Before Hearing Commissioners at Palmerston North

under: the Resource Management Act 1991

in the matter of: Submissions on Chapters 6, 13 and 15 of the Proposed One Plan

between: **Fonterra Co-operative Group Limited**
Submitter

and: **Manawatu-Wanganui Regional Council**
Respondent

Statement of evidence of Duncan Colquhoun Smeaton for Fonterra Co-operative Group Limited

Dated: 30 October 2009

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STATEMENT OF EVIDENCE OF DUNCAN COLQUHOUN SMEATON

QUALIFICATIONS AND EXPERIENCE

1 My full name is Duncan Colquhoun Smeaton.

2 I am an independent agricultural consultant and dairy farmer in a partnership business with my wife. A significant part of my consultancy business involves working as a scientist contractor to AgResearch and DairyNZ. I have a Bachelor of Agricultural Science and a Master of Agricultural Science (Hons I) degree from Massey University. I graduated with my Masters degree in 1975.

3 After graduating from Massey, I was employed by AgResearch in its previous form as a scientific liaison officer writing "scientist-to-consultant" type information and other related technical writing work. After 4 years, I took a position as scientist in sheep and beef nutrition and grazing management at Whatawhata Research Station for 8 years.

4 In 1985, I went dairy farming in the Bay of Plenty. My wife and I now own a 185 cow dairy farm in Waihi and have a 40% shareholding in a 950 cow dairy farm in Canterbury.

5 In 1992, I returned to science research and consultancy work on a part time basis. My science work centred initially on beef cattle farming systems using novel reproductive techniques. In the last 8 years, I have primarily carried out farm systems research in both sheep/beef and dairy farming. Much of this work has involved a mixture of field and modelling work, mostly involving case study farms. Over half of this work in the last 8 years has been about investigating farm systems that are both profitable and yet also control or manage environmental issues, primarily excessive nitrate leaching. In summary, much of my contract consultancy work is involved in seeking ways of improving farm profitability, compatible with containing or reducing environmental degradation. Much of my work has been involved with farm case studies in the Taupo and Rotorua districts.

6 I have authored more than 30 refereed papers, written one book on beef production and co-authored another. I have written other technical reports, delivered presentations to numerous farmer and other groups, and organised field days.

7 In August, 2007 I completed a detailed report on the dairy farms and a small sample of the sheep and beef farms in the Lake Rotorua catchment. I was part of a team which investigated 26 dairy farms and 3 sheep and beef farms as case studies. This project modelled the farms at a production and financial level using UDDER and

determined their Nitrogen (N) leaching rates using OVERSEER®. A range of N leaching mitigation strategies were also tested, for impacts on farm productivity and profitability. My evidence uses experiences gained from the Rotorua work.[1]

8 I am a competent user of the farm production models Farmax® (sheep & beef, and more recently dairy), UDDER, and the nutrient budgeting model OVERSEER[2]. I have begun using OVERSEER regularly in my project work only in the last 6 months. Prior to that, I have used an accredited user to do this part of my modelling work.

9 As a small part of my consultancy work, I carry out farm detail LUC assessments for clients within the Hauraki District Council and have been doing so for the last 10 years

10 I have read the Environment Court's Code of Conduct for Expert Witnesses, and I agree to comply with it. My qualifications as an expert are set out above. I confirm that the issues addressed in this brief of evidence are within my area of expertise, except where I state I am relying on what I have been told by another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

11 I am familiar with the (*POP*) to which these proceedings relate.

SCOPE OF EVIDENCE

12 My evidence will deal with the following:

12.1 A description of the existing N-loss from farms in the Region;

12.2 Available technologies for mitigating N-loss, and limitations of those technologies;

12.3 Case studies used to investigate mitigation of N-loss;

12.4 Applicability of these case studies to the Horizons Region; and

12.5 Comments on the POP approach to limiting N-loss.

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1 Please note that I am bound by confidentiality agreements, which restrict my ability to discuss individual farms in the public arena.

2 UDDER and FarmaxDairy® are both computerised versions of dairy farms. They incorporate feed flows in and out of the dairy farm, animal intake and milk production, liveweight change, sales and purchases, calving and drying off, cropping, supplements bought and sold, nitrogen fertilser used and also include a financial component including farm working expenses and product sales such as milk. Both models contain underlying pasture growth and decay and animal feed intake functions and have also both been tested against real farm data obtained from research farms.

