BEFORE THE ENVIRONMENT COURT
AT CHRISTCHURCH
I MUA I TE KOOTI TAIAO O AOTEAROA
KI OTAUTAHI

ENV-2018-CHC-34

IN THE MATTER OF	the Resource Management Act 1991
AND	
IN THE MATTER OF	appeals under clause 14 of the First Schedule to the Act
BETWEEN	**BEEF+LAMB NEW ZEALAND LIMITED**
	Appellant
AND	**SOUTHLAND REGIONAL COUNCIL**
	Respondent

EVIDENCE IN CHIEF OF THOMAS SPENCER ORCHISTON FOR BEEF+LAMB NEW ZEALAND LIMITED
20 December 2021

FLETCHER VAUTIER MOORE
LAWYERS
PO BOX 3029
RICHMOND 7050

Solicitor: CP Thomsen & CH Luisetti
Telephone: (03) 543 8301
Email: cthomsen@fvm.co.nz
cluisetti@fvm.co.nz

QUALIFICATIONS AND EXPERIENCE

1. My full name is Thomas Spencer Orchiston.

2. I am employed by Beef+Lamb New Zealand (**B+LNZ**) as an environment capability manager. This role aims to build the environmental capability of sheep and beef farmers to improve overall environmental outcomes on farms.

3. I hold a Bachelor of Science and a Postgraduate Diploma in Environmental Science from Otago University (2002).

4. I have a certificate in Sustainable Nutrient Management from Massey University (2010) and an AsureQuality Advanced Auditing Skills Certificate (2016).

5. My previous work experience includes 10 years for AgResearch Ltd as a Research Associate involved in soil, water and climate research based projects; four years with Crop and Food Research investigating sustainable and efficient landuse through crop diversification and; three years with Landcare Research measuring carbon sequestration and plant biodiversity in indigenous forests and shrublands.

6. I have been an auditor for a farm assurance programme that provided sustainable, high value meat from low chemical input New Zealand farms for export.

7. I have been a part of the New Zealand Institute of Primary Industry Management technical advisory group on farm planning certification.

8. I have been involved in development of B+LNZ refreshed farm plan documentation and training of facilitators to deliver the B+LNZ farm plans.

9. I have completed a Land Use Capability course held in Hawke's Bay.

10. I have been co-author in five peer-reviewed journal articles. I have been lead or co-author of eight conference papers or reports and at least 50 other forms of dissemination such as farmer presentations and media articles, principally as part of my employment duties.

11. I confirm this evidence has been prepared in accordance with the Code of Conduct for Expert Witnesses set out in the 2014 Environment Court Practice Note. I reconfirm and declare I am an employee of the appellant B+LNZ. I confirm that the opinions I express in this statement represent a summary of my true and complete professional opinions. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

SCOPE OF EVIDENCE

12. I have been asked by B+LNZ to prepare evidence on management of contaminants of concern from sheep in pastoral farming enterprises, particularly in respect of their exclusion from water ways by fences. I am advised this arises from an appeal on rule 70 Proposed Southland Water and Land Plan (**PSWLP**).

13. Key contaminants of concern from sheep grazing are sediment, phosphorus and faecal bacteria. These contaminants can be managed through farm plans that identify and manage areas of risk. Fencing will have little impact mitigating the key contaminants of concern, which are transported primarily via overland flow. The estimated cost of fencing to exclude sheep in rolling terrain is in the order of $25-30 per metre.

14. In preparing this evidence I confirm I have read:

    (a) Appendix N PSWLP, as proposed by the planning witness for the Respondent and as amended following expert conferencing.

    (b) Will say statements of:

        (i) R Corner-Thomas.

        (ii) D Stevens.

        (iii) C Duncan.

        (iv) D Dalley.

        (v) K McArthur.

(vi) J Kiston.

(vii) A Roberts.

(viii) R Monaghan.

(ix) T Snelder.

(c) Joint witness statement of land management / farm systems experts 22 November 2021.

(d) Brief of Evidence of R Corner-Thomas.

EXPERT WITNESS CONFERENCING

15. I participated in expert conferencing for land management / farm systems experts on 22 November 2021. I prepared a will say statement in advance of conferencing that addressed the matters of interest to B+LNZ that were within my expertise.

16. At conferencing the participants were asked to consider sixteen questions that had been posed by the planning witnesses for the various parties to the appeals. The two relevant questions for me were questions 15 and 16.

