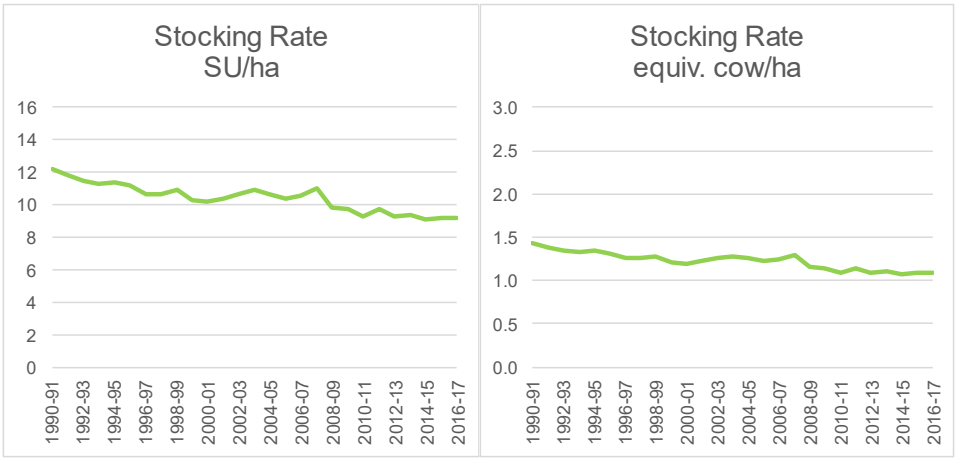
[11] Moran, E., Pearson, L., Couldrey, M., and Eyre, K. 2017. The Southland Economic Project: Agriculture and Forestry. Technical Report. Publication no. 2017-02. Environment Southland, Invercargill, New Zealand. Figure 1, Page ix.

[12] Includes the following districts. Waikato, Matamata-Piako, Hamilton City, Waipa, South Waikato, Taupo

59. Sheep and Beef Farms have become less intensive in Waikato and Bay of Plenty. Weighted average data across all classes of farm from Beef + Lamb New Zealand's Sheep and Beef Farm Survey shows the stocking rate in Waikato-BoP decreased from 12.0 to 9.2 stock units per hectare (SU/ha) for the period 1990-91 to 2016-17.

60. When considering a dairy equivalent stocking rate on Waikato-BoP Sheep and Beef Farms, we arrive at around 1.1 dairy cows equivalent per hectare for sheep and beef farms (Figure 3), this is in comparison to 2.9 dairy cows per hectare for the dairy industry as set out in the section below.

Figure 3: Dairy equivalent stocking rate on Waikato-BoP Sheep and Beef Farms (Cows per hectare)



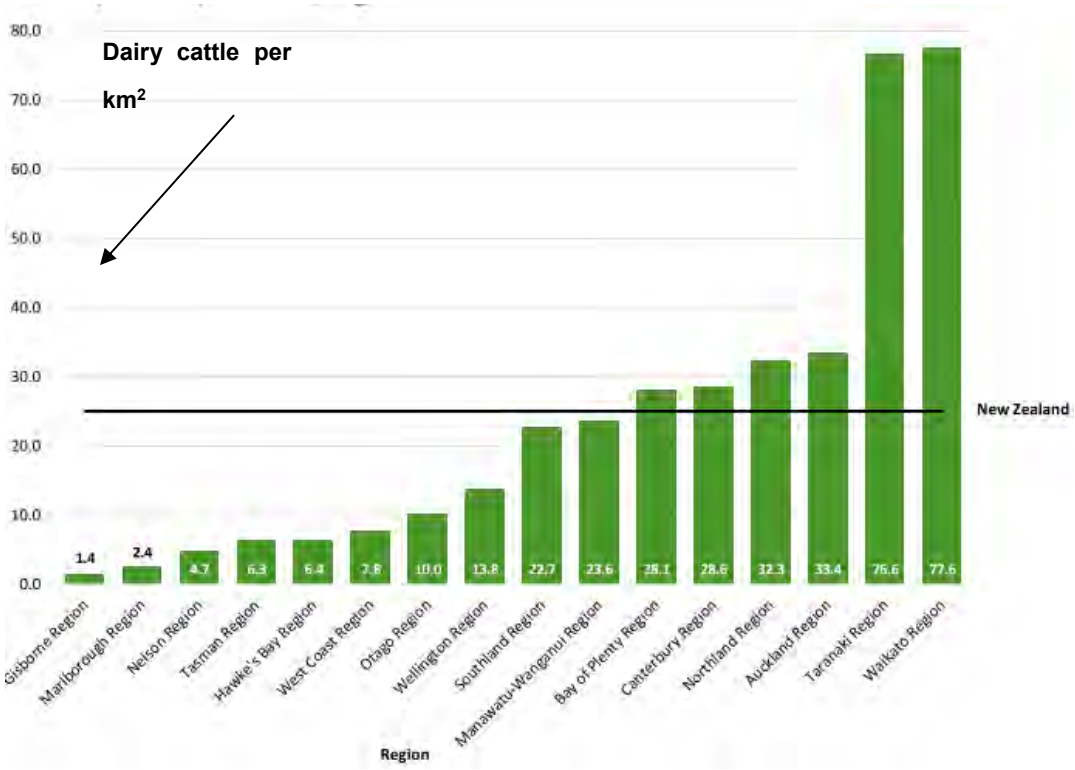
61. The Sheep and Beef Farm Survey shows the weighted average stocking rate in Waikato-BoP is 9.2 stock units per hectare (SU/ha) in 2016-17. Extrapolating from this, a typical Waikato-BoP sheep and beef farm is carrying 580kg LW/ha, i.e. 9.2 SU/ha x 63kgLW (one breeding ewe at 1 July) = 579.6 kg LW/ha. Recent FARMAX modelling work by Dr Chrystal showed that the average LW/ha at 1 July 2015 was 742kg for 38 Sheep and Beef Survey Farm farms in Waikato.

COMPARING SHEEP and BEEF STOCKING RATES TO OTHER MAJOR LAND USES IN THE WAIKATO

62. The majority of dairy herds (73.0%) are located in the North Island, with the

greatest concentration (28.8%) in Waikato.[13] The number of dairy cows in the districts that most closely align with Waikato and Waipa catchments[10] have steadily risen from 655,000 to 1,021,000 head for the period 1990-91 to 2016-17. In 2016 Waikato had the highest density of dairy cattle in New Zealand at 78 animals per km^2 [14]. See figure 4.

Figure 4: Density of dairy cattle by region in New Zealand, 2016 (Year to 30 June) Source Statistics NZ. [15]



63. The large majority of dairy cows in Waikato are Holstein-Friesian/Jersey Crossbreed (47.4%) weighing on average 441kg and Holstein-Friesian (32.3%) weighing on average 475kg[16]. The average stocking rate in

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[13] New Zealand Dairy Statistics. (2016). DairyNZ. Data available from https://www.dairynz.co.nz/media/5416078/nz-dairy-statistics-2015- 16.pdf (accessed November 2017).

[14] Environmental Health Indicators New Zealand (ehinz) (2017) – Massey University Data available from http://www.ehinz.ac.nz/assets/Factsheets/Released2017/NumberDensityOfDairyCattle2002-2016-release201708.pdf (accessed November 2017).

[15] Environmental Health Indicators New Zealand (ehinz) (2017) – Massey University Data available from http://www.ehinz.ac.nz/assets/Factsheets/Released2017/NumberDensityOfDairyCattle2002-2016-release201708.pdf (accessed November 2017).

[16] New Zealand Dairy Statistics. (2016). DairyNZ. Data available from https://www.dairynz.co.nz/media/5416078/nz-dairy-statistics-2015- 16.pdf (accessed November 2017).

Waikato is 2.9 cows/ha.[17] Extrapolating from this, a typical Waikato dairy farm is carrying 1334kg LW/ha, i.e. 2.9 cows/ha x 460kgLW = 1334kg LW/ha.

64. Typically, the higher the stocking rate the more urine patches per unit area and the more N leaching. Dairy farms have on average a higher stocking rate with more LW/ha (1334kg LW/ha vs 742kg LW/ha) and therefore more N leaching on average than sheep and beef farms.

65. These higher stocking rates on dairy farms are supported by better, more fertile country which typically grows more grass. Supplements including home-grown and brought-in feeds, and strategic N are used to support these higher stocking rates as well.

NITROGEN USE ON SHEEP AND BEEF FARMS IN THE WAIKATO

66. On average, N use on sheep and beef farms in the Waikato is minimal compared to other industries. There are properties that use strategic N, e.g. applications prior to lambing, on new grass in the autumn, or on a block on which bulls are run. The author is aware of some intensive bull beef farms using 60-90 kg N/ha/yr, however these are exceptions.

67. Average N input on farms in the B+LNZ Sheep and Beef Farm Survey in Waikato-BOP was around 9.2 kg N/ha/yr for 1990-91 to 2015-16. Recent modelling work on 38 sheep and beef farms in Waikato by Dr Chrystal showed that an average of 20 kg N/ha/yr was applied as fertiliser.

[17] QuickStats about dairying. (2016) DairyNZ. Data available from https://www.dairynz.co.nz/media/1358001/quickstats-waikato.pdf. (accessed November 2017).

COMPARING SHEEP AND BEEF NITROGEN USE TO OTHER MAJOR LAND USES IN THE WAIKATO

68. Table 3 below shows the average N use on owner operated dairy farms in the Waikato for the 2014-15, 2015-16, 2016-17 and 2017-18 seasons.

Table 3: Fertiliser Applications on Waikato Dairy Farms

Waikato Owner/Operators				
	2014-15	**2015-16**	**2016-17**	**2017-18p**
No: of farms	231	225	209	116
Nitrogen applied kg N/ha/yr	127	132	138	143
p = provisional . As at 11 Feb 2019, 2017-18 data was still being collected, so this number is subject to change. Source: DairyBase				

69. Dairy System Monitoring (DSM) is utilised by five independent consultancy firms across New Zealand and provides financial and production benchmarks to farmers across the country. In 2015, dairy farms in this data set used 197 kg N/ha/yr on average, in 2016 187 kg N/ha/yr, and in 2017 160 kg N/ha/yr. As shown by the Southland Economic Project Report, farming systems with higher stocking rates, higher fertiliser use, and potentially systems where feed is brought in, or where significant winter forage such as fodder beet or kale is grown, have more levers to pull in relation to reducing their N leaching while retaining profitable and flexible farming businesses.

Summary

Typically, sheep and beef farms have lower stocking rates, have lower input systems, use less N fertiliser, and have lower N leaching than the dairy sector. This is because they are generally farming to the grass curve rather than relying on imported feed and supplements. This means they have very few levers to pull in relation to reducing N leaching further. To try and do so comes at a significant cost to the farm business in relation to resilience and viability. Any reductions in N

leaching and environmental benefits will be marginal in comparison to the costs to the farm.

KEY FINDINGS AND SUMMARY OF THE BAKERAG REPORT – IMPLICATIONS OF THE PROPOSED WAIKATO REGIONAL PLAN CHANGE 1

70. The following is a summary and tables of the key findings from the **PC1 Report**. For the full report and calculations see Appendix 1.

71. The proposed Waikato Regional Council's Plan Change 1 (PC1) will affect how sheep and beef farmers can operate in the catchment and the choices they can make around land use and farm system change. PC1 will limit the earning potential of the land and reduce the flexibility in enterprise selection that farmers currently have. This in turn will alter what the market is prepared to pay for land, impacting land values and the equity of some businesses. The impact on land values and income-earning potential will be largest on undeveloped sheep and beef properties and conservatively stocked properties that have a low NRP.

72. The **PC1 Report** found that there will be four key costs to sheep and beef farmers as a result of PC1. The up-front capital costs to comply ranged from $26,139 to $541,437 per farm. The ongoing annual costs associated with compliance ranged from $5,905 ($66/ha) to $70,859 ($219/ha) per farm. The ongoing annual costs included additional administration with the Farm Environment Plan (FEP) and complying with the NRP, additional repairs and maintenance on new fences, water systems and stock crossing structures, interest and depreciation costs on the new water reticulation schemes and fencing around streams. The costs of fencing hill country streams are considered further under paragraphs 84 to 87 below.

73. What was clear in talking to many rural professionals and farmers when preparing the PC1 report was the lack of understanding around what impact PC1 will have on land values and potential future income, this was because limitations in relation to N leaching (as modelled by OVERSEER) are fairly new to the sheep and beef sector, and limited research has been undertaken on this issue.

74. On certain farms, land values will depreciate. The **PC1 Report** found on one farm with a very low NRP the potential drop in value could be 21-44%. This will create issues with the 'bankability' of some businesses and current

lending arrangements. The biggest impact and most inequitable outcome will be the yearly opportunity cost or loss of potential future income created by the grandparenting approach to nitrogen. The opportunity cost ranged from $75,698 ($164/ha) to $256,800 ($285/ha) per farm. See table 4 below for a summary of the compliance and opportunity costs.

Table 4: A summary of the compliance and opportunity costs associated with implementing the PC1 in its current form on five drystock farms in the Waikato. Source: BakerAg PC1 Report

Summary* of the compliance and opportunity costs associated with implementing the PC1 on 5 drystock farms in Waikato									
Farm	**Description**	**Up front capital costs**	**Annual costs**	**Annual costs per effective Ha**	**% Increase in farm working costs per effective Ha**	**NRP Kg N/Ha**	**Yearly opportunity costs - Loss of future income**	**Potential for land value to depreciate**	**Summary of reasons for potential depreciation in land value**
A	461 ha Drystock farm	$299,436	$38,248	$83	16%	12	$75,698 $164/Ha	Likely	NRP not at the top end would limit buyer interest. Conservative stocking rate with no annual nitrogen applied. Up front capital costs (fencing, water reticulation) would be factored in if put on the market
B	323 ha Drystock farm	$541,437	$70,859	$219	33%	14	NC	Likely	NRP is at the high end for this class of country which gives some flexibility around stock policies. The large up front capital costs (fencing, water reticulation) would be factored in if put on the market
C	900 ha Drystock farm	$399,091	$51,973	$58	19%	7	$256,800 $285/Ha	Highly likely	Undeveloped farm. NRP very low gives no flexibility and caps the stocking rate. The large up front capital costs (fencing, water reticulation) would be factored in if put on the market as well. Land use change restrictions (Drystock to dairy) will drop the value.
D	550 ha Drystock farm	$188,181	$26,421	$48	8%	15	$106,700 $194/Ha	Highly likely	NRP low for this class of country. Will limit policy options and the ability to change land use within the farm gate. E.g to Maize, Intensive Bull beef etc.
E	89 ha Drystock farm	$26,139	$5,905	$66	6%	17	NC	Highly likely	Land use change restrictions (Drystock to dairy) will drop the value of this property. Limited options to further intensify, capture extra feed, apply strategic N , use winter feed with the current NRP

* A full explanation and calculations are in the body of the PC1 report and in the appendix.
NC : Not calculated

INEQUITIES OF A GRANDPARENTING APPROACH TO NITROGEN AND WHY A NITROGEN REFERENCE POINT (NRP) IS NOT AN APPROPRIATE OR FAIR REGULATORY TOOL

75. A major issue for sheep and beef farmers under PC1 is how the plan treats N losses. As discussed above, the yearly opportunity cost or loss of potential future income created by the grandparenting approach to nitrogen ranged from $75,698 ($164/ha) to $256,800 ($285/ha) per farm in the **PC1 Report**.

76. PC1 introduces a property-scale NRP. Properties must provide Waikato Regional Council with a NRP (highest annual leaching loss in either the 2014-15 or 2015-16 financial year for the property). All NRPs are calculated using OVERSEER. Effectively, the plan restricts N losses from farms to the losses from that property for the 2014-15 or 2015-16 years. This means that farmers will be unable to increase N leaching from either the 2014-15 or 2015-16 year.

77. This approach is “Grandparenting” in that farmers are held to an allocation based on their land use and stock policy at a particular point in time. Properties discharging within the top 25% of N leaching will need to reduce their leaching so that they meet the 75th percentile by 2026. Given the N leaching results mentioned above for the five farms, it is highly unlikely any sheep and beef farms will fall into the top 25% when comparing N leaching across the different industries.