SUMMARY OF EVIDENCE

13 The limited available information on N-loss in the Region indicates the average dairy farm has N-loss of 26 or 27 kg N/ha/year, with two-thirds of dairy farms having N-loss of between approximately 20 and 34 kg N/ha/year.

14 A range of strategies are available to reduce N leaching from both dairy and sheep and beef farms. The impacts on both N leaching and profit (as modelled using farm and nutrient simulation models) can be quite variable, depending on an individual farm's starting position and how any particular option is implemented. There is variation in start-up capital, and managerial skill requirements and in the risk associated with the strategies The impacts of the strategies are not necessarily additive.

15 The profitability and feasibility of some options rely on factors beyond the farmer's control, e.g. availability and price of wintering land or sawdust for feedpads. The profitability of the options can vary depending on milk payout versus farm working expenses.

16 The case study analyses of farms in the Rotorua catchment demonstrated that every farm is different in terms of how it responds to N leaching mitigation options. I concur with the evidence of Dr Monaghan (para 14) for the Manawatu-Wanganui Regional Council (*Horizons*) that there is no "one size fits all" approach to mitigating N losses from farms.

17 The results of the Rotorua catchment case studies showed that the following can reduce N leaching by 5 to 25% and have a minor negative to slightly positive effect on profit:

- Conversion to land based application of effluent;
- No N fertiliser applied in the winter;
- Quitting the use of crops;
- Use of self-feed wintering pads but not herd homes;
- Use of DCD;
- Reduction in use of N fertiliser, if present use is excessive;
- Switching to more efficient cows (not well modelled as yet); and
- Reducing stocking rate and producing more per cow, if currently highly stocked.

18 Modelling showed that the following options can reduce N leaching and be quite profitable:

- Wintering off (N-loss reduction of 20 to 40%); and
- Switching to organic farming (N-loss reduction of 40%).[3]

19 The following are good at reducing N leaching, but as they are unprofitable, most farmers would not want to adopt them:

- Wintering cows in herd homes (capital costs are high);
- Quitting the use of fertiliser N altogether; and
- Conversion to an alternative land use such as forestry.

20 The Lake Rotorua catchment case studies demonstrated that it would be possible to reduce N leaching on a catchment-wide basis by 7kg N/effective ha/year (12%) without negatively affecting profit. However, in the longer term (5 years plus), the effects on profit are unknown. Greater reductions in N leaching/ha/year were considered possible, but the practices required to achieve these were expected to reduce farm profit and it is therefore unlikely that these options would be willingly adopted by the farmers. New, as yet undiscovered solutions would be required to achieve these reductions without loss of profit.

21 The modelled case study results would likely show some variation in the real world due to climate and soil variation between farms, and variation between farms in the cost of changing systems and managerial ability to operate the new system. In the Rotorua catchment case studies, opportunities to reduce N leaching on each farm were quite variable: some farms were able to nearly halve their N leaching without loss of profit, whereas others (already running "N efficient" systems) had few to no further options available to them that did not reduce profit.

22 In my view the results from the Rotorua catchment case studies can be applied to the Manawatu-Wanganui Region because:

22.1 The N leaching issues or problems are the same; and

22.2 The effects of changes in farm management system on productivity and profitability will be the same.

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[3] Note, I have concerns about the safety or reliability of this result because of questions about the level of production and profitability that can be achieved in practice versus what appears to be possible from simulation models.

23 The main difference is due to soil type and rainfall, such that for example, the average N leaching of the Rotorua dairy farms was about 56 kg N/ha/year in the year of measurement versus an estimate of 26 to 27 kg N/ha/year in the Horizons Region.

24 My knowledge of N-loss mitigation strategies already used by farmers in the Water Management Zones targeted by the POP, or the Region generally is limited. I am disappointed that none of the case study results presented by Horizons' witnesses appear to have included farm systems modelling work which would have provided a deeper understanding of the impacts of the suggested mitigation options suggested. This particularly applies to the evidence of Mr Jeremy Neild and Mr Anthony Rhodes. Farm systems modelling would have provided a safer result in terms of describing the effects of the N leaching limits on farm profitability and the wider impacts at a community level.