17. At the conclusion of conferencing a joint witness statement dated 22 November 2021 was prepared and signed by all attending experts (**JWS**). The agreed conclusions on questions 15 and 16 are recorded in that joint witness statement, which I attach as TSO-1.

18. I confirm the conclusions as set out in the JWS remain my expert opinion.

CONFIRMATION OF REASONING IN JWS – SHEEP & CONTAMINANTS

19. To assist the Court, I have been asked to set out the reasons for my views as set out in the JWS and associated conclusions as to the management of sheep and their contaminants of concern. These reasons are those set out in my will say statement dated 1 November 2021.

20. Key contaminants of concerns for sheep farms in relation to stock proximity to water ways, are those that are lost in overland flow (primarily sediment, phosphorus and faecal bacteria).

21. The risk of sediment and phosphorus loss may be increased by animal grazing pressure, especially where this is accompanied by a significant loss of vegetative ground cover, leading to soil loss or damage. The impact of livestock on soil loss is largely attributed to the impacts of reducing vegetation cover and degrading soil physical attributes such as microporosity, infiltration, and bulk density (Donovan 2021). Potential breakdown of soil aggregates into small micro-aggregates and fine particles by direct effects of stock treading may increase the risk of these particles being transported in surface water runoff events. By spatially and temporally limiting soil loss and damage, the impacts and risks associated with grazing can be reduced. A farm plan allows for these risks to be identified and addressed in an efficient and flexible way to improve freshwater ecosystem health outcomes.

22. The impact of treading damage from sheep is lower than for larger animals (such as cattle). This is due to lower body weights and a lower hoof and treading impact. Static hoof pressure for sheep is in the range of 48-83kPa and for cattle the range is 98-192 kPa (Greenwood and McKenzie 2001). When animals are moving these pressures can increase by 2-4 times (Abdel-Magid et al 1987). Less treading impact will mean lower sediment and P loss. Phosphorus contamination of surface water from sheep farms is typically the result of eroded sediment from surrounding land but may also be a result of higher than optimal Olsen-P levels in soils.

23. Faecal microbes contain organisms, such as *Escherichia coli* (*E. coli*), which are deposited in dung and can be directly deposited in waterways if animals have unrestricted access to them. When faeces are deposited on pasture the faecal bacteria can be mobilised during rainfall via overland flow and transported to waterways. Fencing sheep out of waterways will not necessarily reduce *E. coli* contamination, as overland flow will be able to move under and through fences. I note in addition the evidence of Dr Corner-Thomas of studies that show sheep do not commonly interact directly with water bodies and therefore are less likely to directly deposit faeces into waterways.

24. The behaviour of sheep means that in general they have a low likelihood of entering waterways and depositing urine and faeces, especially if provided

with satisfactory feed (quality and quantity) and alternative water sources, such as reticulated water troughs, are available (Bunyaga et al 2020).

25. In my opinion, identifying and applying farm-specific mitigation strategies to critical source areas (CSA) is a key strategy to successfully reduce the impact of sheep farming practices on freshwater health. Reducing the risk of overland flow occurring in CSA or minimising mobilisation of a contaminant source will help to reduce the overall risk of losing contaminants to waterways.

26. Management responses (for all contaminants of concern) require flexibility and need to be tailored to the specific farm system, taking into consideration underlying characteristics of the farm such as geology, soil, slope, topography, vegetation cover, erosion potential and climate. Farm planning is an effective way to do this.

27. Management options recorded in farm plans, specifically in relation to stock and waterway impacts include: stocking rate, appropriate paddock selection in certain weather conditions (areas prone to overland flow during wet periods, keep stock out when wet), keeping vegetative cover on pastures, careful cultivation or low tillage, stock exclusion from waterways at certain times (including fencing or other methods), stock water reticulation, natural topography and vegetation as a means of restricting stock access, keeping animals well fed to reduce them wandering in search of feed and providing shelter for animals away from waterways. Stock crossings and culverts provide points of access for sheep, so they have a means crossing waterways without entering them and are therefore also an important management tool.

28. I have reviewed Appendix N to the PSWLP and consider in general it provides an appropriate framework to give me confidence that CSAs and main contaminants of concern from sheep can be managed on farm if the farm plans are produced and adhered to by farmers.