78. Under the NRP system, farms with the higher loss and consequent higher NRP stand to sustain a higher level of productivity, have more flexibility, and will be valued more highly. Farms with a low NRP and potentially better environmental footprint are effectively capped with a ceiling on stock numbers, production, land value and future income-earning potential. There is no recognition for the differential in N leaching between drystock farms and other sectors. Sheep and beef farms are minor contributors to N loss compared with other pastoral land use. Grandparenting favours businesses’ that already have a high environmental impact. This runs counter to a "polluter pays" principle, because those farms with the lowest environmental footprint are bearing a much larger burden under the proposed PC1 rules. This blunt, one-size-fits-all mechanism reinforces existing inefficiencies and rewards high-intensity farms with high N losses.

79. In the OVERSEER software, stocking rate is one of the key drivers of nitrogen leaching, so capping a farm's level of nitrogen leaching indirectly limits its stocking rate. This may be an appropriate course of action for sheep and beef farms that have been developed and are running at optimum sustainable levels, but it places unfair restrictions on farms that are not currently optimised, or are underdeveloped in relation to the natural capital of their land. Sheep and beef farms with a low NRP will not be able to reach their sustainable potential through responsible development, particularly subdivision and improving soil fertility up to optimal levels.

NITROGEN REFERENCE POINT RESULTS AND SCENARIO MODELLING IN OVERSEER FROM THE PC1 REPORT

80. NRP point results are shown in table 5. On farms A, C, and D, alternative stock policies and land uses were modelled in OVERSEER to see what impact this would have on their NRP. The current farm policies were adapted to reflect the B+LNZ Sheep and Beef Farm Survey averages for the relevant Farm Class. Farm D has several areas where maize could be grown and this was modelled to see the impact on the NRP. In all cases, the OVERSEER modelling showed an increase in a farm's NRP. It's important to note that the farms were only adapted to line up with the B+LNZ Sheep and Beef Farm Survey averages and the properties still exceeded their NRP.

Table 5: Nitrogen reference point results and scenario modelling in OVERSEER. Source: BakerAg PC1 Report

Nitrogen Reference Point (NRP) Results					Alternative Scenarios Modelled in Overseer				
		2014-15	2015-16	NRP (Highest)	Stocking Rate & Cattle Ratio to B+LNZ Class 4 Mean	Stocking Rate & Cattle Ratio to B+LNZ Class 5 Mean	Stocking Rate & Cattle Ratio to B+LNZ Class 4 Top 10%	Dairy on 150Ha. Drystock operation to B+LNZ Class 4 Mean	Grow 80ha Maize Followed by Annual RG and Winter Lamb Trade
Farm Name	Description	N leaching (kg/ha)	N leaching (kg/ha)	N leaching (kg/ha)	N leaching (kg/ha)	N leaching (kg/ha)	N leaching (kg/ha)	N leaching (kg/ha)	N leaching (kg/ha)
Farm A	461 ha Drystock	12	11	12	14				
Farm B	323 ha Drystock	14	14	14					
Farm C	900 ha Drystock	7	7	7	8		10	12	
Farm D	550 ha Drystock	15	15	15		18			18
Farm E	89 ha Drystock	13	17	17					

Key: Red equals an increase in the Farms NRP . Red equals the property exceeding its nitrogen reference point based on the alternative policy scenario.

Note: N loss reported using Overseer v 6.2.3. The NRP data as stated above should not be used for consenting or compliance purposes. BakerAg used WRC protocols as at November 2016, these may change as the plan becomes operative.

AN ALTERNATIVE APPROACH

81. If the Commissioners accept that sheep and beef farms are minor contributors to N loss, matters of fairness must also be considered and the use of a NRP would not be appropriate in my view. My evidence shows that for sheep and beef farms to be viable, resilient, and future-proofed, then flexibility in N leaching up to a threshold should be provided for. Enabling flexibility in N leaching would then enable these farms to optimise their farming systems within the natural capital of the land, which would result in benefits not only to the farming business but also in relation to environmental outcomes including reducing the losses of other contaminants of concern such as sediment and phosphorus and pathogens. The key methods that would provide a more efficient and effective means of ensuring the sustainable management of natural resources including the achievement of freshwater objectives are:

(a) Tailored farm environment planning based off understanding the opportunities and vulnerabilities of a farm's natural capital stocks such as soil, topography, climate, water, and biodiversity;

(b) Identification and management of critical source areas; and

(c) Enabling and empowering sub-catchment tailored management including edge of field mitigation

82. A sub-catchment approach utilising Farm Environment Plans where the four main contaminants – sediment, Nitrogen (N), Phosphorus (P) and faecal microorganisms – are prioritised in terms of their likely effects on water quality in the sub-catchment would enable interventions to be targeted at the sub-catchment and farm level, and provide a more cost-effective and efficient way to address environmental issues.

83. If Nitrogen is to be allocated, then my recommendation would be to investigate the pros and cons of the following:

(a) Allocating N on a natural capital approach. This is effectively a non-uniform cap, which applies limits based on the farm physical characteristics such as Land Use Capability (LUC) class and soil drainage, but applies to all farms regardless of past activities. This approach is more equitable because it treats farms with the same underlying resource in the same way, regardless of current use, and it serves to disadvantage high-input, highly productive farms with little inherent natural capital.

(b) Expressing N leaching (kg N/ha/yr) limits as quantitative ranges (e.g. <15, 15-23, 23-30 etc.) to allow greater Nitrogen flexibility and allow for the uncertainty or minimum error in the predicted N losses generated by OVERSEER. These ranges would be tied to LUC or the natural capital.

Summary

Implementing the NRP (Grandparenting) under the PC1 will impact the ongoing viability of many sheep and beef farms in the Waikato.

Sheep and beef farms with a low NRP will not be able to reach their sustainable potential through responsible development particularly subdivision and lifting soil fertility.

The biggest impact and most inequitable outcome will be the yearly opportunity cost or loss of potential future income.

Grandparenting favours businesses that already have a high environmental impact.

This blunt, one-size-fits-all mechanism reinforces existing inefficiencies and rewards high intensity farms with high N losses.

In my view, mitigating N through a NRP is unjustified for sheep and beef farms given they are minor contributors to N loss compared with other pastoral land use.

If the Waikato sheep and beef sector is to continue to be adaptable and resilient then any plan change framework needs to allow land use flexibility and N flexibility in particular.

THE ECONOMIC IMPACTS OF STOCK EXCLUSION FROM WATERBODIES ON SHEEP AND BEEF HILL COUNTRY UNDER THE PROPOSED WAIKATO REGIONAL PLAN CHANGE 1

84. PC1 requires farmers to exclude all cattle, deer, horses and pigs, from all permanently flowing waterways including drains no later than 1 July 2026. Exclusion involves fencing or a natural barrier including vegetation. Set-back distances of 1-3m also apply for new fences. Livestock must not be permitted to enter onto or cross the bed of a waterbody, except when using a livestock crossing structure. On areas with slope exceeding 25° and where stream fencing is impracticable there is some flexibility through the FEP. Schedule 1, Clause 2 (a) (ii) "*for areas with a slope exceeding 25^0 and where stream fencing is impracticable, provision of alternate mitigation measures*"[18]

85. On the farms investigated in the **PC1 Report** the consultant mapped all the water bodies from which cattle, horses, deer and pigs must be excluded (Compliance with schedule C and schedule 1). Excluding stock from these were costed including the costs of stock crossing structures. Areas with a slope exceeding 25° and where stream fencing was impracticable were identified and alternate mitigation measures were investigated and costed.

86. The up-front capital costs to comply with the plan change including compliance with schedule C and schedule 1 ranged from $26,139 ($294/ha)

[18] Proposed Waikato Regional Plan Change 1 – Waikato and Waipa River Catchments (3rd December 2016 Version) Schedule 1 page 51

to $541,437 ($1676/ha) per farm in the **PC1 Report**. The largest costs were fencing, water reticulation, and livestock crossing structures. The ongoing annual costs associated with compliance ranged from $5,905 ($66/ha) to $70,859 ($219/ha) per farm. A full breakdown of all these costs can be seen in the full report in **APPENDIX 1**. These costs are significant and will have a major impact on the ongoing viability of some sheep and beef farms. Stock exclusion needs to be completed before July 2026 giving farmers only nine years to finance the large up-front capital costs.

87. The above compliance requirements such as fencing up to 25° on hill country are unsustainable and impractical, and effectively the PC1 is asking hill country farmers to bear unsustainable costs.

88. It's important to note the previous Government's draft proposals released under its Clean Water Consultation document in February 2017. These proposals include recommendations on stock exclusion and stock crossings. In summary, the proposals require stock exclusion on slopes up to 15° (with dairy vs. beef cattle having different timeframes) and only require fencing of waterways above 15° where break feeding is occurring by 1 July 2022. This is due to the practicalities of fencing on steep hill country and the high costs relative to the environmental benefits. As the major transmission pathway for faecal matter to enter surface waterbodies, fencing is not the most efficient and effective method to address the potential impact, as a fence does little to stop and overland flow event.

89. The Clean Water Consultation document (2017) recommendations are summarised in table 6 below.

Table 6: Clean Water Consultation Document (2017) (Clean Water Consultation Document (2017) Table 1, page 29)

<table>
<tr><th>Farm/stock type</th><th>Plains (0-3°)</th><th>Undulating / rolling land (>3-15°)</th><th>Steeper land (>15° and over)</th></tr>
<tr><td>Dairy cattle (on milking platforms) and pigs</td><td colspan="3">1 July 2017 for waterways over 1 metre wide on all slopes
1 July 2020 for waterways less than 1 metre wide on the plains</td></tr>
<tr><td>Dairy support (on either land owned/leased by the dairy farmer or third party land)</td><td colspan="2">1 July 2022 for all waterways on the plains regardless of size and waterways over 1 metre wide on rolling land</td><td>Only where break feeding, by 1 July 2022</td></tr>
<tr><td rowspan="2">Beef cattle and deer</td><td>1 July 2025 for all waterways regardless of size</td><td>1 July 2030 for waterways over 1 metre wide</td><td></td></tr>
<tr><td colspan="3">Where break feeding, by 1 July 2022</td></tr>
</table>

90. Under the Clean Water consultation document stock crossing is allowed for the purpose of crossing from one side to the other as long as they are being supervised and are actively driven across the water body in one continuous movement, where this occurs less frequently than once per week.

91. The WRC has set more stringent stock exclusion and crossing requirements under PC1 than those proposed by the previous government. In my view, these stringent stock exclusion rules are financially unsustainable on hill country farms. PC1 should be amended at least to reflect the same stock exclusion and stock crossing requirements as proposed in the Clean Water Consultation document.

92. Tailored farm environment planning and the identification and management of CSAs provides a far more effective approach to addressing environmental risks associated with the overland flow of contaminants including faecal matter. In some areas, fencing may be required where stock access waterbodies, but in other areas mitigation such as gully retirement, stock water reticulation, stock management, or the provision of food and shelter away from the waterbody, may provide the greatest environmental outcomes.

Summary

The up-front capital costs and ongoing annual costs to comply with PC1 stock exclusion rules are financially unsustainable. The WRC has set more stringent stock exclusion and crossing requirements under PC1 than those proposed by the previous government.

MITIGATING ENVIRONMENTAL RISKS ASSOCIATED WITH SHEEP AND BEEF FARMING

93. Effective mitigation of contaminant losses from sheep and beef farms needs to occur at the individual farm scale using tailored farm environment plans and is not a case of one-size-fits-all.

94. Effective mitigations across various scales do exist – e.g. tree-planting for erosion control, riparian zones, wetlands, cattle grazing management, intensive winter crop management, cultivation techniques, fertiliser placement using precision spreading technology, and management of critical source areas (CSA).

95. Overland flow is the primary contaminant transport pathway associated with the sheep and beef sector[19]. The main contaminants of concern that are most commonly associated with overland flow include sediment, P and faecal microorganisms[20]. The management of CSAs is one of the best ways to mitigate environmental risks associated with sheep and beef farming[18].

96. In my view, the plan needs to allow sheep and beef farmers to understand the current water quality and main sources of contaminants in their sub-catchment, to and help them learn and adopt good management practices to mitigate their environmental impact. A key aspect of this will be the implementation of tailored farm-specific Farm Environment Plans (FEPs). A key emphasis of these needs to be managing discharges from CSAs.

Summary

Mitigation of contaminant losses from sheep and beef farms needs to occur at the individual farm level using tailored Farm Environment Plans. A number of mitigation measures do exist. The management of CSAs is one of the best ways to mitigate environmental risks associated with sheep and beef farming.

Richmond Beetham
15 February 2019

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[19] Mr. McFarlane Evidence in Chief. Before the Southland Regional Council. In the matter of Southland water and land plan. May 2017.
[20] Ms. Jordan Evidence in Chief. Before the Southland Regional Council. In the matter of Southland water and land plan. May 2017. Page 3

APPENDIX 1

PC1 REPORT

Implications of the proposed Waikato Regional Plan Change 1

Waikato and Waipa River catchments

Report to: Hill Country Group
C/O: Jason Barrier and Bruce Hill

8th June 2018

Report Prepared By:

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EXECUTIVE SUMMARY

The proposed Waikato Regional Plan Change 1 (PC1) will affect how farmers can operate in the catchment and the choices they can make around land use and land use change. The PC1 will alter the earning potential of the land and reduce the flexibility farmers currently have. This in turn will alter what the free market is prepared to pay for land, impacting land values and the bankability of some businesses. The impact on land values and income earning potential will be largest on undeveloped properties and conservatively stocked properties that have a low nitrogen reference point (NRP).

Under the NRP system (grandparenting approach - compliance rules based around historical performance) farms with the higher loss and consequent NRP stand to sustain a higher level of productivity, have more flexibility, and will be valued more highly. Farms with a low NRP and potentially better environmental footprint are effectively capped with a ceiling on stock numbers, production, land value and future income earning potential. There is no recognition for the differential in Nitrogen (N) leaching between drystock farms and dairy farms. Grandparenting appears to favour businesses' that already have a high environmental impact. This runs counter to a "polluter pays" principle, because those farms with the lowest environmental footprint are bearing a much larger burden as a result of PC1 rules.

Farmers accept the need for measures to address water quality, and that there will be costs involved. They will also have to accept that under the PC1 there will be a sinking lid on acceptable nutrient loss. However, what this report illustrates clearly is these costs will be significant on the five representative farms.

There will be four key costs to farmers. The up-front capital costs which ranged from $26,139 to $541,437 per farm. The ongoing annual costs which ranged from $5,905 ($66/Ha) to $70,859 ($219/Ha) per farm. Both these cost calculations have had the most airtime in recent media articles. What was clear talking to many rural professionals and farmers was the lack of understanding around what impact the PC1 will have on land values and potential future income. On certain farms land values will depreciate. This will create issues with the 'bankability' of some businesses and current lending arrangements. The biggest impact and most inequitable outcome will be the yearly opportunity cost or loss of potential future income created by the grandparenting approach to nitrogen. Until now this has been largely unrecognised/acknowledged, and for some of these properties this will be huge. The opportunity cost ranged from $75,698 ($164/Ha) to $256,800 ($285/Ha) per farm.

Farm environment plans (FEP's) as part of the PC1 are a positive step and a way to help farmers drive towards good environmental management practices. Farmers need to be given the flexibility to work with the certified farm environment planner to identify the best way to address contaminant loss risk factors on their property. Each property is unique and will have its own challenges, making a blanket approach unsuitable. A heavy-handed approach to farm environment plans, where farming practices are more prescriptive from a regulatory point of view, is unlikely to engage farmers and achieve the PC1 targets.

The Waikato regional council (WRC) need to work with farmers at a sub-catchment level to identify contaminant loss risk factors. It needs to be clearly understood if Nitrogen is actually a problem in the sub-catchments of the 5 farms visited. A pragmatic approach needs to be taken regarding stock exclusion from water bodies. Each property is unique and has different challenges associated with excluding stock. It must be noted that the proposed amendments to the National Policy Statement for Freshwater Management 2014 (NPS-FM) require stock exclusion on slopes up to 15 degrees as of 1 July 2022 and only require fencing of waterways above 15 degrees, where break feeding is occurring. BakerAg see this as a more practical solution and believe the PC1 needs to be amended to come in line with the NPS-FM. For water bodies in areas with a slope exceeding 25^{o} and where fencing is impracticable, the WRC need to determine the suite of minimum mitigations measures available to landowners and make this public to create certainty for farmers around the costs of the PC1. Given the importance of determining the slope, data or tools need to be made available to farmers to allow for accurate mapping of slope.

We strongly recommend that local and central government critically review the implications of implementing the PC1 in the Waikato region in its current form. Farming has been described as a three-legged stool, based on the three legs of social sustainability, environmental sustainability, and economic sustainability. All components need to be in place to have a viable business The PC1 focuses heavily on environmental solutions for the

Waikato region but the social and economic impacts appear to not have been thoroughly assessed or understood.