25 In my opinion, farmers that adopt systems which reduce N leaching, either voluntarily or to meet some capped level, may be shutting themselves out of productivity and profitability gains in the future, compared to other farmers in New Zealand or overseas who are not forced to choose N leaching reduction systems.

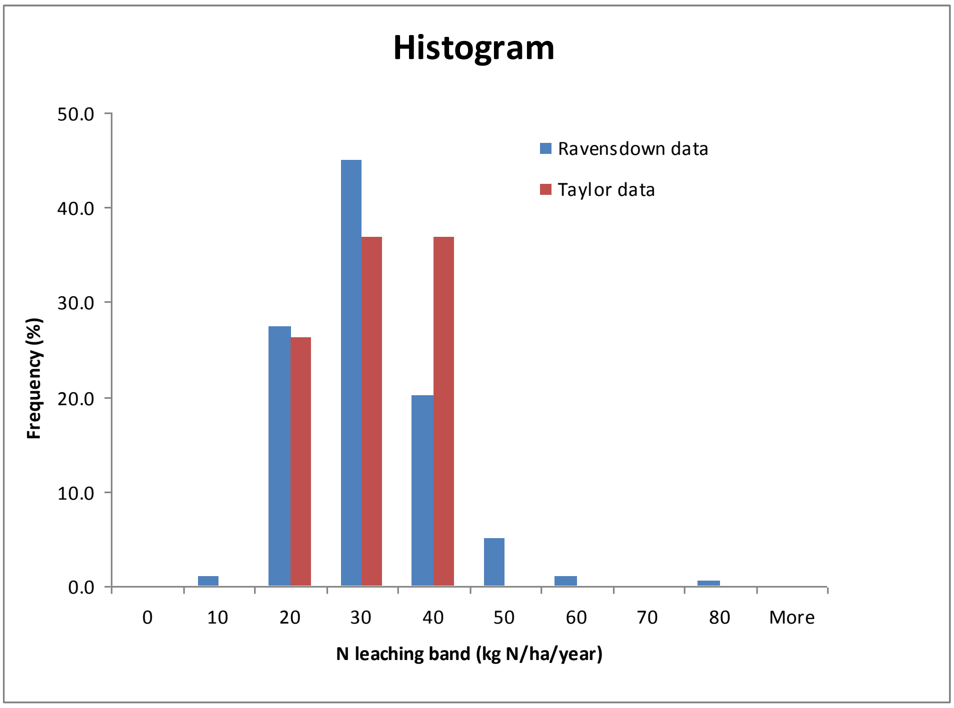
26 The LUC system of rating the productive capability of land is well established in New Zealand and is described objectively in the New Zealand Land Inventory Bulletin. I am not aware of it ever being used before to establish a base for allocating N leaching targets. The use of the system in this way has some merit but it also has some down sides. LUC classification is a skilled job and in my opinion is slightly subjective so that one LUC assessor will achieve a slightly different result from another at the detail level. In my view the N-loss limits in Table 13.2 for LUC classes III – VII should be increased to better reflect the natural capital approach which appears to underpin table 13.2.

EXISTING N-LOSS FROM FARMS IN THE REGION

27 The existing N-loss from dairy farms in the Horizons Region appears to be 26 to 27 kg N/ha/year. This is based on aggregated data provided by Ravensdown Fertilizer Company from the unaudited OVERSEER files of their dairy farmer clients. Limited OVERSEER information on the dairy farms in the sensitive water management zones of the Horizons Region was made available by Ravensdown Fertiliser Company. The data showed that the average N-loss figures for 204 dairy farmer clients in the Region who had up to date OVERSEER nutrient budget models was 26 kg N/ha/year, with a standard deviation (*SD*) of 7. A SD describes the variability of a population – two thirds of a population are distributed within one SD either side of the mean value. Given the number of farms in the Ravensdown data group, it could be expected that they are

representative of the whole population of dairy farms in the Region. The above result agrees closely with the average of the 21 farms described in the evidence of Mr Taylor (paragraph 90) for Horizons. The mean and variation of results are presented in **Figure 1**.