29. I note that an active farm plan that is regularly reviewed is an important aspect of farm planning and is allowed for through many farm planning processes including B+LNZ's farm planning resources. By having regular reviews, progress can be tracked, and changes made as required to

achieve the long-term outcomes. By understanding the parts of a farm plan required by Appendix N (outlined in the following three paragraphs), informed decision making can be undertaken such that appropriate and cost-effective methods of stock exclusion around waterways and management of the impacts of sheep grazing can be put in place.

30. Appendix N (Part B.3) requires many features to be identified and mapped, including physiographic zones, soil types, waterways, subsurface drains, stock access to waterways, cultivated land, critical source areas, winter grazed areas, land within degraded catchments, heritage areas and taonga species (where known). Mapping and identification of these features will help farmers understand their farm better and will enable appropriate actions and mitigations to be made that relate specifically to individual farms and their differing constraints and requirements.

31. Appendix N Part B.4 and B.5 sets out requirements for nutrient budgets and objectives. Part B.5 outlines requirements for nutrient and soil management, waterway and wetland management, effluent management and drainage maintenance. These are all important things to consider in relation to overall farm and freshwater goals. In part B.7 intensive winter grazing is specifically addressed by requiring an intensive winter grazing plan that accounts for risk pathways.

32. Risk assessments are an important part of farm plans and Appendix N enables farmers to assess the risks of various aspects of their farming operations, including stock exclusion and management of waterways. This enables risks to be managed, mitigated or eliminated as appropriate to achieve the overall goals. In my opinion having the flexibility that a well-informed farm plan allows is essential to successful implementation and achieving good long-term outcomes.

CONFIRMATION OF REASONING IN JWS – FENCING

33. In my opinion rules that require fencing of sheep from waterways are unlikely to achieve a significant reduction in contaminants entering waterways. This is partly due to the high degree of complexity and diversity of sheep farms. The often varied and steeper topography of many sheep farms would mean that installing fencing around waterways would be

impractical. In my opinion a farm planning process to establish which contaminants are of most concern and addressing these specifically with appropriate and cost-effective actions is the preferable course of action. I accept stock exclusion is often a useful tool, but fencing may not always be the best or cost-effective management solution. New technologies are currently being developed that will allow for stock containment and exclusion through GPS collars being fitted to animals. In the future this may mean that traditional fences may become less important on farm as a means of stock exclusion.

34. The cost of constructing fences to exclude sheep are greater than those for larger ruminants, at least partly due to the nature of fences required (e.g. more wires, more posts and more materials) to keep sheep contained. This is because sheep are smaller and more adept at pushing around or through fences.

35. Another issue, arising from their size, is the need for fences to closely follow the topography of a paddock to prevent sheep from going under fences. The topography of sheep farms is often steeper and more varied, which means fences have to follow complex shapes, rather than long stretches of straight lines that are possible in flatter areas. Each change of direction requires robust post assemblies that can remain stable through the directional changes. These assemblies contribute to a high proportion of the overall cost of a fence.

36. A fence used exclusively for cattle can be a 2-wire electric fence. A Ministry for Primary Industries report (2016) estimated the cost of a 2-wire cattle fence to range between $2.91/m (flat land) - $11.58/m (steep land). In contrast, a sheep fence using non-electric 8 wire would cost between $9.90/m (flat land) - $24.88/m (steep land). Since 2016 the costs of labour and materials have risen significantly. I note the MPI estimates do not include costs for any earthworks or vegetation clearing that may be required prior to fence installation which may be significant.

37. Additionally, in some areas the topography will make it very difficult or impossible to fence adequately, this is particularly the case in the hill country. The topography and threat of ground movement in some areas

around waterways also make fencing impractical and inefficient in light of the risk.

38. The risk of flood damage or contributing to increased risk of flooding through trapping debris can also be relevant considerations. When considering the risks of sheep fencing around waterways the risks are increased due to the smaller holes required to keep sheep out making it more likely that debris will get caught.

39. The different characteristics of waterways also have an impact on the effectiveness and efficiency of fencing. For instance, some waterways are naturally protected from stock due to topographic features (e.g. steep sides) or vegetative cover excluding stock.

40. Fencing is relatively ineffective at mitigating overland flow, as contaminants can flow under the fence. As such other measures are required. These measures may include installation of culverts and crossings, providing access to sufficient feed to reduce nutritional stress, feeding supplementary feed in appropriate areas, adequate shelter and shade, reticulated water sources, stock exclusion at times (including temporary or permanent fencing where appropriate), use of natural topography and vegetation to restrict access as described earlier in my evidence.

41. I confirm my view that in general all stock should be excluded from natural, unmodified wetlands that are typically in a wet or saturated state and mainly comprise indigenous wetland species.