Objective 4 of the PC1 *"provides for a staged approach to long term achievement of the vison and strategy. It acknowledges that in order to maintain the social, cultural and economic wellbeing of communities during the 80-year journey, the first stage must ensure that the overall costs to people can be sustained".* The findings of this report clearly demonstrate the costs of implementing the PC1 on these five dry stock farms are not even handed or sustainable. There appears to be a lack of understanding of the impacts the PC1 will have and the complexity of the issues and their effects on communities.

Table 1 below is a summary of the compliance and opportunity costs associated with implementing the PC1 in its current form on five representative drystock farms in the Waikato.

Table 1: Summary* of the compliance and opportunity costs associated with implementing the PC1 on 5 drystock farms in Waikato									
Farm	**Description**	**Up front capital costs**	**Annual costs**	**Annual costs per effective Ha**	**% Increase in farm working costs per effective Ha**	**NRP Kg N/Ha**	**Yearly opportunity costs - Loss of future income**	**Potential for land value to depreciate**	**Summary of reasons for potential depreciation in land value**
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C	900 ha Drystock farm	$399,091	$51,973	$58	19%	7	$256,800 $285/Ha	Highly likely	Undeveloped farm. NRP very low gives no flexibility and caps the stocking rate. The large up front capital costs (fencing, water reticulation) would be factored in if put on the market as well. Land use change restrictions (Drystock to dairy) will drop the value.
D	550 ha Drystock farm	$188,181	$26,421	$48	8%	15	$106,700 $194/Ha	Highly likely	NRP low for this class of country. Will limit policy options and the ability to change land use within the farm gate. E.g to Maize, Intensive Bull beef etc.
E	89 ha Drystock farm	$26,139	$5,905	$66	6%	17	NC	Highly likely	Land use change restrictions (Drystock to dairy) will drop the value of this property. Limited options to further intensify, capture extra feed, apply strategic N , use winter feed with the current NRP

* A full explanation and calculations are in the body of the report and in the appendix.

NC : Not calculated

BACKGROUND

- For the past two decades, the Waikato community has identified water quality as one of the top issues in the Waikato region.
- The Waikato Regional Council's Proposed Plan Change 1 (Healthy Rivers Plan), hereinafter referred to as PC1, has recently been notified on the 22nd of October 2016.
- The PC1 is a statutory document which was developed over more than a two-year period by a Collaborative Stakeholders Group (or the CSG). The proposed plan change gives effect to recent (passed in 2004) Government legislation, on how we manage our fresh water resources. The proposed plan also gives effect to Te Ture Whaimana o Te Awa o Waikato (The vision and strategy for the Waikato and Waipa rivers) which was adopted by Government as part of treaty settlement legislation. The WRC has a legal requirement to give effect to both of these.
- Key issues for sheep & beef farmers:
    - Conversion from farming to forestry could be required to achieve long term targets
    - Restrictions on land use change
    - Nitrogen management adopts a nitrogen reference point (NRP) system or 'grandparenting approach'
    - Stock exclusion is required for some permanent water bodies
    - Reduction of contaminant losses from farms
    - Regulatory requirements for Farm Environment Plans (FEP)
- Submissions on the proposed plan change close at 5pm, 8th March 2017

BRIEFING

BakerAg was engaged by a group of concerned Waikato drystock farmers to investigate the implications of the PC1 on five representative drystock farms.

BakerAg's brief for this report was:

- Gain a thorough understanding of the implications of the proposed plan change.
- Visit five farms and build a physical profile of the properties, with specific consideration to stock policies, soil types, topography, and rainfall.
- Complete a nutrient budget for each property to determine their NRP.
- Identify all waterways that fall under schedule C of the proposed plan change.
- Measure these waterways and estimate costs to a) comply with schedule C (fence off waterways) and b) supply stock water to paddocks affected due to removing natural water supply.
- Use recognised industry benchmark figures to quantify the effects of this compliance on the financial viability of the businesses.
- Comment on the balance sheet impacts of compliance – debt associated with compliance and change in land value due to land use change restrictions and the NRP.
- Identify potential mitigation options for land greater than 25˚ and assess cost of these strategies.
- Compile the above in a detailed report to help with submissions on the proposed plan change.

METHODOLOGY

- Five farms in sub-catchment priority 1 (Map 3.11-2, PC1) were visited in the Waikato river catchments.

Table 2. Description of the five Waikato drystock farms investigated

Farm Name	Description	Freshwater managemnt unit
Farm A	461 ha Drystock - Sheep breeding/finishing, cattle trading, dairy grazers	Lower Waikato River
Farm B	323 ha Drystock - Beef cattle backgrounding operation	Lower Waikato River
Farm C	900 ha Drystock - Sheep & beef breeding/finishing and cattle trading.	Lower Waikato River
Farm D	550 ha Drystock - Sheep & beef breeding/finishing and cattle trading.	Lower Waikato River
Farm E	89 ha Drystock - Beef finishing and cattle backgrounding operation	Lower Waikato River

Farm visit and property inspection

- Physical and financial information was gathered during a farm visit for the 2015 and 2016 financial years.
- A full farm tour was undertaken, identifying and mapping all water bodies from which cattle, horses, deer and pigs must be excluded (Compliance with schedule C & schedule 1). ***Note:*** *There is currently a contradiction in the PC1 between schedule C which requires stock exclusion, and Schedule 1 which allows for alternative mitigations.*
- Areas with a slope exceeding 25˚ and where stream fencing is impracticable were identified and alternate mitigation measures were investigated and costed (Compliance with schedule 1).
- No explanation of how to measure slope, or the tools available, were detailed in the PC1.
- There is digital elevation information available, as well as topographic maps. These are inaccurate and not sufficient to accurately determine slope. The WRC indicated that LIDAR information would likely be required if slope mapping is to be done with any accuracy.
- After conversations with WRC staff, the following approach was used:
    - Slope was measured using the “Angle Meter Pro App” with an IPhone placed on a board along several points of the slope to get an average slope (see Appendix 1). The slopes measured were on the catchment hills perpendicular to the stream bed. Contour lines on the maps were also used as part of the assessment of the slope. There was an element of qualitative assessment due to the variable nature of hill country terrain.
    - In a number of cases there were gullies where the slope on one side was over 25˚ but on the other side the slope was less. There were also situations where some parts of a valley fell under the 25˚ slope rule and other parts didn’t. In most of these situations it was not practical to fence half way up a stream so the fence was run to the nearest fence or the area excluded. The consultant made his best assessment based on his interpretation of the rules, practical knowledge of farming, and using the tools above.

Estimate of fencing costs

- QGIS mapping software and Google Earth was used to measure waterways and fence lines needed to exclude stock.
- Fencing materials and costs were determined for several waterways using a quantitative survey. A local fencing contractor (www.barakatcontractors.co.nz) then priced these jobs individually using this information.
- Several other sources and methods were used to estimate fencing costs on a per metre rate for each of the different waterways:
    - Recent on-farm fencing invoices were gathered from farms.

- The 'planting and fencing waterways calculation sheet' on the WRC website was also used.
- The consultant made an independent assessment based on his own practical experience with fencing and the costs associated.
- The consultant made an assessment of what type of fence would be needed based on the contour, flood risk and stock policy operated on each property.
- Evidence was gathered on each property as to what the current fencing was and what type of new fence the farmers had already put in place around water bodies that was relevant to their stock policies.

Why haven't one-wire fences been used in all situations?

- The stock policy and type of animal farmed and contour played an important role in determining the type of fence.
- Three of the farms purchase beef weaners each autumn. These beef weaners were typically from large stations and the first human contact was often weaning when they were straight on a truck. When they arrive on farm they are very wild and without mum to direct them. A single wire (no matter how much power) would not provide enough of a barrier to these freshly-weaned large mobs and all farmers mentioned that they would run straight through a one-wire fence.
- Hand-reared dairy-cross beef animals are often quieter than station beef weaners and one wire would be sufficient in some situations.
- Single or double wire fencing is unsuited for stock exclusion when sheep are part of the policy due to the damage caused by sheep continually pushing through fences to feed and during mustering.
- The dairy industry often use one wire to fence waterways, the main difference being the cows are large (no chance to fit under high points in the wire), hand-reared and quiet (handled in the shed each day). They are shifted daily for milking and often never push under fences to get extra feed. Grazing residuals are higher so cattle don't go looking for feed.
- It therefore cannot be assumed that a one-wire fence is suitable in all situations and the consultant has used their professional judgment in each case.

Streams were typically not straight and the contour varied

Many of the waterways were not straight and the terrain varied. The cost of fencing on this type of terrain greatly increases for several reasons:

- Cost to get the material into the site. Often this must be walked in.
- Less opportunity to use a labour-saving post rammer, so that more manual labour is required.
- More 'benching' preparation by machinery needed to allow fence lines.
- A lot more angles needed and additional stays.
- More foots needed in dips.
- More floodgates needed in dips.

It is clear in the PC1 (Background and explanation page) that further reductions in nitrogen, phosphorus, sediment and microbial pathogen losses from land will be required in subsequent regional plans. It is unclear as to the future requirements of the plan in terms of excluding sheep from waterways, which would be a substantial cost to get contractors back in to upgrade fences.

Note: For this report no estimate of the financial impacts of the lost grazing land was made. On farms like B and C this will be considerable due to the nature of the main streams needing to be fenced. The contractor will have to fence where it is practical e.g. along ridges and up tracks. Benching the toe of hills will only create more sediment run-off and make the hills more susceptible to erosion. When calculating the fencing required no

provision of minimum grazing setbacks was included as per Schedule 1. This could be up to 3 m for land between 15 º and 25 º which would further increase the total grazing area lost.

Erosion and sediment control

- Some of the main critical source areas from which sediment, nitrogen, phosphorus and microbial pathogens could be lost were identified. This was not part of the brief so more time would be required to fully map all these areas to the extent required by the FEP.
- There wasn't time at the visit to identify all actively eroding areas, erosion prone areas, and areas of bare soil for erosion and sediment control and re-vegetation (This would be covered as part of the FEP process). The number of poplars needed for planting was estimated based on the size of the property and erosion status, however this would need more investigation to get an exact figure. Popular pole costings were calculated after talking with WRC staff.

Estimate of water reticulation costs

- Google Earth and QGIS mapping software were used to design the water reticulation system and estimate associated costs. Key reticulation costs such as additional pumps, power, header tanks, break tanks, source dams and main lines were calculated for the properties. Recent costings from a local hill country water reticulation system were used, aided by discussions with a natural resource engineer, to estimate the full costs for each property.

Calculating the Nitrogen Reference Point (NRP)

- The NRP was calculated for each property by Stefan Bryant of BakerAg. This was done using the current version of OVERSEER v 6.2.3 and adhering to the best practice data input standards 2016 and data input methodology as currently set out by Waikato Regional Council in the proposed Plan Change 1 for the Waikato and Waipa River Catchments (as at Nov 2016).
- The consultant has 20 years' experience in the agricultural industry and heads the environmental consultancy arm at BakerAg. The consultant uses OVERSEER extensively and completed the Massey University advanced nutrient management course in 2014.
- Soil order for each property was determined using S-map Online and information from Landcare. This was overlaid on individual farm maps.

Estimated costs of livestock crossing structures (Compliance with schedule C)

- Environment Waikato's "Best Practice Guidelines for Waterway Crossings" was used to determine appropriated livestock crossing structures for each situation. These crossing structures were then priced using a local building contractor.
- The WRC were consulted on what the consent costs would be and these were included in the calculations.
- A number of crossings needed an engineer involved and several companies were contacted to get an estimate of the engineering costs. For smaller culvert crossings not needing consent, prices were obtained from local rural supply firms.

Calculations of the potential loss of future income

- Based on each property's contour, soil fertility, current stock policies and climate, an assessment was made as to what farm class they would be (See B+LNZ farm classes in appendix 2).
- For the three farms on which the PC1 will have the biggest impact in terms of potential loss of future income, current financial performance was analysed using annual accounts and Cash Manager information. This was then used as the status quo.

- A judgment was also made on the potential of each property run under an average efficient operator and at top 20% performance. BakerAg had information from similar high performing properties close to some of the farms to help determine this. Market prices were obtained locally for lease rates on maize land and dairy leases.
- The status quo was then compared to similar properties in the farm class for those financial years to determine the opportunity costs. One-off policies such as leasing land for maize and dairy support was also investigated.
- A change of policy on the property was then modelled in Overseer to see the impact this would have on the property's NRP. Specific policies were also modelled such as growing maize. For example, on Farm D leasing 80ha of maize was modelled. Stocking rate was adjusted accordingly and the resulting N leaching on the whole farm went from 15kgN/Ha to 18kgN/Ha.

Discussion on the potential impact on land values

- It must be noted that the consultant is not a registered valuer. None of the properties were valued by BakerAg. The calculations are hypothetical and are the consultant's personal opinion of what could potentially happen to land values evidenced by what has happened in other catchments. The consultant researched recent land sales via local real-estate agents and valuer's and sales analysis provided from the banks. The consultant talked to several farmers and rural valuation firms to build a picture of the current market.

RESULTS AND IMPLICATIONS

Nitrogen reference point results and scenario modelling in Overseer

Nitrogen reference point results are shown in table 3. A detailed Overseer nutrient budget showing the highest NRP for each farm is in appendix 4. These sheep and beef results are in line with typical industry parameters shown below in table 4.

On farms A, C, and D alternative stock policies were modelled in Overseer to see what impact this would have on their NRP. The current farm policies were tweaked to reflect the B+LNZ sheep & beef farm survey class average. On farm C modelling was carried out looking at dairying on part of the land as well. Farm D has several areas where maize could be grown and this was modelled to see the impact on the NRP. In all cases the Overseer modelling in table 3 showed an increase in the farms NRP. It must be noted that no mitigation measures were modelled in Overseer as this was not part of the brief.

Table 3. Nitrogen reference point results and scenario modelling in Overseer

Nitrogen Reference Point (NRP) Results					Alternative Scenarios Modelled in Overseer				
		2014-15	2015-16	NRP (Highest)	Stocking Rate & Cattle Ratio to B+LNZ Class 4 Mean	Stocking Rate & Cattle Ratio to B+LNZ Class 5 Mean	Stocking Rate & Cattle Ratio to B+LNZ Class 4 Top 20%	Dairy on 150Ha. Drystock operation to B+LNZ Class 4 Mean	Grow 80ha Maize Followed by Annual RG and Winter Lamb Trade
Farm Name	Description	N leaching (kg/ha)	N leaching (kg/ha)	N leaching (kg/ha)	N leaching (kg/ha)	N leaching (kg/ha)	N leaching (kg/ha)	N leaching (kg/ha)	N leaching (kg/ha)
Farm A	461 ha Drystock	12	11	12	14				
Farm B	323 ha Drystock	14	14	14					
Farm C	900 ha Drystock	7	7	7	8		10	12	
Farm D	550 ha Drystock	15	15	15		18			18
Farm E	89 ha Drystock	13	17	17					

Key: Red equals an increase in the Farms NRP . Red equals the property exceeding its nitrogen reference point based on the alternative policy scenario.

Note: N loss reported using Overseer v 6.2.3. The NRP data as stated above should not be used for consenting or compliance purposes. BakerAg used WRC protocols as at November 2016, these may change as the plan becomes operative.

Table 4. Typical industry parameters

Industry	N leaching (kg/ha)	P loss risk (kg/ha)	Gross margin, 2012 ($/ha)
Dairy	29-49	0.8-2.1	$3,000-$4,500
Sheep and beef	8-18	0.1-0.5	$50-$800
Forestry	2	0.1	$250

Source: AgResearch - (Kaye-Blake et al 2013)

Note: The gross margin figures are for 2012 data on prices, costs and productivity

IMPLICATIONS ON INDIVIDUAL FARMS

FARM A

Farm A is a 514 ha (461 effective ha) sheep and beef hill country property running 9.5-10SU/ha. It is rolling and steep to very steep hill country, predominantly ash and greywacke soils. The farm runs 1500 Coopworth breeding ewes and 500 replacements. Lambs are finished with some sold store. R1 or R2 steers are purchased in April/May, selling most of these store the following January and finishing the rest. The farm grazes 300-400 dairy heifers annually. Stock water is predominantly springs and associated streams. There are also a number of small stock dams. The farm receives approximately 1375 millimetres of rain per annum.