Figure 1: Frequency distribution of farms within N leaching bands (10 kg N/ha/year wide). The Ravensdown data contain 204 un-audited OVERSEER files and the Taylor data contain 21 case study files. The histogram values on the x axis are the maximum for the group e.g. the middle column for the Taylor data represent values lying between 20-30.



AVAILABLE TECHNOLOGIES FOR MITIGATING N-LOSS, AND LIMITATIONS OF THOSE TECHNOLOGIES

28 **Table 1** summarises the mitigation strategies currently available to reduce N leaching from both dairy and sheep and beef farms. It includes the common mitigation options listed in the evidence of Mr Peter Taylor for the Council, the evidence of Dr Andrew Manderson[4] and the report of Yates *et al*. (2008).

29 The table shows that there are a wide range of options for reducing N leaching on dairy farms in particular. However, their impacts on both N leaching and profit can be quite variable. An individual farm's starting position, and how any particular option is implemented, will impact on the effectiveness of the option and its impact on farm profit. For example, wintering cows off the farm

4 Table 12 and Appendix 2 respectively

over the winter always reduces N leaching on that farm and is usually profitable. But, it can also be unprofitable if management changes are not made to accommodate the system change. This example is also complicated by the fact that N leaching due to the wintering cows is exported to the farm where the cows are grazed.

30 The following factors are relevant to consideration of **Table 1**[5]:

30.1 Some of the options shown may already have been adopted on a particular farm. In this case, the impact of that option should already be incorporated in Overseer's N leaching estimate for that farm;

30.2 Some options will not be technically feasible on some farms or the personnel involved may not be competent to successfully implement the option;

30.3 The options are not necessarily additive;

30.4 The profitability and feasibility of some options rely on factors beyond the farmer's control (e.g. availability and price of wintering land or sawdust for feedpads);

30.5 Some options will require substantial financial commitment (e.g. capital costs for feed pads or herd homes, changes to calving date, organic farming) to enable them to be adopted. This makes these options expensive to "un-adopt" if circumstances change;

30.6 Some unprofitable options (e.g. wetlands) may be adopted for non-profit reasons;

30.7 The profitability of the options can vary depending on the relationship between payout and farm working expenses. For example, at high payouts relative to costs, use of DCD, or purchased supplements is profitable (this drives a trend to high input farming). At low payouts relative to costs, low input farming is financially favoured, so that use of imported feed and DCD will probably be unprofitable. This is further complicated by uncertainty about the impacts of DCD on pasture growth rates;

30.8 The impacts on profit of changing to organic farming are inconclusive due to uncertainty around impacts on production.

31 Even if modelling suggests that profit will not be affected by a particular mitigation strategy, many farmers may be unwilling to

[5] Note: the comments in the right hand column of Table 1 were made in the context of the high rainfall and ash soils of the Rotorua catchment.

adopt a number of the above options because they appear to involve some 'regression' of their present farming systems. It will be difficult to convince farmers to make the changes if they see them as "going backwards".

Table 1: Options for reducing N leaching: a summary table showing expected responses. (Source: Ledgard et al., 2007)

Option	Likely % reduction in N leaching	Likely profitability of option	But…
1. Cows wintered off vs. grazed at 'home'	30 (20-40)	++	Dependent on availability & cost. System changes required. This option transfers N loss to other catchments.
2. Nitrification inhibitor (DCD)	10 - 25[1]	O	Unproven technology under high rainfall; more effective in South Island?
3. Reduce N fertiliser use & reduce production	15 (0-35)	–	If current N use is high (>200 kg N/ha) reduced N use may increase profit
4. Use winter feed- pad or stand-off pad	10 (5-20)	O?	Increased work, capital cost including infrastructure, availability, or price, of bark or sawdust could be a problem
5. FDE on larger area & less N fertiliser	5 (0-10)	+	Depends on current FDE area
6. Replace winter crop with grass -to-grass	5 (0-15)	O	Typically only a small area is cropped, profit depends on need for pasture renewal
7. Don't apply fertiliser N in winter	5 (0-10)	–	May need other management changes
8. Sell off silage in autumn & have a shorter lactation	5 (0-15)	– –	Unprofitable due to foregone milk production
9. Put in artificial wetland	Unknown[2]	– –	Highly farm specific (contour, soil)
10. Reduce use of brought-in feed	4 (0-7)	–	Depends on quality, use and price of brought-in feed
11. Change brought in feed to low protein source (e.g. maize silage)	2 (0-5)	–	Depends on current level of brought-in feed and feed costs
12. Reduce stocking rate & increase per-cow production	1 (-5 to 5)	– / +	Profitable only on very high stocked farms? Change could require increased management skill
13. Plant steep areas of farm in bush or forest	5 (0 to 10)	– / O	Effects will depend on contour of retired land and area retired
14. Reduce area planted in forage crops & change cultivation techniques	20 (5 to 30)	– / +	Impacts will vary depending on area presently in crops and their profitability