DEFINITION OF *STOCK UNIT*

42. I have been provided with a definition of *stock unit* that I am advised the planning witnesses have agreed is appropriate for inclusion in the PSWLP.

> *Stock unit* means the equivalent of one 55 kilogram breeding ewe, bearing a single lamb, consuming 550 kilograms DM average quality feed over a year.

43. I confirm that this definition is a commonly used definition of stock unit nationally. In my experience it is a definition that is, therefore, well understood by farmers.

TS Orchiston

20 December 2021

References

Abdel-Magid, A. H., Trlica, M. J., & Hart, R. H. (1987). Soil and vegetation responses to simulated trampling.

Bunyaga, A. S., Corner-Thomas, R. A., Burkitt, L. L., Draganova, I., & Kenyon, P. R. (2020). BRIEF COMMUNICATION: The behaviour of sheep around a natural waterway. *New Zealand Journal of Animal Science and Production*, *80*, 124-127.

Donovan, M., & Monaghan, R. (2021). Impacts of grazing on ground cover, soil physical properties and soil loss via surface erosion: A novel geospatial modelling approach. *Journal of Environmental Management*, *287*, 112206.

Greenwood, K. L., & McKenzie, B. M. (2001). Grazing effects on soil physical properties and the consequences for pastures: a review. *Australian Journal of Experimental Agriculture*, *41*(8), 1231-1250.

Ministry for Primary Industries (2016). Stock exclusion costs report. MPI Technical paper No. 2017/11, Wellington, New Zealand. 33pp.

Expert Conference – Land Management / Farm Systems

Topic: Proposed Southland Water and Land Plan – Southland Regional Council

Date of conference: 22 November 2021

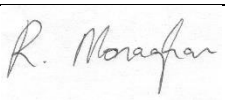
Venue: Remote AVL

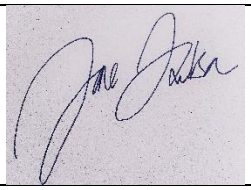
Facilitator: Anne Leijnen

Recorder: Isabelle Harding

Attendees

1. Witnesses who participated and agreed to the content of this Joint Witness Statement (JWS) by signing it on 22 November 2021

Name	Employed or engaged by	Signature
Dr Rene Corner-Thomas	Beef + Lamb NZ	
Tom Orchiston	Beef + Lamb NZ	
Cain Duncan	Fonterra	
Anna Wilkes	Ravensdown	
Dr Antony Roberts	Ravensdown	Ants Roberts
Dr Ross Monaghan	Southland Regional Council	
Dr Ton Snelder	Southland Regional Council	
Dr Dawn Dalley	DairyNZ	
~~Sarah Elmes~~	~~Ballance~~	
~~Jim Risk~~	~~Ballance~~	
Kate McArthur	Fish and Game / Forest and Bird	

Jane Kitson	Nga Runanga	
~~David Stevens~~	~~Beef + Lamb NZ~~	

2. For ease of reference throughout this JWS, all experts had some relevant expertise in land management except the following:

- Dr Ton Snelder is a water quality expert, not farm systems expert
- Jane Kitson is an ecologist/water quality expert, not a farm systems expert
- Dr Rene Corner-Thomas is an animal scientist, not a farm systems expert
- Kate McArthur is an ecologist/water quality expert, not a farm systems expert

3. David Stevens was excused from the conference and did not attend.

Environment Court Practice Note

4. All participants confirm that they have read the Environment Court Consolidated Practice Note 2014 and in particular Section 7 (Code of Conduct, Duty to the Court and Evidence of an expert witness) and Appendix 3 – Protocol for Expert Witness Conferences and agree to abide by it.

5. Dawn Dalley has acknowledged that she is an employee of DairyNZ and may not be considered to be independent simply because of that employee status. Notwithstanding that, she confirms that she prepared and will present her evidence in all other respects as an independent expert in compliance with the Code of Conduct.

6. Dr Jane Kitson acknowledges that she is a member of Te Runanga o Oraka-Aparima and also whakapapa to Te Runanga o Awarua and Waihopai Runaka. She notes that her expertise is partially derived from those cultural associations. She recognises that whilst she is of Ngāi Tahu descent, she is required to be impartial and unbiased in her professional opinions expressed.

7. Dr Rene Corner-Thomas acknowledges that she is an employee of Massey University and can confirm that she has prepared and will present unbiased and impartial evidence as an expert in compliance with the Code of Conduct.