Table 5. Costs associated with complying with the PC1

Farm A	
Up-front capital costs	$299,436
Ongoing annual costs	$38,248
Ongoing annual costs per effective Ha	$83
% Increase in farm working costs per effective Ha	16%

A more detailed breakdown of the individual costs is shown in Appendix 3.

Loss of future income– "Frozen Income"

Through compliance with schedule B, farm A will lose the potential to increase stock numbers through responsible land development. Farm A has a NRP of 12kgN/Ha. This is 2 kgN/Ha less than farm B just down the road which has lower inherent capacity soils and terrain. Overseer modelling results in table 3 show a lift in the NRP from 12kg/N/Ha/Yr to 14 with a policy change. This amounts to a considerable loss in potential future annual income. Farm A is being limited in future sustainable profitability to the value of approximately $75,698 per annum (see calculations in Appendix 3). Small increases can still be made through individual per head performance (production gains) but nowhere to the extent that was available to the property prior to notification of the PC1.

Farm A is farmed conservatively, reflecting the 'age and stage' of the owners in their farming career. Like all intergenerational farms eventually the next generation will take over and often must lift production to service debt associated with the succession process. Alternatively the farm may be sold to another party that needs to optimise performance to meet debt commitments. Both scenarios above will be very difficult based on the properties current NRP.

Loss of flexibility

Farm A has lost the option to change farming practices to meet market changes, grass surpluses or feed deficits. Even changing stock types to reduce workload or achieve higher returns may not comply with the PC1. This could ultimately lead to a loss in viability if there is no flexibility to increase production in the face of rising costs.

Increased economic costs

Ongoing annual compliance costs were calculated at $38,248 p.a. for Farm A. This represents a 16% increase in farm working expenses. Additional costs will be incurred for ongoing consent fees, NRP audit fees and professional fees if needed.

Impact on land value

The low NRP will likely impact the value of the land by limiting the pool of buyers. The up-front capital costs of water reticulation, fencing and culverts will also likely impact on the current land value.

FARM B

Farm B is a 370 ha (323 effective ha) hill country beef finishing and backgrounding farm. It is medium hill country with some river flats and some steeper faces. The farm runs approximately 13.4 SU/Ha, made up mostly of 950 R1 steers which are purchased from April to June and sold store the following March. Some smaller tail-end steers are carried through a second winter and finished. A small flock of 50 breeding ewes is also run.

The Waipuna stream is a predominant feature on the property, meandering through the flat land beside the road. Stock water is predominantly from springs and perennial streams including the Waipuna stream. Stock dams also provide water. There is limited reticulation on the property.

Table 6 Costs associated with complying with the PC1

Farm B	
Up-front capital costs	$541,437
Ongoing annual costs	$70,859
Ongoing annual costs per effective Ha	$219
% Increase in farm working costs per effective Ha	33%

A more detailed breakdown of the individual costs is shown in Appendix 3.

Up-front capital costs

The up-front capital costs of fencing and water reticulation combined with the 33% increase in farm working costs will place huge financial stress on the business. Based on the property's current value and lending it would be difficult to secure finance to meet these compliance costs. To the extent that additional lending is made available, the resulting higher debt levels will increase debt servicing costs, and raise security issues and potentially lead to increased risk margins factored into the interest rate.

Loss of flexibility

Farm B would lose the option to change farming practices to meet market changes, grass surpluses or feed deficits. Farm B currently uses no nitrogen and would lose the ability to have this as a strategic tool when faced with a feed deficit. In a growthy year Farm B could not buy in more stock to control feed as this would likely increase its NRP.

Increased economic costs

Ongoing annual compliance costs were calculated at $70,859 p.a. for farm B. This represents a huge 33% increase in farm working expenses. As with farm A, additional costs will be incurred for ongoing consent fees, NRP audit fees and professional fees if needed. This will ultimately lead to a loss in viability if there is no flexibility to marginally intensify on parts of the land in the face of rising costs.

Impact on land value

Potential purchasers will factor in the large up-front capital costs to comply with the PC1, reducing what they are prepared to pay for the property.

FARM C

Farm C is a 1,000 ha (900 effective ha) sheep and beef breeding and finishing farm. Approximately 150 ha of this is a flat to rolling decommissioned dairy unit with soil types conducive to market gardening and growing maize. The rest of the property is flat to rolling, with approximately 500 hectares of medium to steep hills. Olsen P levels on the hills are 7 with minimal fertiliser history. The operation currently runs 4.6 SU/ha, with approximately 100-150 breeding cows. The cows calve in September with the calves weaned in April at around 200kgLW. Surplus heifers and own-bred steers are fattened, plus additional beef steers and friesian bulls are brought in at 350-400kgLW and finished to heavy weights of around 700kgLW (350-360kg CW). A small flock of 250-300 Coopworth breeding ewes are run with replacements. Lambs are either finished or sold store. There is approximately 400ha of reticulated country fed from two separate bores. A number of stock water dams are also on the property. Most hill country stock water is from springs or dams.

Table 7 Costs associated with complying with the PC1

Farm C	
Up-front capital costs	$399,091
Ongoing annual costs	$51,973
Ongoing annual costs per effective Ha	$58
% Increase in farm working costs per effective Ha	19%

A more detailed breakdown of the individual costs is shown in Appendix 3.

Loss of future income – "Frozen Income"

In the Overseer software, stocking rate is one of the key drivers of nitrogen leaching, so by capping a farm's level of nitrogen leaching, in a rough sense, stocking rate is being capped. For farms that have been developed and are running at near optimum levels this may be seen as an appropriate course of action but it places unfair restrictions on farms that are not currently well developed.

An example of this is farm C. Soil fertility is well below optimum levels. Due to this, and the current maturity of the business, it is not being farmed to optimal levels. This is highlighted in table 8 below that shows farm C is only carrying 4.6 SU/ha compared to the B+LNZ class average of 9.3 SU/ha and the B+LNZ top 20% of 10.2 SU/ha.

This low stocking rate is also driving a low NRP of 7kgN/ha/Yr. Compare this to similar land classes that are better developed where the NRP might be 15-20. The impact of the rules in the proposed plan is that farm C, which to this point has had very little nitrogen impact, would lose the opportunity to invest in improving soil fertility and improving the profitability of the business in the future.

Under PC1, the property would lose the option of growing maize or market gardening on the flats as either land use would lift their N leaching. The property also has a decommissioned dairy farm. Under the land use change rules this land could not be returned to dairying or leased to neighbouring dairy farms.

Table 8 Farm C's stocking rate compared to the B+LNZ land class average for class 4

	Farm C	B+LNZ 2015 Class 4	B+LNZ 2015 Class 4
	2015	**2015**	**2015**
		Mean	**Top 20%**
Effective Ha	**900**	**334**	**341**
Total SU	4150	3116	3488
SU/Ha	4.6	9.3	10.2

In the absence of the PC1 rules, if property C were to lift performance to the average for the B+LNZ Class 4 on 750 ha, and leased the 150 ha dairy farm out for $900/ha, the increased annual income would be $256,800, or $285/ha. This then represents the loss of potential income for this property as a result of PC1

limitations. Under this above scenario the NRP was exceeded lifting from 7kgN/Ha/Yr to 12. If farm C was to continue sheep & beef farming on all the land and run a policy similar to the B+LNZ class 4 the lost annual income potential would be $184,195, or $205/ha. Under this policy the NRP was exceeded lifting from 7kgN/Ha/Yr to 8 see appendix 3 for detailed calculations.

Loss of flexibility

Farm C has lost the option to change farming practices and lift the stocking rate to meet market changes or grass surpluses. With the current farm policy, the use of small amounts of strategic N to fill feed deficits would likely lift the NRP. Additional land use options such as growing maize, market gardening, dairy support or dairying would not be available as they would likely not comply with the PC1 and exceed the current NRP.

Increased economic costs

Ongoing annual compliance costs were calculated at $51,973 p.a. for farm C. This represents a 19% increase in farm working expenses. Again, this will ultimately lead to a loss in viability if there is no flexibility to increase stocking rate and production in the face of rising costs.

Impact on land value

Potential purchasers will assess the large up-front capital costs to comply with the PC1 and factor this into what they are prepared to pay for the property. The very low NRP of 7kgN/Ha/Yr caps the future potential of the property and will have a big impact on the property's future value. The restrictions on land use change to dairy and the limited ability to change land use to market gardening or maize growing will also impact the value.

Several hypothetical calculations were made (See appendix 3 farm C) to see the impact on farms C's land value. Looking at restrictions on land use change from dry stock to dairy and adjusting the value of the dairy farm to a sheep & beef value, this dropped the value of the whole property from an estimated market value of $8,901,800 to $7,056,600 (-21%). This however ignored the major issue of the low NRP of 7kg N/Ha and cap on stocking rate. Calculations were then done using the Taupo methodology of putting a value on Nitrogen and where in the current market farms with N leaching under 18kg/N/Ha are getting discounted. It assumed a farmer looking to purchase the property wanted to run a system with a NRP of 18kg N /Ha. This could potentially drop the value of this property in this buyer's eyes by $4400/ha or $3,960,000 or a 44% drop in value. Either way you look at it a potential drop in value of between 21 - 44% would have big implications with current lending and the bankability of this business.

FARM D

Farm D is a 630 ha (550 ha effective) sheep and beef breeding and finishing farm with a 1,400mm average rainfall. It is predominantly easy rolling hill country with flats, and 110 hectares easy hill. The flats have many land uses including growing maize, dairy support and intensive bull finishing. The farm has a dairy farmer on the boundary and 100ha could be leased for dairying. Farm D runs approximately 10.9SU/ha. The farm runs 2,500 Coopworth breeding ewes and 650-700 replacement ewe hoggets. All lambs are finished on farm. The farm also runs 150 MA Angus breeding cows and 30 in-calf heifers. Angus cows are put to an Angus or Charolais bull on 25th November, and calves are finished as 2 year olds at approximately 310kgCW or sold as weaners in March. Trade cattle are bought in to fit with the system and pasture growth, mostly yearling bulls in the spring at 300kg liveweight. It is a well subdivided farm with 55 paddocks. Plantain/clover is grown along with rape and lucerne. Stock water is predominately reticulated through gravity-fed troughs and siphons from dams.

Table 9 Costs associated with complying with the PC1

Farm D	
Up-front capital costs	$188,181
Ongoing annual costs	$26,421
Ongoing annual costs per effective Ha	$48
% Increase in farm working costs per effective Ha	8%

A more detailed breakdown of the individual costs is shown in Appendix 3.

Loss of future income

Farm D would lose the potential to increase stock numbers through responsible land development. The greatest impact on farm D will be little flexibility to change land use such as growing maize or dairy support. Land use change restrictions and the NRP also take away the option to lease 100Ha of the best land to the neighbouring dairy farm. This amounts to a considerable loss in potential future annual income. Farm D is potentially being limited in future sustainable profitability to the value of approximately $106,700 per annum (see calculations in Appendix 3). Increases can still be made through individual per head performance (production gains) but nowhere to the extent that was available to the property prior to notification of the PC1. Farm D is farmed conservatively and the owners are at an 'age and stage' in their farming carrier (100+ years in the family) where they don't have to be performing at the top end of this land class. As noted above, the next generation will likely be looking to increase profitability to service the debt associated with the succession process.

Loss of flexibility

Farm D has lost the option to change farming practices and lift stocking rate to meet market changes or grass surpluses. Additional land use options such as growing maize, dairy support or leasing for dairying have been curtailed as they will lift the NRP and not comply with the land use change rules.

Increased economic costs

Ongoing annual compliance costs were calculated at $26,421 pa for farm D. This represents an 8% increase in farm working expenses.

Impact on land value

The current low NRP for this class of land caps the future potential of the property and will have an impact on the property's future value. The restrictions on land use change to dairy will also impact the value of the property. Limited ability to alter land use within the boundary such as growing maize, dairy support, or techno bull beef will also impact the value of the property. See the section below on the potential impact on land values for more detailed calculations on farm D.

FARM E

Farm E is an 89 ha beef finishing and backgrounding property. Farm E is predominately flat with some rolling hills at the back. The property is well subdivided and tracked with water reticulation to all paddocks. The property has had an excellent fertiliser history. The property is running approximately 310 R1 heifers, 30 R2 heifers, 10 cows and 30 breeding ewes. The predominant policy is backgrounding weaner heifers for sale in the autumn as rising 2-year-olds. Weaned heifers come in from April to June, and are taken through until the following February and sold store. Tail-end heifers are wintered and finished. Breeding ewes are predominately for house consumption however some of the progeny are finished.

Table 10 Costs associated with complying with the PC1

Farm E	
Up-front capital costs	$26,139
Ongoing annual costs	$5,905
Ongoing annual costs per effective Ha	$66
% Increase in farm working costs per effective Ha	6%

A more detailed breakdown of the individual costs is shown in Appendix 3.

The PC1 will impact farm E in terms of potential loss of future income through not being able to diversify into dairy support or lease land to dairy. The farm has a NRP of 17kg/N/Ha/Yr well below similar more intensive cattle finishing properties. The low NRP will limit the ability to marginally intensify or change policies within the farm gate. The farm will lose flexibility to capture feed surpluses through lifting stocking rate or to use small amounts of strategic nitrogen to get through periods of feed deficit.

Impact on farm E's land value

- Photo 1 below shows a 174ha dairy & dry stock farm (red boundary) that is currently for sale with an asking price of $3,600,000 + GST. This is currently under contract at around the $3,300,000 mark ($18,965/Ha).
- Farm E has approximately 44ha of flat dairy country surrounded by neighbouring dairy farms and 45 ha easy rolling hill suitable for dairy support which is of a better quality than the hills on the farm mentioned for sale above.
- Before notification of the PC1 on the 22nd of October 2016, the highest and best land use (farms valued on this basis) for farm E would have been dairying on the 44ha of flats and some of the lower rolling hills, and dairy support on the rest of the hills. The latest GV for farm E is $1,820,000 ($20,449/Ha). This GV is roughly in line with recent farm sales, with dairy ranging from $19,000 – $48,000/Ha, dairy support type blocks $20,000 – $39,000/Ha and dry stock sheep & beef farms $9,000 – $18,000 (BNZ & Marsh & Irwin analysis of recent farm sales).
- There is always an element of neighbourly premiums paid for small blocks like farm E because the neighbouring dairy farm can afford to pay more as they can easily incorporate it in their operation, taking this into account the GV might be undervaluing this property if it was put on the market prior to the notified PC1.

PC1 restricts land use change

- Under the PC1 land use change from dry stock to dairy is strongly discouraged and it sets a high consenting threshold.
- Farm E's NRP is low at 17kgN/Ha/year . Little nitrogen is applied on the property. Typically dairy farms on the same country are leaching in the range of 29 -49 kgN/Ha/year. Dairy support is around 16-25 kgN/Ha/year.
- The NRP rules and land use change restrictions will impact the potential value of this property as purchases are not likely to be able to convert the flats to dairy or run a dairy support type operation. Maize growing or more intensive bull beef would also lift N leaching above the current NRP.

Likely impact on farm E's land value

- The PC1 will have a negative impact on farm E's land value. Potential buyers will have to farm similar policies that stay within the NRP and comply with the land use change rules. This would likely drop the current per Ha value more in line with recent dry stock sheep & beef farm values ranging from $9,000 – $18,000/ha.
- Taking the midpoint of this range the value could drop from $1,820,000 ($20,449/Ha) to $13,500/ha or $1,201,500. This is a potential loss of $618,500 in equity which would have an impact on current lending arrangements and potential increases in bank margins. This drop in value lines up with the work Telfer Young did in the Taupo catchment recently (see discussion p 22 below).