++	Profitable
+	Slightly profitable
O	Neutral
–	Slightly unprofitable
– –	Unprofitable

Some options require capital expenditure and/or significant farm system changes.

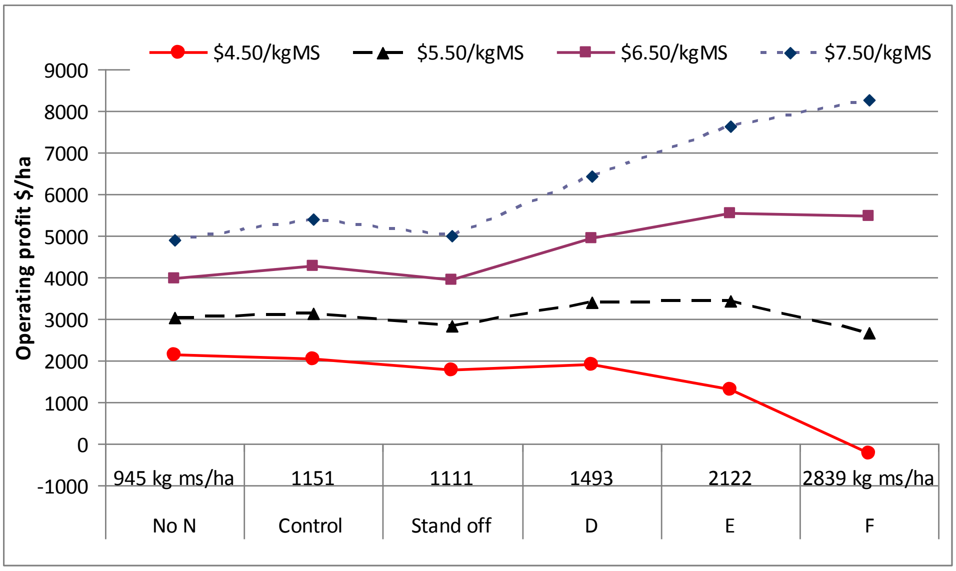
[1] DCD use has not been trialled in high rainfall catchments and there is still some uncertainty around responses to this new technology

[2] N reduction from this practice is extremely variable and highly farm specific.

32 Some of the above options involve increased management complexity. For example, running a lower stocking rate and higher production per cow requires a higher level of grazing management skill to ensure pasture quality is maintained. A failure here could result in a significant loss in production and profit.

33 A further example of management complexity is shown by the recently completed "RED" trial which ran for several years at Scott Farm, DairyNZ, Hamilton[6]. This demonstrated that N leaching increased with intensification via the use of more supplementary feed, but that profit did not necessarily rise. In fact, at lower payouts, profit fell with increased intensification (**Figure 2**). Even at the highest payouts, where profit increased with intensification, the risk to achieving this profit also increased. These results as reported probably underestimate this effect, because costs were not varied as payout changed. As was so clearly demonstrated in the last two years, when payout goes up, costs tend to rise also. When payout comes down, costs tend to fall, although not to levels previously prevailing.

Figure 2: Profitability ($/ha) of six farm systems at four payout levels investigated by the "RED" trial at Scott farm, DairyNZ. The farms represented below increased in intensity from left to right as shown by production (ms/ha) on the x axis.