Experts' qualifications and experience

8. These are set out in each experts' statement of evidence.

Purpose of expert conference

9. The purpose of the expert witness conferencing is to enhance the efficiency of the court hearing process by providing for expert witnesses to confer and identify the issues on which they agree, with reasons. They are also to clearly identify the issues on which they do not agree and give reasons for their disagreement. This will enable the court to focus primarily on matters that remain in dispute, while understanding the basis for agreed matters.

Attachments to this JWS

10. Attached to this JWS is answered questions from the from the Farm systems/Water quality experts to the Planning experts.
11. Appendix N.

Conference outcomes

12. The Farm Systems conference answered a number of technical questions that was provided by the Planning experts.

Attachment one – questions to the Farm system experts:

1. ***To what extent will there be water quality improvements achieved by farming in accordance with farm environmental management plans prepared and implemented under Appendix N?***

   An analysis that shows the net benefit to water quality improvements from implementing FEMP's would be complex. It is possible to evaluate these benefits. However, this expert group is unable to quantify the extent of water quality improvement based on the implementation of Appendix N. We can say with certainty, that the implementation of Appendix N practices on farm will reduce losses of contaminants in Table 1. However, ultimately the overall effect will depend on how well all farms within a catchment can address these losses.

   Table 1:

Attribute	***Mitigation change/improvement potential***	***Agreement/disagreement***
Phosphorus, sediment, microbial pathogens	- Appendix N would be effective at achieving some improvements. - Except for, Mole-pipe drains soils where there will continue to be significant sources of P, sediments and faecal loss from farms in catchments where these soils occupy a significant proportion of area. Some of the actions in Appendix N can reduce but will not eliminate these losses.	- *All agree to the extent that expertise allows.* - *R.C has no opinion*
Nitrogen	- Measures in the Plan may not change nitrogen leakages as nothing specifically addresses this. - There is an implicit expectation that the measures in the plan will reduce leakages in Nitrogen, but this is not explicit. The Plan should contain additional incentives to reduce nitrogen leakages. - Explicit references are needed in farm management plans that will manage N losses. Clear objectives are needed in Appendix N and Farm plans should deal with nitrogen as a key component (if degraded catchments for N) - Certification, audit process should help to get water quality improvement. - There are measures in place in Appendix N via provisions 5(c)	- *A.W agrees with the last statement* - *C.D agrees with last statement* - *D.D agrees with the last statement* - *T.O has no opinion* - *KM agrees* - *AR agrees with last statement* - *JK agrees*

	and 6(a) and (b) to specifically deal with nutrient losses and their reduction. This could be strengthened by 5(c) specifically referencing nitrogen as a contaminant where losses need to be avoided or minimised.	
Habitat (instream)	*KM suggests the science experts should fill in the remainder of this table in conferencing.*	*JK agrees*
Habitat (outstream/riparian margins)		
Aquatic health		
Considerations for taonga species and mahinga kai species		
Human health aspects		
Connection to place/understanding what it was		
All water types (groundwater, springs, drains that were streams, wetlands)		
Biodiversity components		

2. Would Farm Environment Management Plans under Appendix N deliver water quality improvements that progress Te Mana o te Wai?

To some degree it will approve the holistic wellbeing of that waterbody. To what extent is unknown. Eventually over time this, could be determined.

Te Mana o Te Wai is a fundamental freshwater management principle that recognises the mauri of the water and places the priority on holistic health and the wellbeing of the water. The mauri sustains the hauora (health) of the water. Hauora is both a continuum and a state with the desired outcome progressing towards this.[1] It would make more sense for this question to use 'hauora' rather than 'Te Mana o Te Wai'. Farm environment plans under Appendix N may deliver water quality improvements, however, this does not "progress" Te Mana o Te Wai as giving effect to Te Mana o Te Wai requires the health of waterbodies to be the first priority.

T.O has no opinion
R.C has no opinion

[1] MEMORANDUM OF COUNSEL FOR NGĀ RŪNANGA REGARDING CULTURAL INDICATORS OF HEALTH JWS Water Quality and Ecology (River and Lakes) Sept 2019

A.R has no opinion

3. Could improvements from an implementation perspective be made to Appendix N?

Appendix N could be improved with clearer objectives. Implementation will be driven through objectives which people will be required to document and implement. Existing guidance helping to inform those developing FEMP's needs to be brought together (consolidated) and additional guidance needs to be developed for addressing hauora, including ecological health.