Hypothetical example

- Another way to look at the potential impact on farm E's land value is putting a value on the nitrogen like the Taupo catchment.
- 'Farmer Jo' wants to buy farm E. To run farmer Jo's system would mean N leaching of 30kg/N/Ha/yr. Farmer Jo would have to buy 13kg of N/ha or he would have to factor this cost into what he was willing to pay for farm E.
    - 13kg of N x $400kg = $5,200/Ha
    - Farm E current GV of $20,449/Ha
    - Buyer factors this into their purchase price - $20,449/Ha - $5,200 = $15,249/Ha (25% drop in land value)

Photo 1: Dairy farm for sale next door to farm E

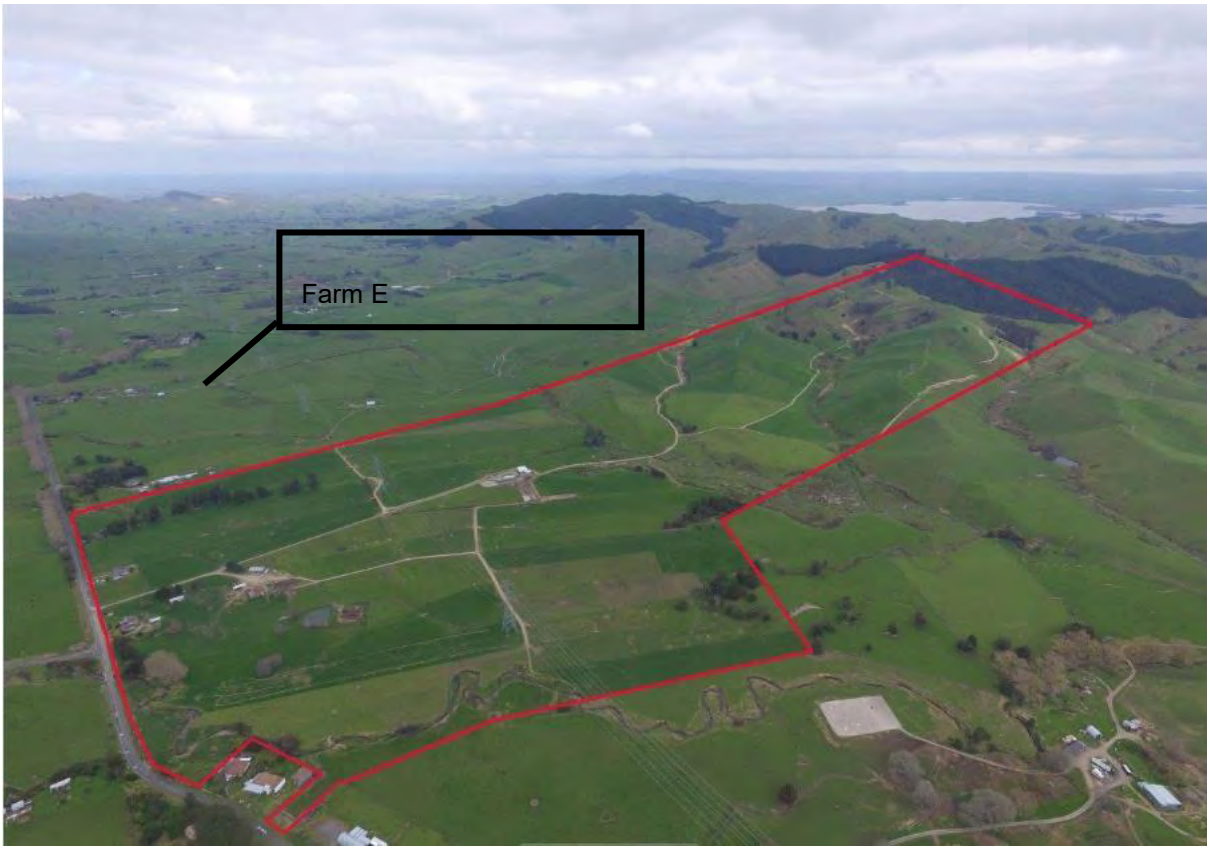


Photo 2: Farm E beside a neighbouring dairy farm

DISCUSSION – OPERATING UNDER A NRP (GRANDPARENTING APPROACH)

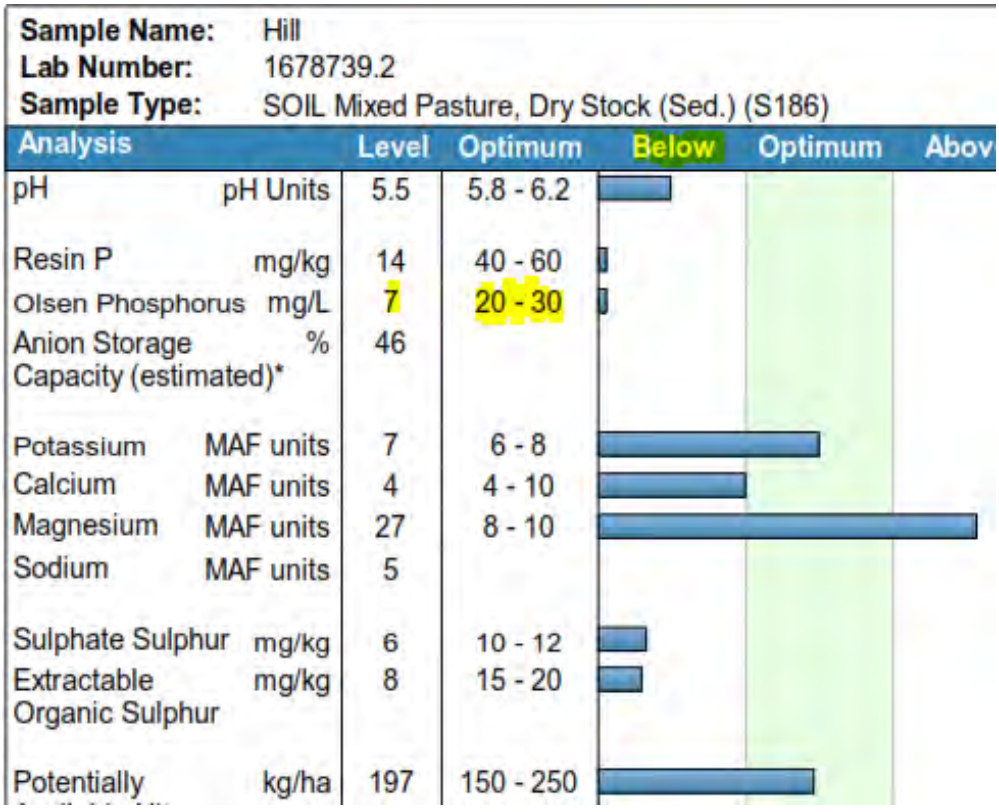
- Under a NRP farms will lose the potential to increase stock numbers through responsible land development. Increases can still be made through individual per head performance (production gains) but nowhere to the extent that was available to the property prior to notification of the PC1. “In summary, there is an inability to realise remaining unrealised, sustainable potential in this farm” (Burton,2016).
- A grandparenting approach to Nitrogen brings several inequities. Table 4 demonstrates industries such as dairy farming on a per ha basis leach more N. It seems ironic that farming systems that have lower N leaching and potentially a better overall environmental footprint are more severely affected by the PC1. Farmers who have the most flexibility and potentially more valuable land after the PC1 will be the ones with the highest nitrogen leaching in the two years the NRP was set. This runs counter to the accepted “polluter pays” principle.
- Grandparenting will especially disadvantage many land owners who have farmed conservatively and thus have a low NRP effectively their stock numbers will be frozen, in turn severely limiting the potential growth of production and income.
- Meanwhile farm input and operating costs will continue to increase. The B+LNZ sheep and beef on-farm inflation report reviews the annual changes in farm input prices. On-farm inflation has increased 23.6 per cent over the last 10 years. In addition, these farms will face increased compliance costs.The net result of static income and rising expenses will be a steady erosion of real profits.

Inequities of a grandparenting approach to Nitrogen

- Photo 3 below demonstrates the inequities with a grandparenting approach (compliance rules based around historical performance).
- Although very similar in many respects, the properties differ in fertiliser history. Soil fertility on farm C is well below optimum (see figure 1 below). Due to the current maturity of the business farm C is running at about 46% of potential carrying capacity. In contrast, farm E on the right has had regular fertiliser inputs, has good fertility and thus a higher stocking rate on the hills. Farm E has realised the sustainable potential on the hills.
- As far as Overseer is concerned, stocking rate is a key driver of nitrogen leaching so by capping a farm’s level of nitrogen leaching, in a rough sense, stocking rate is being capped. For farms like farm E that have been developed and are running at near optimum levels this may be seen as an appropriate course of action.
- With a very low NRP of 7 Kg/N/Ha, Farm C will have limited ability to realise remaining unrealised, sustainable potential in this farm.
- It is highly inequitable that as of the 22nd of October 2016, Farm E now has more flexibility than Farm C, and greater income earning potential.

Photo 3: Neighbouring farms with different fertiliser histories face different impacts under PC1

Figure 1: Soil test results, farm C



Sample Name: Hill
Lab Number: 1678739.2
Sample Type: SOIL Mixed Pasture, Dry Stock (Sed.) (S186)

Analysis		Level	Optimum	Below Optimum Abov
pH	pH Units	5.5	5.8 - 6.2	
Resin P	mg/kg	14	40 - 60	
Olsen Phosphorus	mg/L	7	20 - 30	
Anion Storage Capacity (estimated)*	%	46		
Potassium	MAF units	7	6 - 8	
Calcium	MAF units	4	4 - 10	
Magnesium	MAF units	27	8 - 10	
Sodium	MAF units	5		
Sulphate Sulphur	mg/kg	6	10 - 12	
Extractable Organic Sulphur	mg/kg	8	15 - 20	
Potentially	kg/ha	197	150 - 250	

DISCUSSION – IMPACT ON LAND VALUES, EVIDENCED IN OTHER REGIONS

The PC1 will affect how farmers farm in the catchment, the value of the land they farm, and the choices they can make around land use and land use change.

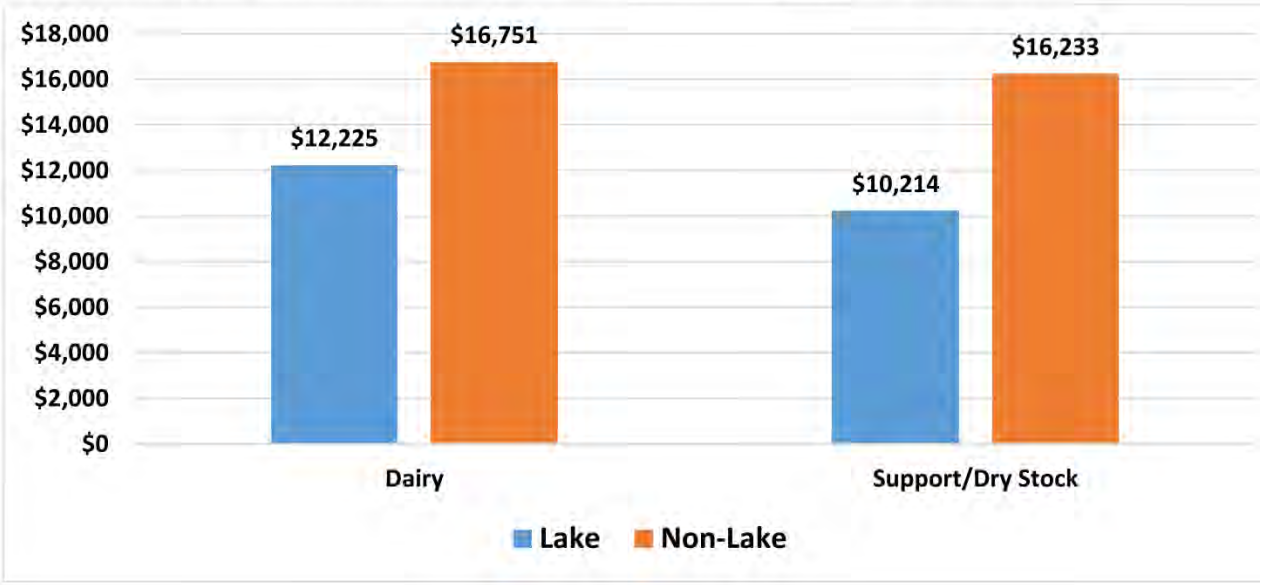
Evidence in other regions

- There is evidence in other regions that nutrient limits and restrictions on land use change have impacted land values. Under a grandparenting approach to nitrogen management, the effect on sheep & beef properties, under-developed land or properties with a more conservative stocking policy looks to be the greatest.

Taupo catchment example

- The Waikato Regional Council's "Variation No. 5 - Lake Taupo Catchment" became operative in 2011. Variation No. 5 has capped nitrogen leaching discharges for all farms in the catchment. Work carried out by Telfer Young on the Taupo and Rotorua Lake catchments has shown a differential in land prices because of restrictions on nitrogen leaching (Journeaux, 2015). Analysis of land sales in the Lake Taupo and Lake Rotorua catchments by Telfer Young showed the following:

Figure 12: Analysis of sales Lake Taupo/Rotorua catchments 2007-2012 ($/ha)



Source: Telfer Young

Nitrogen sourcing and trading in the Lake Taupo catchment

- There is currently a nitrogen trading system in the Lake Taupo catchment. Each farm has a nitrogen discharge allowance (NDA) based on their highest leaching during the benchmarking period July 2001 to June 2005. Farms in the catchment wanting to alter their NDA can sell nitrogen, buy nitrogen, lease out surplus nitrogen or lease extra nitrogen.
- Nitrogen is transferable and the current market value is around $400 per kgN (A. McLaughlin, personal communication, November 24, 2016).
- Typically, on sheep & beef farms in this catchment 9-11Kg of N/Ha/year is a low NDA. Around 18-22kg N/Ha/year is typical on more highly stocked properties or dairy support type operations (A. McLaughlin, personal communication, November 24, 2016).

- If you wanted to go from a low NDA of 11Kg N/Ha/year to 18kg you would need to buy or lease extra nitrogen. At $400 per kg/N this would cost you $2800/Ha (7x$400). This formula is being reflected in land values shown by a similar discount per ha. Typically land in the Taupo catchment with a NDA below 18Kg of N/Ha/year is being discounted (A. McLaughlin, personal communication, November 24, 2016).

Canterbury

- In Canterbury, there is a baseline nutrient level determined. The land area is broken up into different zones – red, orange and green. Farms need to make sure their farm policies are within the recommended guidelines for the different zones. Consultants working with clients looking to purchase a property have been doing additional analysis to see what implication the proposed stock policy will have on the environment and if it will be within the recommended guidelines for the different zones set by Environment Canterbury.

- There are examples of land prices that have been discounted because of this approach. Dairy farmers looking for dryland properties to winter cows on are discounting farms with a low base line level. Dryland with a low base line level provides less flexibility and is selling for around $15-18,000/Ha while similar land with a higher base line and thus greater flexibility is selling for around $20-25,000/Ha (P. Mills, personal communication, December 5, 2016).

DISCUSSION – POTENTIAL IMPACT OF THE PC1 ON WAIKATO SHEEP & BEEF LAND VALUES

- The PC1 was only notified on the 22nd of October 2016 so it is too early to see what impact it has had on land values. The large majority of farmers and industry professionals I talked to did not have a good handle on the impacts of the plan change particularly the impacts of the NRP (Grandparenting approach) and restrictions on land use change.

- There is evidence that buyers are more cautions in the catchment and are requiring more information regarding nitrogen application and stocking rates. Real estate agents are seeing more due diligence clauses on sale & purchase agreements (P. Kelly, personal communication, November 15, 2016).

- The cost of complying with the stock exclusion rules will have an immediate impact on values as potential purchasers will factor this in to what they pay as they will see the investment needed to exclude stock through fencing and other mitigation measures needed such as water reticulation. If you take farm A for example, the water reticulation and fencing costs are those which a potential purchaser will factor in.

- Restrictions on the conversion of land to more intensive land uses such as dairy farming will also immediately impact land values. With no opportunity to intensify production within the farm gate or via land use change, the speculators in the market who look to buy land and develop it will be out of the market.

- The big issue especially for drystock sheep & beef farmers is the issue of operating under a grandparenting NRP system which will no doubt impact land values. The impact on land values will be largest on undeveloped properties that have a low NRP. Properties with a low stocking rate in the 2015 and 2016 years will have no chance to lift stocking rate through sustainable development. These properties will be less appealing to buyers as the low NRP will give less flexibility and effectively 'freeze' production and income at current levels.

- Properties that have been run very conservatively (often little debt, lower stocking rate, farmers at an 'age and stage' where they don't need to extract every cent) will also be impacted the most. This will have implications for the incoming generation who often take on debt and need to lift production to service debt.

- A property with a low NRP will have little flexibility to change policies within the farm gate such as growing maize or dairy support which will impact the value. This demonstrates the impact on the land's productive value or its value relative to rent or profits obtainable from the land. The above highlights the inequalities created by a blanket grandparenting approach to nitrogen leaching.

- A report by Phil Jourrneaux *"The Effect of Environmental Constraints on Land prices"(2015)* talks about the consumptive component of land value. Farming is a great lifestyle, you are your own boss and it is a great environment to work in. Sheep & beef farmers historically have had poor cash returns but have had the security of increasing land value (capital gains). The PC1 will likely reduce cash returns further and impact

land values thereby also reducing returns via capital gain, with the net result of making farming less desirable. Increasing administration and compliance costs, the risk of non-compliance, and increased debt will put farmers off and impact the consumptive value aspect of their land.