34 Many of the mitigation options in **Table 1** would take months or years to implement, because they:

34.1 Require the farmer to upskill (e.g. increasing per cow production);

6 Dalley et al., 2008.

34.2 Have high capital costs or infrastructure requirements which take time to fund or construct (e.g. use of a winter feedpad);

34.3 Can only be implemented in particular seasons (e.g. wintering off cows); and/or

34.4 Require time for vegetation to establish (e.g. planting steep areas of land in bush).

35 Over time, farmers that adopt systems which reduce N leaching, either voluntarily or to meet some capped level, may be shutting themselves out of productivity gains in the future, compared to other farmers who are not forced to choose N leaching reduction systems. This could be important because in the past most farmers have used intensification and productivity gains to allow them to remain profitable in the face of declining terms of trade whereby product returns increase at a slower rate than costs (the cost - price squeeze). Dr Mackay made similar comments in his evidence for Horizons (paragraph 73). Accordingly, it cannot be assumed that merely because a farmer may be able to implement a mitigation strategy and remain profitable today that profitability will continue in the future relative to non N-limited farms.

CASE STUDIES USED TO INVESTIGATE MITIGATION OF N LEACHING

36 In 2006 I was part of a team which used case study analysis of farms in the Lake Rotorua catchment to investigate the farm by farm impacts of N leaching mitigation options. This project involved all 26 dairy farms in the catchment. The investigation process involved the following steps:

36.1 An initial farm visit to collect all physical data including fertiliser information;

36.2 Entering the data onto UDDER to create a base or bench mark year of production and profitability. This also established the pasture growth rate for the farm. Imported feed, use of N fertiliser and cropping programmes were included;

36.3 The farm data were also entered into OVERSEER by another member of the project team to establish N leaching levels;

36.4 Scenario testing was then carried out on UDDER and OVERSEER to determine the benefits of N-loss mitigation actions and their effects on productivity and profitability relative to the base scenario.

37 The work was funded by DEXCEL (now DairyNZ) and published in a report (Smeaton and Ledgard 2007).

38 Although there was farm to farm variation in the responses, the case study results broadly supported the information in **Table 1**. In summary, the case studies showed that the following mitigation methods reduced N leaching by 5 to 25% and had a minor negative to slightly beneficial effect on profit:

38.1 Conversion to land based application of effluent from a pond system;

38.2 No N fertiliser applied in the winter;

38.3 Quitting the use of crops;

38.4 Use of self-feed wintering pads but not herd homes;

38.5 Use of DCD. Note that DCD works best where the weather is cool and not too wet (eg. Southland), and will be least effective where it is warm and wet;

38.6 Reduction in use of N fertiliser (only if present use is in excess of about 180 kg N/ha);

38.7 Switching to more efficient cows (not well modelled as yet); and

38.8 Reducing stocking rate and producing more per cow. This requires greater management skill to maintain pasture quality on the farm.

39 The case studies demonstrated that the following options can also reduce N leaching and be quite profitable:

39.1 Wintering off (but it does export the N leaching problem which therefore does not reduce it at a regional or national level);

39.2 Switching to organic farming. Although this option looks promising, I remain concerned that this result is dependent on a range of factors not fully or accurately incorporated into the modelling calculations. Few, if any, examples exist where organic farms are performing at the level predicted by modelling. Further investigation of the performance of this system is required.

40 Finally, the case studies showed that the following are good for reducing N leaching, but would reduce profit by more than 10%, and so most farmers would not want to utilise them:

40.1 Wintering cows in herd homes (capital costs are high);

40.2 Quitting the use of fertiliser N altogether;

40.3 Conversion of the dairy farm to an alternative land use such as sheep & beef or forestry production.

41 These options would also likely reduce the capital value of the farms due to the decline in the earning levels of the farms.

42 It is also important to remember that the modelled case study results will show some variation in the real world due to:

42.1 Climate and soil variation between farms; and

42.2 Variation between farms in the capital or start-up costs of changing systems and managerial ability to operate the new system.

43 The case study analyses of 26 dairy farms in the Lake Rotorua catchment demonstrated that it would be possible to reduce N leaching on a catchment-wide basis by 7kg N/effective ha/year below the benchmark figure without negatively affecting profit, assuming:

43.1 A benchmark (or starting) leaching figure of 56kg N/ha/year;

43.2 Best practise options presently available would be applied;

43.3 All the farmers would be willing and able to adopt the optimum scenarios derived (for their farms)

43.4 This is a one off reduction which could not be repeated year on year.

44 Further significant reductions in N leaching/ha/year for the Rotorua farmers were considered possible, but the practices required to achieve these were forecast to reduce farm profit and it is therefore less likely that these options would be willingly adopted by the farmers.