Wherever physiographic zones are mentioned in Appendix N, it should always also reference the variants.

KM has no opinion on the statements below here.
Timeframe and measurement wording in 6(c) and (d) require clarification as can be interpreted several ways.

It is impossible for farmers to measure leakages but can document inputs or record completion of specific actions. Research on the impact of specific mitigations/actions on water quality in FEMPs, is a way of estimating improvements.

Is ensuring the implementation of mitigations rather than measuring water quality outcomes the purpose of 6(d)? Suggested change to wording of 6(d): Records to be kept for demonstrating mitigations have been actioned and are achieving the objectives

Is the intent for FEMPs to deliver continuous improvement, driven by the audit framework proposed, appropriately reflected in Appendix N and elsewhere in the Plan?

T.O has no opinion
R.C has no opinion
T.S has no opinion
JK has no opinion

4. How can Ngāi Tahu indicators of health be incorporated into Appendix N? What would their purpose be?

Indicators would be useful for farmers to understand hauora. Section 3 requires land owners to understand the locations of attributes of hauora. With the aim to progress towards hauora, incorporating Ngāi Tahu indicators of health somewhere in the Plan will be needed and should be referenced by Appendix N.

Is cultural degradation part of the consideration of what sites are degraded? Will sites that are assessed as culturally degraded be listed in Schedule X? The journey towards hauora would require them to be in the Plan.

T.O has no opinion

R.C has no opinion
A.R has no opinion
A.W has no opinion
D.D has no opinion
C.D has no opinion
R.M has no opinion
T.S has no opinion

5. ***How do you think hauora can be recognised and monitored through Appendix N and farming practice? Are additional tools, methods and/or indicators needed? If so, what should be included?***

Making sure the objectives of Appendix N adequately address hauora (including ecological health). Objectives 5(c), (d) and (f) do not currently do this. The paragraph after 5(f) is unnumbered and could be strengthened to include objectives around hauora (including ecological health).

There is a need to incorporate and/or reference cultural indicators of health into Appendix N.

Listing the different freshwater features: springs need to be included in part 3(b).

K.M has concern surrounding ephemeral streams and whether their ecological values are captured in the Plan.

T.O has no opinion
R.C has no opinion
T.S has no opinion
R.M has no opinion
A.R has no opinion
A.W has no opinion
D.D has no opinion
C.D has no opinion

6. ***Does the current resourcing in the Southland's farm systems advice sector have the capacity to deliver on the FEMPs now or will there be a lag in implementation?***

Resourcing exists in the dairy sector for FEMPs to be delivered without significant lag.
Certification of advisors to deliver the FEMP's will need to be in place in a timely manner and relies on approval from SRC.
Define a lag? Staggering of FEMP preparation would be advantageous to spread the workload of both the advisors and auditors, especially given auditing is proposed for 12 months after the development of the FEMP.
Will the council be sufficiently resourced to either provide auditors for FEMP's or certify advisors to complete the auditing?
Nutrient budget and risk assessment tools already exist but these also require approval from SRC before the FEMP's could be completed
Not likely to be a significant problem.

Adequate resourcing for farmers.

J.K has no opinion
R.C has no opinion
K.M has no opinion
T.S has no opinion
T.O has no opinion

Setbacks for cultivation

7. ***Rule 25 (cultivation) regarding effectiveness of setback differences: how much more effective at reducing sediment and nutrient runoff would it be to have 10m for 4-16 degree slopes and 20m above 16 degree slopes than the current suggestion of 5m up to 10 degree slopes and 10m between 10 and 20 degree slopes?***

Quantification of the effectiveness of different setback widths on reducing contaminant runoff is a question for science.

Setback buffers should ideally be delineated where convergent runoff flow occurs i.e. CSAs; edge-of-field set distances for setbacks is a less efficient way of achieving a good outcome (takes out a lot of productive land, potentially)

No amount of buffer will prevent contaminants reaching water in high intensity storms

Buffer size will be important because the wider buffer the more productive land is removed from the farm business. However, wider buffers are more effective at capturing fine sediment and adsorbed nutrients/microbes (KM).

Buffer length is probably an important consideration - long narrow buffers in zones of convergent flow (such as gullies and swales) have been shown to be effective (60-70%) for reducing sediment and P transport.

Outside of CSAs a minimum buffer width is still required for paddocks not bisected by flow paths (CSAs) to capture sediment flows from paddocks to waterways.