Some examples of the potential impacts on land values on the case study farms

FARM D

- Farm D is currently going through succession and the current owner needs to pay out siblings. In July 2016, the farm was valued before notification of the PC1 on the 22nd of October 2016.
- Farm D is currently run conservatively with a lower than average stocking rate for the class of country and a low NRP of 15kg N/Ha/year.
- Let's say potential buyers needed the NRP to be 20kg N/ha/year for what they were looking at doing with the land. When looking at similar properties they would likely factor this into what they are willing to pay. Using Taupo as an example of what the NDA system has done to land values this might look like 5kgs N/Ha/year needed x $400 per kg/N = $2000/Ha.
- This could potentially drop the July valuation of this property (In these buyer's eyes) of $10,021/Ha to $8021. The potential impact of this is demonstrated in the following table.

Example of the impact of a drop in land value post PC1			
Pre PC1			
Example Farm	455Ha		
Actual value July 2016	$4,560,000		
Value/Ha	$10,022		
Loan to Value Ratio	50%		
Debt	$2,280,000		
Interest Rate	6.0%		
Annual Interest	$136,800		
Debt Servicing % GFR	24%		
Equity	$2,280,000		
Post PC1			
Value Post PC1	$3,649,555	20% Drop Land Value	
Value/Ha	$8,021		
Loan to Value Ratio	62%	Loan to value ratio increases (Security Issues)	
Debt	$2,280,000	Same debt	
Interest Rate	7.5%	*Bank Interest Margin Increases 1.5%	
Annual Interest	$171,000	Annual Interest cost increase by	$34,200
Debt Servicing % GFR	30%	Debt Servicing as % GFR ($1250/Ha)	
Equity	$1,369,555	Equity Drops (If sell lost $910,445 capital)	

****Agletter 2016 – "Your Interest Rate Margin" and discussions with several banks***

In farm D's case this would raise several issues

- The siblings wanting a pay-out will likely opt for the higher valuation.
- The farmer would likely look to get a new valuation that reflects the impact of the PC1.
- This has the potential to create friction and stress in the family unit. It would likely stall succession and create uncertainty.
- If the farmer pays out the siblings on the July valuation and the land value drops they would risk losing considerable equity.
- There are issues around bank security and potentially increased bank margins.

Effects on the mental well-being of farm households

- It was clear from visiting the 5 farms and their families that the uncertainty around the impacts of the PC1 had increased anxiety and stress levels of farmers. Until the full implications of the PC1 are clear it will be difficult for farmers to make investment and management decisions with confidence on their farm. Up-front capital costs to comply with the stock exclusion rules, increased debt servicing, and increased annual compliance costs will all place pressure and stress on farming families.

IMPACT ON SECURITY AND BANKABILITY

- Within the same bank, a customer who has a higher risk profile and is more expensive to manage is charged a higher interest rate margin than one that has a lower risk profile. There may be a 150-200 pt (1.5% - 2%) difference in pricing between low and higher risk customers.

- Banks will lend up to a percentage of land and stock value (loan to value ratio). While this ratio varies across banks, it is typically 60-65% for land and 50%-65% for stock. If the banks find that their lending is going outside of these limits because of the PC1, their risk pricing could potentially increase.

- Banks look at the quality and saleability of your farm**.** For example, if your property has a low NRP and is seen to have less general market appeal because it can't be developed then risk pricing may be higher.

- Debt servicing on many farms is a big expense and something that must be manged very carefully. The banks talk about your "Interest cover ratio". This is economic farm surplus (farming surplus) divided into annual interest+rent cost. This number wants to be higher than 1.25. What impact will the plan change and the associated reduction in farm surplus (6% - 33% increase in farm working expenses over the 5 farms p.a.) have on this key ratio and these farms' customer margin?

BENEFITS OF IMPLEMENTING THE PC1 ON THE CASE STUDY FARMS

Benefits of the FEP

- Compliance with schedule 1 requiring farmers to have a Farm Environmental Plan is a good way to help farmers drive towards good management practices. A detailed farm map identifying waterways, soil types and critical source points is a positive step to help farmers further reduce sediment, nutrient, and microbial pathogen discharges. Only one of the farms visited had a detailed environment map, which had been completed by the fertiliser company. There did appear to be a lack of planned erosion control (both from the farmers and WRC) on some properties. There was a big opportunity for farmers and the WRC to work together on a catchment-type plan to control the risk of erosion and the risk of sediment run-off into water ways. Better management of critical source areas will be a positive outcome of the Farm Environmental Plans.

Benefits of Subdivision

- There have been comments in previous reports that fencing waterways would create more subdivision on these hill country properties and potentially outweigh the capital costs. There is no denying that subdivision has one of the best returns on investment on hill country properties. However, all the properties visited were reasonably well subdivided. The streams that needed to be fenced didn't appear to create any more subdivision 'benefits'; in fact, they often created logistic issues with stock movements ("particularly farms B and C) and would lead to more annual repairs and maintenance for fence line upkeep.

Yours faithfully

BAKERAG NEW ZEALAND LTD

Richmond Beetham
Agribusiness Consultant

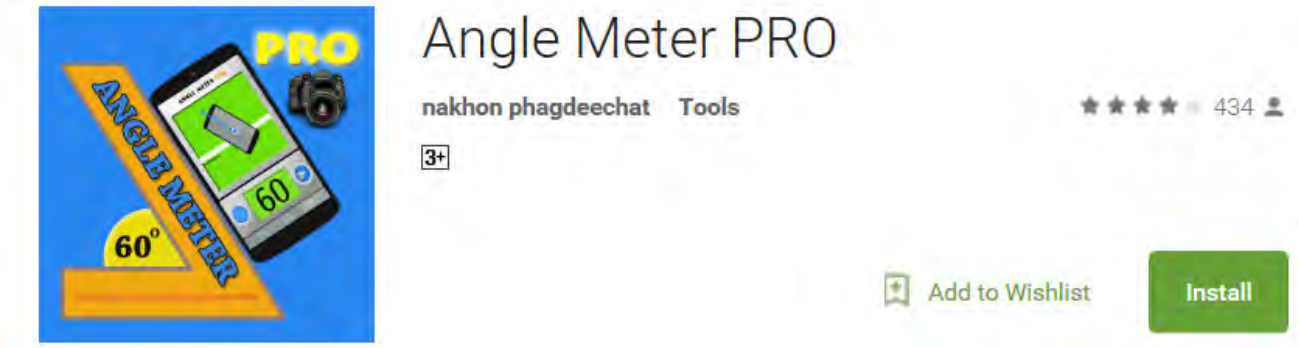
Chris Garland (Director)
Agribusiness Consultant

APPENDICES

1. SLOPE MEASUREMENT
2. BEEF AND LAMB FARM CLASSES
3. DETAILED FARM CALCULATIONS
4. DETAILED OVERSEER RESULTS
5. QUOTES
6. REFERENCES

1. SLOPE MEASUREMENT

Slope was measured using the “Angle Meter Pro App” with an iPhone. The iPhone was placed on a board at a number of representative locations.



2. BEEF AND LAMB FARM CLASSES

Beef + Lamb NZ Economic Service Farm Class Definitions:

Class 3 - North Island hard hill country

Steep hill country or low fertility soils with most farms carrying six to 10 stock units per hectare. While some stock are finished a significant proportion are sold in store condition.

Class 4 - North Island hill country

Easier hill country or higher fertility soils than Class 3. Mostly carrying between seven and 13 stock units per hectare. A high proportion of sale stock sold is in forward store or prime condition.

Class 5 - North Island intensive finishing farms

Easy contour farmland with the potential for high production. Mostly carrying between eight and 15 stock units per hectare. A high proportion of stock is sent to slaughter and replacements are often bought in.

3. DETAILED FARM CALCULATIONS

Farm A

Upfront Capital Costs to Comply with the PC1

Farm environmental plan			
*Average cost of preparing a Farm Environment Plan (AgFirst Estimate) excluding the NRP assuming the farm doesn't have an electronic map map			**$3,980**
Recent soil tests to set up Overseer file			
	Tests	**$/Test**	
	3	200	**$600**
Initial nutrient budget 2015 & 2016 Yr to set NRP			
	Hrs	**$/Hr**	
Farm visit	5	150	$750
Travel 100Km @ 80c km			$80
Set up Overseer files 2 years	13	150	$1,950
Further correspondence with accountant & farmer	1	150	$150
Note: Ballacne environmental team Est range $800-2880 for 2 files they have indicated $3000			**$2,930**
Stock Exclusion as per schedule C			
Fencing water bodies from which cattle, horses, deer and pigs must be excluded			**$27,704**
Mitigation measures as per schedule 1			
		Poles/Yr.	
Erosion Control -Poles planted to control erosion and ^CSPs		150	**$4,109**
Water Reticulation - Hill block mitigation (Perennial streams that are above 25 degrees and impracticable to fence)			**$238,500**
Riparian planting per year			**$2,500**
Livestock crossing structures - Install Culverts	22	$869	**$19,114**
Total Costs			**$299,436**

*Average time taken by Agfirst to complete a FEP for S&B farms was 21.75 excluding the NRP

^ CSPs = Critical source points are areas from which sediment, nitrogen, phosphorus and microbial pathogens are lost.

Nexus culvert 400mm x 6m $359

Culvert ends = 8m railing 150mmX 32mm $2.50/m = $20. 4X No1 1/4 round post 7.45 each = $29.8

Digger 4 culverts a day = $1360/Day = $340/culvert. Fencer 3 Hours per culvert x $40/Hr = $120

Ongoing Annual Costs to Comply with the PC1

Yearly Overseer updates to test policy change on NRP and compliance with the maximum NRP			
	Hrs.	**$/Hr.**	
Farm visit	3.5	150	$525
Travel			$80
Set up overseer file	1.5	150	$225
Further correspondence with accountant & farmer	0.5	150	$75
			$905
Ongoing mitigation measures as per schedule 1			
		Poles/Yr.	
Erosion Control -Poles planted to control erosion and CSPs		150	**$4,109**
Riparian planting & maintenance per year			**$2,500**
Water Riticulation - Ongoing annual costs			
*Additional **R&M & Labor** with new system $20/Trough			$1,844
Annual **Depreciation** 40 Yr. Lifespan			$5,963
Interest @ 7%			$16,695
		Total Costs	**$24,502**
* Fixing water leaks, replacing trough fittings, maintenance of pumps, maintenance of trough surrounds with metal etc.			
Fencing - Stock Exclusion - Ongoing annual costs			
*Additional **R&M Labor Required** ^1% Capital Value			$277
Annual **Depreciation** 20 Yr. Lifespan			$1,385
Interest @ 7%			$1,939
		Total Costs	**$3,601**
*More fences to look after, more flood damage, erosion damage, stock pushing 1 wires, Keeping electrics going, finding faults, spraying lines to keep power up. ^Lincoln financial budget manual 12-13			
Maintenance of livestock crossing structures			
Maintenance of culverts - Repairing eroded surrounds, clearing flood debris, * 3% Capita			$573
* Lincoln financial budget manual 12-13			
Interest @ 7%			$1,338
		Total Costs	**$1,911**
Additional Administration			
Monitoring, record keeping, reporting and gathering information to demonstrate and/or monitor complience with the Farm Environmnet Plan and NRP			
	Hrs	**$/Hr**	
	24	$30	**$720**
Total Annual Costs			**$38,248**
Effective Ha	**461**	**$/Ha**	**$83**
% increase in farm working costs/Ha (Based on farm As actual costs)			**16%**

Main System Details		
Block 1		
Tank 1 & 2 @ 380m		
Tank 3 @ 295m		
Source spring diesel pump @ 340m		
500m main line pump to tank		
Block 2		
Pump Shed 147m (high pressure pump)		
Tank 4 246m		
Tank 5 248m		
Details & Costs		
System Design	$2,500	
5 X 30,000 L tank (Range $3500 - 3900)	$17,500	
Excavation of tank sites, level, base x 5	$3,000	
*Helicopter Tanks to Site -($1200 Ferry, $320 Tank)	$2,800	
Tapping Spring Source + Materials	$2,500	
Pump diesel ($3500-5000)	$4,000	
Electrical Pump Multistage 5.5 kw	$3,000	
Threephase power to pump shed	$15,000	
Startomatic for pump	$800	
Tank Level Meter	$500	
Pump Shed - Concrete Base	$2,500	
	$54,100	
Costs for Main System & Troughs		
Ha	461	
Ha/Trough	5	
Total Troughs	92	
System Formula $2000/Trough	**$184,400**	
		$/Ha
Total Costs	**$238,500**	**$517**
* Helicopter $1600/Hour		

Fencing - Stock exclusion as per schedule C

Description	Fence Type	Meters	$/m	Total	Commnets
Stock Dams/Seeps/ Springs	4 Wire electric, posts at 5m spacing's -	1142	$10.33	$11,797	Sheep proof to safe guard plantings
Perennial Streams < 25 deg	2 Wire Elec No1 Round Post @ 5m Spacing	2908	$5.47	$15,907	Purchasing freshly weaned beef weaners and dairy grazing
Total Fencing Costs				**$27,704**	

Notes: No allowance has been made for new energiser units and under ground cabling or gates

Calculations of the opportunity cost or "Frozen Income"

	Farm A		B+LNZ 2015 Class 4	B+LNZ 2015 Class 4
	2015	**2016**	**2015**	**2015**
			Mean	**Top 20%**
Effective Ha	**460**	**460**	**334**	**341**
Total SU	4341	4585	3116	3488
SU/Ha	9.4	9.9	9.3	10.2
Sheep:Cattle SU Ratio %	51%	47%	42%	24%
Gross Farm Revenue	**$405,172**	**$350,898**	**$358,082**	**$567,596**
Gross Farm Revenue/Ha	$879	$761	$1,073	$1,666
Total Farm Working Expenses	**$236,474**	**$253,954**	**$218,770**	**$282,348**
Total Farm Working Expenses/Ha	$514	$552	$655	$828
Farm Working Expenses % GFR	58%	72%	61%	50%
EBITR TOTAL	**$152,698**	**$80,944**	**$139,439**	**$285,562**
EBITR/Ha	**$331**	**$176**	**$418**	**$838**
Applied Fert N kg/ha	0.00	0.00	14.10	25.2
Applied Fert P kg/ha	25.00	18.00	18.00	26.7

Opportunity costs or "Frozen Income"
Calculations based on the difference from status quo

Lift to B+LNZ Mean of Class 4 doing $418 EBITR/Ha
Lost annual income potential of **$75,699 (EBITR)**
Higher cattle ratio
Nitrogen application 14.10Kg/N/Ha/Yr
Nitrogen leaching moves from 12Kg/N/Ha/Yr to 14.
Under the new policy farm A would exceed its nitrogen reference point

Farm B

Upfront Capital Costs to Comply with the PC1

Farm environmental plan			
*Average cost of preparing a Farm Environment Plan (AgFirst Estimate) excluding the NRP assuming the farm doesn't have an electronic map map			**$3,980**
Recent soil tests to set up Overseer file			
	Tests	**$/Test**	
	0	200	**$0**
Initial nutrient budget 2015 & 2016 Yr to set NRP			
	Hrs	**$/Hr**	
Farm visit	5	150	$750
Travel 100Km @ 80c km			$80
Set up Overseer files 2 years	13	150	$1,950
Further correspondence with accountant & farmer	1	150	$150
Note: Ballacne environmental team Est range $800-2880 for 2 files they have indicated $3000			**$2,930**
Stock Exclusion as per schedule C			
Fencing water bodies from which cattle, horses, deer and pigs must be excluded			**$240,788**
Mitigation measures as per schedule 1			
		Poles/Yr.	
Erosion Control -Poles planted to control erosion and ^CSPs		100	**$2,739**
Water Reticulation - Hill block mitigation (Perennial streams that are above 25 degrees and impracticable to fence)			**$155,900**
Riparian planting per year			**$2,500**
Livestock crossing structures Waipuna Stream (14 crossing points currently - 6 is bare minimum	6	$20,600	**$123,600**
`Engineering and Consent estimate for crossings			**$9,000**
Total Costs			**$541,437**

*Average time taken by Agfirst to complete a FEP for S&B farms was 21.75hr excluding the NRP

^ CSPs = Critical Source Points are areas from which sediment, nitrogen, phosphorus and microbial pathogens are lost.