45 Opportunities to reduce N leaching on each farm were quite variable: some farms were able to make quite big reductions in N leaching without loss of profit, whereas others (already running "N efficient" systems) had few to no further options available to them that did not reduce profit.

APPLICABILITY OF THE ABOVE CASE STUDIES TO THE HORIZONS - REGION

46 In an effort to understand what capacity farms in the Horizons Region have to reduce their N-loss, I have attempted to apply my

experience from the Rotorua catchment case studies to the knowledge of current N-loss in the Region.

47 There are a number of difficulties with this process, including:

47.1 Knowledge of current N-loss in the Region is limited;

47.2 There is little or no information available about which farms in the Region are already using which N-loss mitigation methods, and if so where[7]; and

47.3 It is unclear whether the N-loss mitigation achieved in the Rotorua case studies should be applied to the Horizons Region on a proportional or absolute basis.

48 Nevertheless, in my view the broad principles obtained from the Rotorua catchment case studies can be applied to dairy farms in the Manawatu-Wanganui Region. Application of these principles suggests it would be possible to achieve an average 10-15% reduction in N-loss from farms in the Region, over 10 years, without significant impact on profit However, the absolute impacts will not be known until farmers actually try the mitigation options or they are estimated from farm systems modelling using either UDDER or Farmax and OVERSEER. It is a great pity that this appears not to have been already done for the case study farms described in the evidence of Mr Taylor for Horizons and the report of Yates *et al*, (2008).

49 Given that the Rotorua farms (on their high rainfall, free draining soils) were starting from an N leaching base of 58 kg N/ha/year, compared to the Horizons farms of 26 to 27, the 7 kg N figure above might be expected to be less, say 4 to 5. Unfortunately, there is no information available to confirm this statement. Clearly, farm systems analyses of dairy farms in the Horizons area, combined with OVERSEER modelling is required to answer this question.

50 It is also not possible to say with precision by how much the Ravensdown sample of existing farms in the Region will have to reduce their N leaching to meet the POP Table 13.2 limits because there is no information available on the LUC classification details of their farms. The Taylor data, derived from his Table 7 show (**Table 2** below) for that sample, that on average, N leaching will have to reduce by 10 kg N/ha/year (estimate 37%) to be compliant with the limits set for year 20.

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7 I understand further research in this area is underway, and is hoped to be available in time for the presentation of evidence in February or March 2010.

Table 2: Determination of the change in N leaching required per dairy farm to be compliant by year 20 (derived from Taylor evidence, Table 7).

Farm	Present N leaching	Year 20 limit	Year 20 Total reduction
Barrow	25	18	-7
Glenbrook	26	16	-10
Day Dairy incl conv	30	12	-18
Tutu	17	20	3
Stoney Crk	31	15	-16
Jala	31	16	-15
Windwood	25	16	-9
Muskit	34	14	-20
Waka	35	19	-16
Janssen 380	28	15	-13
Janssen 500	40	15	-25
Johnston	25	14	-11
Bryeburn	37	22	-15
Hokio	26	20	-6
Whirokino	18	14	-4
Moutoa	32	21	-11
Martyn	16	21	5
Ivo	18	21	3
Koot	13	16	3
Averages	27	17	-10
Standard deviation	7	3	8
Count	21	21	21

51 Given the similarity of the two distribution histograms in **Figure 1** and the averages of the two data sets, it would seem that on average, the 204 Ravensdown dairy farmers are going to miss the Year 20 N leaching limit by 10 kg N/ha/year (37%) compared to present leaching levels. From Table 13.2 in the POP, most of the N leaching reduction has to occur within the first 5 to 10 years.

52 The modelling results described for the Lake Rotorua catchment strongly suggest that the reductions required above will not be achieved without loss of productivity and profitability to the dairy farms and, by extension, loss of income for the whole community. The Regional community therefore needs to decide:

52.1 Who pays for the reduction?

52.2 How much are they willing to pay?

52.3 How much change in water quality is desired and at what price?

53 I have not been able to find this information in the evidence provided by Horizons.

COMMENTS ON THE POP APPROACH

54 The POP approach of using LUC classification, described in the evidence of Ms Marr and Dr Mackay's natural capital approach seem sensible and I support them both. However, as described above, it is very difficult to ascertain the costs of setting N leaching limits on farm production and profit in the absence of adequate farm systems analyses.