K.M stated that a 10m grass buffer is highly effective at capturing fine sediment before it reaches water (Lui et al. 2008) however research cited in LandCare Report (envirolink.govt.nz) reported that a 5m buffer will remove 70% of sediment (Death 2018) (D.D). As stated above, quantification of the impact of buffer width on contaminant loss needs to be addressed in the Science conferencing. Discussion on the farm system impacts of alternative buffer options will be readdressed by the Farm System experts at their next conferencing following feedback from the Science group and additional information provided by the Planners (see NB below).

NB - Planners to prepare summary of Rule 25 and cultivation definition for the next conference.

A.W defers to those with greater expertise in this matter.
R.C has no opinion

T.O has no opinion
T.S has no opinion
J.K has no opinion

Critical Source Areas

If the suggested definition for critical source areas is: a landscape feature like a gully, swale or a depression that accumulates runoff (sediment and nutrients) from adjacent flats and slopes, and delivers it to surface water bodies (including lakes, rivers, artificial watercourses and modified watercourses) or subsurface drainage systems.

8. Does this definition miss any landscape features that could be a critical source area?

Laneways, stock camps, silage pits, fertiliser storage areas and drain/waterway crossings are potential critical source areas for contaminants, However, these are different in terms of the way they are managed with regards to reducing the losses compared to critical source areas such as a gully or swale).

Location of non-landscape features should be included in part B 3, e.g silage pit, fertiliser storage areas, laneways.

R.C has no opinion
KM remains concerned that ephemeral streams are not specified and their ecological values captured.

9. What are the factors that determine the riskiness of critical source areas?

If CSAs are landscape features where source and transport factors overlap the following factors will influence the risk:

Size of catchment contributing to the critical source area,
Slope and slope length of catchment contributing to the critical source area,
Soil properties which contribute to erodibility in particular,
Soil property in relation to the imperviousness of it,
Land use and management occurring in the vicinity of the critical source area,
Climate factors, e.g rainfall erosivity,
Presence of protective plant cover,
Proximity of the CSA to a waterbody,

R.C has no opinion

10. Are some critical source areas riskier than others?

Yes. Refer to above.

Some examples of riskier CSAs are:

1. grazed winter forage crops, where plant cover has been removed and soil has been subjected to treading damage, or

2. near-stream animal camping areas, where large quantities of animal excreta may be deposited

R.C has no opinion

11. What is the best way of determining what/where a critical source area is?

a) Physical mapping during wet conditions,
b) Google/aerial maps/GIS,
c) Visual observation,
d) LIDAR mapping,
e) Hydrologically based modelling e.g., LUCI Ag, Mitigator can assist in identifying CSAs.

CSA's need to be validated/confirmed in the field during the FEMP development process, however other methods can be used to help in their identification. Identification of CSA's cannot just rely on modelling/maps.

R.C has no opinion

Intensive Winter Grazing

12. Is reducing or restricting mob size (i.e., no more than 120 cattle or 250 deer) important for avoiding or mitigating adverse effects of IWG (assuming the same stocking density)? Could there be perverse outcomes for water quality? If stocking density is a more critical factor to the extent of adverse effects, is there a simple measure for that?

Reducing or restricting the mob size is not important in IWG because the stocking density is dictated by the yield of the crop and/or the amount of crop being allocated per animal per day.

Perverse outcomes on water quality are possible if mob size is restricted based on the following:

- more individual mobs under IWG at one time therefore potentially more critical source areas to be managing
- with more smaller mobs grazing through paddocks will take longer for individual paddocks to be fully grazed, reducing the opportunity to implement catch crops as a mitigation for N, sediment and P losses
- more mobs will increase the complexity of developing and implementing adverse weather plans, potentially increasing the environmental risk

A simple measure for stocking density could be square metres per animal between the front fence and the back fence. The challenge for this approach is there is no data defining the optimal square metres required to minimise any adverse environmental effects.

J.K has no opinion
R.C has no opinion
K.M has no opinion
A.W has no opinion
T.O has no opinion
T.S has no opinion

13. ***If intensive winter grazing is to occur in a critical source area, what controls and restrictions should be in place to result in minimising sediment and nutrient loss? Are there any practices that could be adopted that make this appropriate?***

The preference would be to not winter graze a critical source area.

If undertaking this high-risk activity these practices would be required;

- not planted in crop and exclusion of animals from the non-planted area,
- implement last bite grazing of the CSA in low-risk conditions,
- bunds or sediment traps installed for any losses after grazing.