` $20,600 Quoted (See Appendix) crossing for Waipuna stream. Culvert Consent = $1265/Culvert. Bulk deal Est $1000 x 6. Design Engineer $3000 Personal Communication 1/12/16 - Murray Preston CES

Ongoing Annual Costs to Comply with the PC1

Yearly Overseer updates to test policy change on NRP and compliance with the maximum NRP

	Hrs.	$/Hr.	
Farm visit	3.5	150	$525
Travel			$80
Set up overseer file	1.5	150	$225
Further correspondence with accountant & farmer	0.5	150	$75
			$905

Ongoing mitigation measures as per schedule 1

	Poles/Yr.	
Erosion Control -Poles planted to control erosion and CSPs	100	**$2,739**
Riparian planting & maintenance per year		**$2,500**

Water Riticulation - Ongoing annual costs

*Additional **R&M & Labor** with new system $20/Trough		$1,292
Annual **Depreciation** 40 Yr. Lifespan		$3,898
Interest @ 7%		$10,913
	Total Costs	**$16,103**

* Fixing water leaks, replacing trough fittings, maintenance of pumps, maintenance of trough surrounds with metal etc.

Fencing - Stock Exclusion - Ongoing annual costs

*Additional **R&M Labor Required** ^1% Capital Value		$2,408
Annual **Depreciation** 20 Yr. Lifespan		$12,039
Interest @ 7%		$16,855
	Total Costs	**$31,302**

*More fences to look after, more flood damage, erosion damage, stock pushing 1 wires, Keeping electrics going, finding faults, spraying lines to keep power up.
^Lincoln financial budget manual 12-13

Maintenance of livestock crossing structures

Maintenance of culverts - Repairing eroded surrounds, clearing flood debris, * 3% Capita		$3,708
* Lincoln financial budget manual 12-13		
Interest @ 7%		$9,282
	Total Costs	**$12,990**

Additional Administration & Farm labour

Monitoring, record keeping, reporting and gathering information to demonstrate and/or monitor complience with the Farm Environmnet Plan and NRP

	Hrs	$/Hr	
	24	$30	**$720**
Additional time spent shifting stock after reducing Waipuna stream crossings from 14 down to 6 (Extra 3 Hours/week stock work)	144	$25	**$3,600**

Total Annual Costs			**$70,859**
Effective Ha	**323**	**$/Ha**	**$219**
% increase in farm working costs/Ha (Based on class 4 B+LNZ Farm Survey)			**33%**

Main System Details	
Tank 1 Feed - Front country & MX Track @ 217M	
Tank 2 @ 320m	
Source Dam & Diesel pump @ 147m - Feed tank 2	
2.7km main line electric pump to tank 1	
830m main line diesel pump to tank 2	
Details & Costs	
System Design	$2,500
2 X 30,000 L tank (Range $3500 - 3900)	$7,000
Excavation of tank sites, level, base x 2	$1,200
*Helicopter Tanks to Site -($1200 Ferry, $320 Tank)	$1,840
Dam excavation - 3 days @ $1,120/day	$3,360
Pump diesel ($3500-5000)	$4,000
Electrical Pump Multistage 5.5 kw	$3,000
Startomatic for diesel pump	$800
Tank Level Meter	$500
Pump Shed - Concrete Base	$2,500
	$26,700
Costs for Main System & Troughs	
Ha	323
Ha/Trough	5
Total Troughs	65
System Formula $2000/Trough	**$129,200**
Total Costs	**$155,900**

	$/Ha
	$482.66

* Helicopter $1600/Hour

Fencing - Stock exclusion as per schedule C

Description	Fence Type	Meters	$/m	Total	Commnets
Stock Dams/Seeps/ Springs		334	$10.33	$3,450	Sheep proof to safe guard plantings
Waipuna Stream	3 wire Electric (2.5 mm wire, No. 1 round posts, 3 meter spacing)	12022	$18.08	$217,358	Beef weaners freshly weaned 1 wire not sufficient. Winding stream , many angles, mostly hand dug, benching needed large labor cost
Perennial Streams < 25 deg	3 Wire Elec No1 Round Post @ 5m Spacing	1670	$5.97	$9,970	Beef weaners freshly weaned 1 wire not sufficient. Streams into Waipuna stream from Road
Perennial Streams < 25 deg	2 Wire Elec No1 Round Post @ 5m Spacing	1830	$5.47	$10,010	Wetland area by Mx Track
Total Fencing Costs				**$240,788**	

Notes: No allowance has been made for new energiser units and under ground cabling or Gates on fencing that doesn't include the Waipuna Steam

Farm C

Upfront Capital Costs to Comply with the PC1

Farm environmental plan			
*Average cost of preparing a Farm Environment Plan (AgFirst Estimate) excluding the NRP assuming the farm doesn't have an electronic map map			**$3,980**
Recent soil tests to set up Overseer file			
	Tests	**$/Test**	
	3	200	**$600**
Initial nutrient budget 2015 & 2016 Yr to set NRP			
	Hrs	**$/Hr**	
Farm visit	5	150	$750
Travel 100Km @ 80c km			$80
Set up Overseer files 2 years	13	150	$1,950
Further correspondence with accountant & farmer	1	150	$150
Note: Ballacne environmental team Est range $800-2880 for 2 files they have indicated $3000			**$2,930**
Stock Exclusion as per schedule C			
Fencing water bodies from which cattle, horses, deer and pigs must be excluded			**$134,712**
Mitigation measures as per schedule 1			
		Poles/Yr.	
Erosion Control -Poles planted to control erosion and ^CSPs		150	**$4,109**
Water Reticulation - Hill block mitigation (Perennial streams that are above 25 degrees and impracticable to fence)			**$249,760**
Riparian planting per year			**$3,000**
Livestock crossing structures - Install Culverts	0	$869	**$0**
Total Costs			**$399,091**

*Average time taken by Agfirst to complete a FEP for S&B farms was 21.75 excluding the NRP

^ CSPs = Critical Source Points are areas from which sediment, nitrogen, phosphorus and microbial pathogens are lost.

Nexus Culvert 400mm x 6m $359

Culvert ends = 8m railing 150mmX 32mm $2.50/m = $20. 4X No1 1/4 Round Post 7.45 each = $29.8

Digger 4 culverts a day = $1360/Day = $340/Culvert. Fencer 3 Hours per culvert x $40/Hr = $120

Ongoing Annual Costs to Comply with the PC1

Yearly Overseer updates to test policy change on NRP and compliance with the maximum NRP

	Hrs.	$/Hr.	
Farm visit	3.5	150	$525
Travel			$80
Set up overseer file	1.5	150	$225
Further correspondence with accountant & farmer	0.5	150	$75
			$905

Ongoing mitigation measures as per schedule 1

	Poles/Yr.	
Erosion Control -Poles planted to control erosion and CSPs	150	**$4,109**
Riparian planting & maintenance per year		**$3,000**

Water Reticulation - Ongoing annual costs

*Additional **R&M & Labor** with new system $20/Trough	$2,000
Annual **Depreciation** 40 Yr. Lifespan	$6,244
Interest @ 7%	$17,483
Total Costs	**$25,727**

* Fixing water leaks, replacing trough fittings, maintenance of pumps, maintenance of trough surrounds with metal etc.

Fencing - Stock Exclusion - Ongoing annual costs

*Additional **R&M Labor Required** ^1% Capital Value	$1,347
Annual **Depreciation** 20 Yr. Lifespan	$6,736
Interest @ 7%	$9,430
Total Costs	**$17,513**

*More fences to look after, more flood damage, erosion damage, stock pushing 1 wires, Keeping electrics going, finding faults, spraying lines to keep power up.
^Lincoln financial budget manual 12-13

Maintenance of livestock crossing structures

Maintenance of culverts - Repairing eroded surrounds, clearing flood debris, * 3% Capita	$0
* Lincoln financial budget manual 12-13	
Interest @ 7%	$0
Total Costs	**$0**

Additional Administration

Monitoring, record keeping, reporting and gathering information to demonstrate and/or monitor compliance with the Farm Environment Plan and NRP

Hrs	$/Hr	
24	$30	**$720**

Total Annual Costs			**$51,973**
Effective Ha	**900**	**$/Ha**	**$58**
% increase in farm working costs/Ha (Based on farm Cs actual costs)			**19%**

Main System Details	
Block 1	
Tanks @ 245m (Sheep & Cattle Yards)	
Spring 235m - 190m main line spring to tank	
Details & Costs	
System Design	$2,500
3 X 30,000 L tank (Range $3500 - 3900)	$10,500
Excavation of tank sites, level, base x 3	$1,800
*Helicopter Tanks to Site -($1200 Ferry, $320 Tank)	$2,160
Tapping Spring Source + Materials	$2,500
Pump diesel ($3500-5000)	$4,000
Startomatic for pump	$800
Tank Level Meter	$500
Pump Shed - Concrete Base	$2,500
	$27,260
Costs for Main System & Troughs	
Ha	500
Ha/Trough	5
Total Troughs	100
System Formula $2000/Trough	**$200,000**
Total Costs	**$227,260**

$/Ha
$454.52

* Helicopter $1600/Hour

Additional troughs on reticulated country	
$1,250 including 100m pipe x 18	**$22,500**
Final Costs	**$249,760**

Fencing - Stock exclusion as per schedule C

Description	Fence Type	Meters	$/m	Total	Commnets
Stock Dams/Seeps/ Springs	4 Wire electric, posts at 5m spacing's -	489	$10.33	$5,051	Sheep proof to safe guard plantings
Perennial Streams < 25 deg	2 Wire Elec No1 Round Post @ 5m Spacing	23704	$5.47	$129,661	Dairy breed calves Home breed weaners finished & Friesian Bulls.
Total Fencing Costs				**$134,712**	

Notes: No allowance has been made for new energiser units and under ground cabling or Gates

Calculations of the opportunity cost or "Frozen Income"

	Farm C	B+LNZ 2015 Class 4	B+LNZ 2015 Class 4
	2015	2015	2015
		Mean	Top 20%
Effective Ha	**900**	**334**	**341**
Total SU	4150*	3116	3488
SU/Ha	4.6	9.3	10.2
Sheep:Cattle SU Ratio %	7%	42%	24%
Gross Farm Revenue	**$472,899**	**$358,082**	**$567,596**
Gross Farm Revenue/Ha	$525	$1,073	$1,666
Total Farm Working Expenses	**$281,020**	**$218,770**	**$282,348**
Total Farm Working Expenses/Ha	$312	$655	$828
Farm Working Expenses % GFR	59%	61%	50%
EBITR TOTAL	**$191,879**	**$139,439**	**$285,562**
EBITR/Ha	**$213**	**$418**	**$838**
Applied Fert N kg/ha	2.50	14.10	25.2
Applied Fert P kg/ha	9.92	18.00	26.7

**2015-16 = 3685 Total SU 4.1SU/Ha*

Opportunity Costs or "Frozen Income"

Calculations based on the difference from Status Quo

Lift to B+LNZ Mean of Class 4 doing $418 EBITR/Ha
Lost annual income potential of **$184,195 (EBITR)**
Higher SR of 9.3 SU/Ha (+ 4.7 SU/Ha)
Higher sheep ratio
Nitrogen application 14.10Kg/N/Ha/Yr
Nitrogen leaching moves from 7Kg/N/Ha/Yr to 8.
Under this new policy farm C would exceed its nitrogen reference point

Lift to the B+LNZ Mean of Class 4 & Lease 150Ha out for dairying ($900/ha)
Lost annual income potential of **$256,800 (EBITR)**
Higher SR on the 750Ha of 9.3 SU/Ha (+ 4.7 SU/Ha)
Higher sheep ratio
Nitrogen application on the sheep & beef country of 14.10Kg/N/Ha/Yr
Nitrogen leaching moves from 7Kg/N/Ha/Yr to 12.
Under this new policy farm C would exceed its nitrogen reference point
Land use change - Non complying activity requiring resource consent

Calculations of the PC1 impact on farm C's land value

Farm C - Current rating value

Ha	RV	RV Date	$/Ha	Contour & Best and highest land use
278	$2,170,000	1/07/2014	$7,806	Flat to rolling hill country - sheep & beef (Some cropping)
490	$2,040,000	1/07/2014	$4,163	Medium to steep hill country sheep & beef
38	$920,000	1/07/2014	$24,211	Flat to easy rolling dairy with some cropping
10.8	$520,000	1/07/2014	$48,148	Flat dairy or cropping
83	$1,485,000	1/07/2014	$17,892	Flat to easy rolling dairy with some cropping
900	**$7,135,000**		**$7,929.54**	

Farm C - *Estimate of current market value

Ha	Est MV	$/Ha	Contour & best and highest land use
278	$2,780,000	$10,000	Flat to rolling hill country - sheep & beef (Some cropping)
490	$2,695,000	$5,500	Medium to steep hill country sheep & beef
38	$988,000	$26,000	Paid $25k/Ha in 2007 -Flat to easy rolling dairy with some cropping
10.8	$280,800	$26,000	Paid $25k/Ha in 2007 - Flat dairy or cropping - Life style appeal
83	$2,158,000	$26,000	Paid $25k/Ha in 2007- Flat to easy rolling dairy with some cropping
900	**$8,901,800**	**$9,893.09**	

*Using recent sales analysis , evidence of sales in the area and discussions with real estate agents

Using the Taupo example where sheep & beef farms with a low NRP are discounted in the current market
Assumed farming the entire unit as a sheep & beef breeding & finishing farm
Farm C's current stocking rate is very low and resulting NRP is very low at 7kg/N/Ha
Develop hill country > lift stocking rate >realise sustainable potential
Need a NRP of 18kg/N/Ha to farm new policy
18 - 7 = 11, 11x$400 = $4400
$9893/Ha -$4400 = $5493/Ha
Using the Taupo catchment example it could devalue by $4400/ha or $3,960,000 or 44%

Calculating the drop in value by looking at the restrictions on land use change and ignoring the low NRP issue
Farm C - *Estimate of current market value under land use change restrictions

Ha	Est MV	$/Ha	Contour & Best and highest land use
278	$2,780,000	$10,000	Flat to rolling hill country - sheep & beef (Some cropping)
490	$2,695,000	$5,500	Medium to steep hill country sheep & beef
38	$456,000	$12,000	Paid $25k/Ha in 2007 -Flat to easy rolling Dairy with some cropping
10.8	$129,600	$12,000	Paid $25k/Ha in 2007 - Flat dairy or cropping - Life style appeal
83	$996,000	$12,000	Paid $25k/Ha in 2007- Flat to easy rolling dairy with some cropping
900	**$7,056,600**	**$7,842**	
	$1,845,200	**$2,050.68**	**Drop** 21%

Take speculative nature out of market and value it purely on a SU basis

	Total SU	Value per SU	Farm Value
Currently running	4150	$950	$3,942,500
Potential to Run	9000	$950	$8,550,000
Difference			**$4,607,500**

FARM D

Upfront Capital Costs to Comply with the PC1

Farm environmental plan			
*Average cost of preparing a Farm Environment Plan (AgFirst Estimate) excluding the NRP assuming the farm doesn't have an electronic map map			**$3,980**
Recent soil tests to set up Overseer file			
	Tests	**$/Test**	
	0	200	**$0**
Initial nutrient budget 2015 & 2016 Yr to set NRP			
	Hrs	**$/Hr**	
Farm visit	5	150	$750
Travel 100Km @ 80c km			$80
Set up Overseer files 2 years	13	150	$1,950
Further correspondence with accountant & farmer	1	150	$150
Note: Ballacne environmental team Est range $800-2880 for 2 files they have indicated $3000			**$2,930**
Stock Exclusion as per schedule C			
Fencing water bodies from which cattle, horses, deer and pigs must be excluded			**$95,554**
Mitigation measures as per schedule 1			
		Poles/Yr.	
Erosion Control -Poles planted to control erosion and ^CSPs		50	**$1,370**
Water Reticulation - Hill block mitigation (Perennial streams that are above 25 degrees and impracticable to fence)			**$80,110**
Riparian planting per year			**$2,500**
Livestock crossing structures - Install Culverts	2	$869	**$1,737.60**
Total Costs			**$188,181**

*Average time taken by Agfirst to complete a FEP for S&B farms was 21.75 excluding the NRP

^ CSPs = Critical Source Points are areas from which sediment, nitrogen, phosphorus and microbial pathogens are lost.