55 The LUC system of rating the productive capability of land is well established in New Zealand and is described objectively in the New Zealand Land Inventory Bulletin. However, LUC classification is a skilled job and in my opinion is slightly subjective so that one LUC assessor will achieve a slightly different result from another at the detail level.

56 The Section 42A Report of Ms Marr states that "*the intent of the Year 1 leaching figures was to approximate current leaching. … The Year 1 nitrogen loss limits were selected by modelling average potential production scenarios on the different land use capability classes, and adjusting for likely attainment of that potential.*"[8] Table 3 of Ms Marr's evidence shows that the N-loss limits imposed by Table 13.2 are higher than those modelled by Overseer for LUC I, II and VIII, but lower than the Overseer modelled values for LUC classes III – VII. Ms Marr explains that these adjustments were made because of Horizons' view that higher LUC class land "*is generally more hilly, more difficult to develop and likely being used at a lower percentage of potential.*"[9]

57 In my view Ms Marr's description is fair for class VII land, but it is incorrect to describe all higher value LUC class land in the way Ms Marr has. In fact, LUC classification may be defined due to four sub-classes: erodibility, wetness, soil limitation (presence of rocks etc) and climate. In addition, the adjusted N-loss limits fail to recognise that in certain instances, farmers are able to overcome some of the limitations and difficulties of developing at least LUC class land III – VI and are using it above its potential. The LUC Handbook provides examples of where such improvement will even justify changing the LUC class for the land. One of these is where permanent drainage is installed on soil types that have inadequate 'drainability', thereby removing the wetness restriction on the LUC

[8] Page 26.

[9] Page 27.

classification that would otherwise be applied. The POP should be flexible enough to recognise the ability of some farmers to operate above the expected potential of their high LUC class land.

58 The low Table 13.2 values for LUC classes III – VII was recognised as being a potential problem in the Section 42A Report of Dr Mackay (para 54) who stated that *"If the goal is to sustain rural communities into the future, a case for allocating higher N loss limits to soils with little natural capital would be required. This would be designed to retain the limited land use options and flexibility available to landowners on these landscapes."*[10]

59 In my view the Year 1 N-loss limits for LUC classes III – VI should increase to the following values:

LUC class	Suggested value	Present value in Table 13.2
III	25	22
IV	19	16
V	17.8	13
VI	16	10

60 The above values are based on the Overseer modelled "potential production" values for the LUC classes (shown in Table 3 of Ms Marr's evidence), increased by 1.5 kg N/ha/year (consistent with Horizons' suggested increases for LUC classes I, II and VIII). I have not recommended increasing the value for LUC class VII because I consider the constrained productive potential of this land class would actually be very difficult to overcome.

61 In my view increasing these Year 1 values will not undermine the aim of Rule 13.1, because farmers on LUC class III – VII land will still need to decrease their N-loss over time. Additionally, all of the suggested values are still below the current existing average N-loss from dairy farms in the Region of 26 to 27 kg N/ha/year (**Figure 1**).

62 I agree that OVERSEER is appropriate for investigating N-loss issues of the type described in this evidence. It is the only suitable tool available in New Zealand that has been designed for our pastoral grazing systems and is well backed by science research. It has been adequately described in the evidence of Dr Ledgard for Horizons. However, I agree with the concerns raised in the evidence of Mr Sean Newland about whether OVERSEER would

[10] Page 14.

provide sufficiently robust "evidence" to support any prosecutions Horizons chooses to bring in the future.

COMMENTS ON RELEVANT COUNCIL OFFICER REPORTS

63 In the preparation of this evidence, I have read the officer reports and statements of evidence by: Helen Marr, Jeremy Nield and Anthony Rhodes, Brent Clothier, Alec Mackay, Andrew Manderson, Peter Taylor, Mark Shepherd, Roger Parfitt, Grant Douglas, David Houlbrooke, Ross Monaghan and Stewart Ledgard. Where necessary, I have referred to relevant Officer Reports in the main body of my evidence.

Duncan Smeaton
30 October 2009.

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