Nexus Culvert 400mm x 6m $359

Culvert ends = 8m railing 150mmX 32mm $2.50/m = $20. 4X No1 1/4 Round Post 7.45 each = $29.8

Digger 4 culverts a day = $1360/Day = $340/Culvert. Fencer 3 Hours per culvert x $40/Hr = $120

Ongoing Annual Costs to Comply with the PC1

Yearly Overseer updates to test policy change on NRP and compliance with the maximum NRP

	Hrs.	$/Hr.	
Farm visit	3.5	150	$525
Travel			$80
Set up overseer file	1.5	150	$225
Further correspondence with accountant & farmer	0.5	150	$75
			$905

Ongoing mitigation measures as per schedule 1

	Poles/Yr.	
Erosion Control -Poles planted to control erosion and CSPs	50	**$1,370**
Riparian planting & maintenance per year		**$2,500**

Water Reticulation - Ongoing annual costs

*Additional **R&M & Labor** with new system $20/Trough		$720
Annual **Depreciation** 40 Yr. Lifespan		$2,003
Interest @ 7%		$5,608
	Total Costs	**$8,330**

* Fixing water leaks, replacing trough fittings, maintenance of pumps, maintenance of trough surrounds with metal etc.

Fencing - Stock Exclusion - Ongoing annual costs

*Additional **R&M Labor Required** ^1% Capital Value		$956
Annual **Depreciation** 20 Yr. Lifespan		$4,778
Interest @ 7%		$6,689
	Total Costs	**$12,422**

*More fences to look after, more flood damage, erosion damage, stock pushing 1 wires, Keeping electrics going, finding faults, spraying lines to keep power up.
^Lincoln financial budget manual 12-13

Maintenance of livestock crossing structures

Maintenance of culverts - Repairing eroded surrounds, clearing flood debris, * 3% Capita		$52
* Lincoln financial budget manual 12-13		
Interest @ 7%		$122
	Total Costs	**$174**

Additional Administration

Monitoring, record keeping, reporting and gathering information to demonstrate and/or monitor compliance with the Farm Environment Plan and NRP

Hrs	$/Hr	
24	$30	**$720**

Total Annual Costs			**$26,421**
Effective Ha	**550**	**$/Ha**	**$48**
% increase in farm working costs/Ha (Based on farm Ds actual costs)			**8%**

Main System Details		
Hill Block - Actual 174 ha (100 -120 Eff)		
Tank @ 104m Alt		
Source dam and Diesel pump @ 74m		
75m main line pump to tank		
Details & Costs		
System Design	$2,500	
30,000 L tank (Range $3500 - 3900)	$3,500	
Excavation of site, level, base	$1,200	
Deliver Tank to Site -(Truck)	$250	
Dam excavation - 3 days @ $1,120/day	$3,360	
Pump diesel ($3500-5000)	$4,000	
Startomatic for pump	$800	
Tank Level Meter	$500	
Pump Shed - Concrete Base	$2,500	
	$18,610	
Costs for Main System & Troughs		
Ha	110	
Ha/Trough	5	
Total Troughs	22	
System Formula $2000/Trough	**$44,000**	
		$/Ha
Total Costs	**$62,610**	**$569**
Additional troughs on reticulated country		
$1,250 including 100m pipe x 14	$17,500	
Final Costs	**$80,110**	

Fencing - Stock exclusion as per schedule C

Description	Fence Type	Meters	$/m	Total	CommNet's
Stock Dams/Seeps/ Springs	4 Wire electric, posts at 5m spacing's -	906	$10.33	$9,359	Sheep proof to safe guard plantings
Perennial Streams < 25 deg	4 Wire electric, posts at 5m spacing's -	1033	$10.33	$10,671	Swampy Native Bush area and stream that runs from the waterfall. Sheep proof to let native regenerate
Perennial Streams < 25 deg	2 Wire Elec No1 Round Post @ 5m Spacing	13807	$5.47	$75,524	Home breed calves quiet and Frs bulls hand reared
Total Fencing Costs				**$95,554**	

Notes: No allowance has been made for new energiser units and under ground cabling or Gates

Calculations of the opportunity cost or "Frozen Income"

	Farm D		B+LNZ 2015 Class 5	High Performing Farm Same Class Country
	2015	2016	2015	2015
			Mean	
Effective Ha	**550**	**550**	**236**	**456**
Total SU	5998	5884	2591	9017
SU/Ha	10.9	10.7	11.0	19.8
Sheep:Cattle SU Ratio %	54%	51%	23%	100%
Gross Farm Revue	**$711,906**	**$650,626**	**$448,294**	**$1,570,556**
Gross Farm Revenue/Ha	$1,294	$1,183	$1,898	$3,444
Total Farm Working Expenses	**$367,654**	**$290,881**	**$240,720**	**$720,334**
Total Farm Working Expenses/Ha	$668	$529	$1,020	$1,580
Farm Working Expenses % GFR	52%	45%	54%	46%
EBITR TOTAL	**$319,252**	**$334,745**	**$186,262**	**$829,022**
EBITR/Ha	**$580**	**$609**	**$789**	**$1,818**
Applied Fert N kg/ha	4.36	9.42	14.00	90.8
Applied Fert P kg/ha	22.57	9.38	22.00	48.9

Opportunity Costs or "Frozen Income"

Frozen Income

Lift to B+LNZ mean of class 5 doing $789 EBITR/Ha
Lost annual income potential of $106,700 (EBITR)
Higher SR + 0.2 SU/Ha
Higher Cattle Ratio
Nitrogen application 14 Kg/N/Ha/Yr
Nitrogen leaching moves from 15Kg/N/Ha/Yr to 18.
Under the new policy farm D would exceed its nitrogen reference point.

Replicate local high performing farm on same class of country
Lost annual income potential of $672,667 (EBITR)
Higher SR + 8.9 SU/Ha
More N applications
All Cattle
Under the new policy farm D would exceed its nitrogen reference point

Lease 80Ha for Maize @ $1000/Ha
Lost annual income potential of $27,700 (EBITR)
More N inputs per Ha on the 80Ha than SQ
More N leaching on the 80Ha
Farm N Leaching moves from 15kg N to 18Kg of N.
Under the new policy farm D would exceed its nitrogen reference point.

FARM E

Upfront Capital Costs to Comply with the PC1

Farm environmental plan			
*Average cost of preparing a Farm Environment Plan (AgFirst Estimate) excluding the NRP assuming the farm doesn't have an electronic map map			**$3,980**
Recent soil tests to set up Overseer file			
	Tests	**$/Test**	
	0	200	**$0**
Initial nutrient budget 2015 & 2016 Yr to set NRP			
	Hrs	**$/Hr**	
Farm visit	5	150	$750
Travel 100Km @ 80c km			$80
Set up Overseer files 2 years	13	150	$1,950
Further correspondence with accountant & farmer	1	150	$150
Note: Ballacne environmental team Est range $800-2880 for 2 files they have indicated $3000			**$2,930**
Stock Exclusion as per schedule C			
Fencing water bodies from which cattle, horses, deer and pigs must be excluded			**$16,907**
Mitigation measures as per schedule 1			
		Poles/Yr.	
Erosion Control -Poles planted to control erosion and ^CSPs		30	**$822**
Water Reticulation - Hill block mitigation (Perennial streams that are above 25 degrees and impracticable to fence)			**$0**
Riparian planting per year			**$1,500**
Livestock crossing structures - Install Culverts	0	$869	**$0**
Total Costs			**$26,139**

*Average time taken by Agfirst to complete a FEP for S&B farms was 21.75 excluding the NRP

^ CSPs = Critical Source Points are areas from which sediment, nitrogen, phosphorus and microbial pathogens are lost.

Nexus Culvert 400mm x 6m $359

Culvert ends = 8m railing 150mmX 32mm $2.50/m = $20. 4X No1 1/4 Round Post 7.45 each = $29.8

Digger 4 culverts a day = $1360/Day = $340/Culvert. Fencer 3 Hours per culvert x $40/Hr = $120

Ongoing Annual Costs to Comply with the PC1

Yearly Overseer updates to test policy change on NRP and compliance with the maximum NRP			
	Hrs.	**$/Hr.**	
Farm visit	3.5	150	$525
Travel			$80
Set up overseer file	1.5	150	$225
Further correspondence with accountant & farmer	0.5	150	$75
			$905
Ongoing mitigation measures as per schedule 1			
		Poles/Yr.	
Erosion Control -Poles planted to control erosion and CSPs		30	**$822**
Riparian planting & maintenance per year			**$1,500**
Water Reticulation - Ongoing annual costs			
*Additional **R&M & Labor** with new system $20/Trough			$0
Annual **Depreciation** 40 Yr. Lifespan			$0
Interest @ 7%			$0
		Total Costs	**$0**
* Fixing water leaks, replacing trough fittings, maintenance of pumps, maintenance of trough surrounds with metal etc.			
Fencing - Stock Exclusion - Ongoing annual costs			
*Additional **R&M Labor Required** ^1% Capital Value			$169
Annual **Depreciation** 20 Yr. Lifespan			$845
Interest @ 7%			$1,183
		Total Costs	**$2,198**
*More fences to look after, more flood damage, erosion damage, stock pushing 1 wires, Keeping electrics going, finding faults, spraying lines to keep power up. ^Lincoln financial budget manual 12-13			
Maintenance of livestock crossing structures			
Maintenance of culverts - Repairing eroded surrounds, clearing flood debris, * 3% Capita			$0
* Lincoln financial budget manual 12-13			
Interest @ 7%			$0
		Total Costs	**$0**
Additional Administration			
Monitoring, record keeping, reporting and gathering information to demonstrate and/or monitor compliance with the Farm Environment Plan and NRP			
	Hrs	**$/Hr**	
	16	$30	**$480**
		Total Annual Costs	**$5,905**
		Effective Ha 89 **$/Ha**	**$66.34**
% increase in farm working costs/Ha (Based B+LNZ Class 5 Mean 2015)			**6%**

Fencing - Stock exclusion as per schedule C

Description	Fence Type	Meters	$/m	Total	Commnets
Stock Dams/Seeps/ Springs		0	$0.00	$0	
Perennial Streams < 25 deg	3 Wire Elec No1 Round Post @ 5m Spacing	2832	$5.97	$16,907	Some fenced on one side. Stock Policy SI freshly weaned beef weaners used 3 wire.
Total Fencing Costs				**$16,907**	

Notes: No allowance has been made for new energiser units and under ground cabling or Gates which would ad additional costs to the fencing

4. DETAILED OVERSEER RESULTS

Farm A

Stefan Bryant
BakerAg

Client reference:

Farm name:

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
Nutrients added							
Fertiliser, lime & other	0	22	0	26	55	0	0
Rain/clover N fixation	72	0	3	6	4	9	49
Irrigation	0	0	0	0	0	0	0
Supplements imported	0	0	0	0	0	0	0
Nutrients removed							
As products	19	4	1	2	8	0	1
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	21	0	0	0	0	0	0
To water	12	2	12	40	17	6	24
Change in internal pools							
Plant material	0	0	0	0	0	0	0
Organic pool	21	9	0	-10	0	0	0
Inorganic mineral	0	2	-22	0	-4	-6	-7
Inorganic soil pool	0	6	12	0	38	9	31

Farm B

Version 6.2.3, on 2016-12-02 02:21:23

Stefan Bryant
BakerAg

Client reference:

Farm name:

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
Nutrients added							
Fertiliser, lime & other	0	25	0	43	56	0	0
Rain/clover N fixation	95	0	3	6	4	9	44
Irrigation	0	0	0	0	0	0	0
Supplements imported	0	0	0	0	0	0	0
Nutrients removed							
As products	41	10	3	5	20	0	1
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	27	0	0	0	0	0	0
To water	14	2.6	11	48	29	4	18
Change in internal pools							
Plant material	0	0	0	0	0	0	0
Organic pool	14	11	0	-4	0	0	0
Inorganic mineral	0	1	-24	0	-6	-9	-11
Inorganic soil pool	0	1	13	0	17	13	36

Farm C

Version 6.2.3, on 2016-12-06 05:07:57

Stefan Bryant
BakerAg

Client reference:

Farm name:

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
				(kg/ha/yr)			
Nutrients added							
Fertiliser, lime & other	2	9	9	21	21	0	0
Rain/clover N fixation	43	0	2	4	2	5	18
Irrigation	0	0	0	0	0	0	0
Supplements imported	0	0	0	0	0	0	0
Nutrients removed							
As products	12	3	1	1	6	0	0
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	22	0	0	0	0	0	0
To water	7	1.9	9	33	9	3	11
Change in internal pools							
Plant material	0	0	0	0	0	0	0
Organic pool	4	6	0	-9	0	0	0
Inorganic mineral	0	0	-16	0	-4	-6	-7
Inorganic soil pool	0	-1	18	0	12	8	13

Farm D

Version 6.2.3, on 2016-12-02 02:20:09

Stefan Bryant
BakerAg

Client reference:

Farm name:

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
Nutrients added							
Fertiliser, lime & other	5	21	6	32	64	0	0
Rain/clover N fixation	76	0	3	6	4	8	41
Irrigation	0	0	0	0	0	0	0
Supplements imported	0	0	0	0	0	0	0
Nutrients removed							
As products	18	3	1	2	6	0	1
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	28	0	0	0	0	0	0
To water	15	0.7	10	43	42	18	42
Change in internal pools							
Plant material	0	0	0	0	0	0	0
Organic pool	21	10	0	-8	0	0	0
Inorganic mineral	0	8	-12	0	-1	-1	-4
Inorganic soil pool	0	0	9	0	21	-8	3

Farm E

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FARM E

Stefan Bryar
BakerAg

Client ref[illegible]

Farm name: FARM E NRP 15-16 (2016)

Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
				(kg/ha/yr)			
Nutrients added							
Fertiliser, lime & other	32	19	30	49	48	0	0
Rain/clover N fixation	122	0	3	5	4	8	38
Irrigation	0	0	0	0	0	0	0
Supplements imported	0	0	0	0	0	0	0
Nutrients removed							
As products	46	11	3	5	23	1	1
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	61	0	0	0	0	0	0
To water	17	1.7	17	56	59	20	40
Change in internal pools							
Plant material	0	0	0	0	0	0	0
Organic pool	29	16	0	-8	0	0	0
Inorganic mineral	0	7	-14	0	-2	-3	-5
Inorganic soil pool	0	-16	27	0	-28	-10	2

5. QUOTES

[redacted]
Waipuna Road
Waerenga

Estimate to Supply & Construct Rural Stock and Vehicle Crossing.

Estimate is based on dimensions and approaches of existing stock crossing at [redacted] stock yards, Waipuna Road, Waerenga. Costing has been calculated prior to any input from engineers. And is irrespective of district/regional council or environmental authorities, or the like.

Materials, Plant Hire & Labour

Reinforced concrete crossing and approach aprons, incorporating 4 rows of concrete culvert pipes. Option 1; @ 450mm dia	$20600.00+gst
Option 2; @ 600mm dia	$22500.00+gst

N.B. no allowance has been made to supply off site quarried base course/aggregates

Terms
Goods remain property of contractor until paid for in full.
Payment required 20th of following month of invoice issue.

[redacted]

August 23rd 2016

[redacted]

SUBJECT: WAIPUNA VALLEY STREAM FENCING - WATER WAYS.

(1) **3 Electric Wire Fencing. (Beef Only)**

To Supply and Construct approx 14,500 lineal mtrs of 3 Wire Electric Fencing plus Electric Bungy Gates.

ESTIMATE PRICING INCLUDES
Materials – Labour – Plant Hire – Travel –Cartage - Health & Safety

104 x 2.4 No 1 Gate Strainers		$ 3,882.40
550 x 2.4 No 2 Angles		$ 17,199.40
4000 x 1.8 No 1 Rnd Posts @ 3 m Spacings		$ 52,900.00
865 x 1.8 Galvanized Steel Y Posts @ 3 m Spacings		$ 11,240.10
43,500 mtrs of 2.5 H.T Wires x 3		$ 6,003.00
124 x Gate Electric Bungy (2 per Gateway)		$ 2,931.35
2595 x Y Post Insulators		$ 1,581.25
12,000 x Wooden Post Insulators		$ 4,554.00
230 kg Post Staples		$ 1,666.35
2000 x End Insulators		$ 3,492.15
Excavator Hireage (approx 15 hrs)		$ 1,650.00
Lay Materials on Line		$ 28,840.00
Labour – Plant Hire Construct Fence (Includes Hand Digging)		$105,120.00
Tractor – Rammer Hireage		$ 17,000.00
Cartage – Travel		$ 4,100.00
Approx 14,500 l/m @ $18.08 per mtr	Total	$262,160.00

6. REFERENCES

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