J.K has no opinion
R.C has no opinion
K.M has no opinion
A.W agrees with the first statement and has no opinion on the second statement.
T.O has no opinion
T.S has no opinion

14. ***Is it possible to increase the land area subject to IWG from 10% to 15% of the farm area without increasing losses of nitrogen, phosphorus, sediment or microbiological contaminants from the subject land?***

Yes, providing;

1. Other practices are implemented that mitigate any potential increases in nutrient loss risk. And/or,
2. Crop type was changing to one with a lower environmental footprint. e.g going from a brassica to fodder beet (specifically in relation to nitrate leaching losses) And/or,
3. Wintering system type was changing. e.g from crop based to pasture based (in relation to sediment and phosphorus, and potentially nitrogen, because of plant material left after grazing). And/or,
4. Adoption of minimal/nil tillage crop establishment (sediment loss)

And providing that an appropriate and robust assessment process can verify that these measures will at least offset the (otherwise) expected increases in contaminant discharges if winter grazing areas are increased from 10 to 15%.

J.K has no opinion
R.C has no opinion

K.M has no opinion
A.W defers to those with greater expertise in this matter.
T.O has no opinion
T.S has no opinion

Stock Exclusion (sheep)

15. How do sheep behave and what are the potential adverse effects of sheep in and around natural wetlands and what risk to water quality and impacts on vegetation in natural wetlands do sheep present? How are those potential adverse effects best managed? For example, is fencing required? Where? What type?

Sheep have a low risk of depositing urine/faeces into waterways and wetlands. They may enter these areas under nutritional stress. There is a small risk they would have an adverse impact on water quality (if well-fed). This can be managed with a FEMP. There is limited research on grazing behaviour of native species. Based on nutritional information of native grasses, there is the suggestion that sheep will have a limited impact on native vegetation. – R.C, T.O

Potential adverse effects can be appropriately managed by farm plans (FEMP) that may include practices such as,restricting access during periods of nutritional stress, strategic locations for culverts and crossings, potentially supplementary feeding and the location for that feeding, reticulated water sources, appropriate shelter, stock exclusion at certain times (fencing or other methods), natural topography (to an extent). – R.C, T.O

Sheep do pose a risk to water quality, generally with regard to overland flow rather than direct deposition into waterways although the authors note that direct deposition research is ongoing (Moriarty and Gilpin (prepared for Environmental Southland by ESR, Report number: CSC17002, URL: Sheep as a potential source of microbial contamination in Southland.pdf es.govt.nz)) – K.M

Fencing will not deal with E. coli contamination from sheep via overland flow, other measures will be required.

R.M strongly suggests that the expertise of other suitably qualified experts is sought to guide the question 15 about how sheep behave and potential adverse potential adverse effects of sheep in and around natural wetlands and what risk to water quality and impacts on vegetation in natural wetlands do sheep present? How are those potential adverse effects best managed? For example, is fencing required? Where? What type?
R.C disagrees
T.O disagrees

There are difficulties in applying the definition of a natural wetland in the NESFM. There is lack of definition of extent of natural wetlands, “in and around natural wetlands” is also uncertain.

T.S has no opinion

D.D has no opinion
A.W has no opinion
C.D has no opinion

16. What are the differences in fencing required to exclude sheep from freshwater bodies compared with other stock? What are the cost differences associated with those differences?

Fences required to keep cattle out of water ways may be as minimal as a 2-wire electric. MPI (2016) estimated the costs of this type of fence on flat land to be approximately $4.70/m, on rolling land to be $4.90 and on steep land to be $5.90/m. By comparison a fence required to keep sheep out would be either 7 wire or netting with increased support between posts (in the form of battens or waratahs), being $12.00/m, $12.60/m and 16.00/m on flat rolling and steep land respectively. Since those costs were produced, the cost of labour has risen approximately 30% (Statistics NZ) and the cost of materials about the same (Goldpine pers com). A further complicating factor is the potential to have a much greater number of qualifying streams and wetlands as slope increases. This greatly accelerates the whole farm cost of fencing waterways. Using a topographic model to estimate this effect, estimates for sheep-type fencing increased from approximately $23,000 for a Beef + Lamb NZ Class 7 (breeding/finishing flat) farm of 226 ha, to approximately $1.1 million for a class 2 (steep hill country) farm of 1491 ha.

Sheep are a lot smaller and can fit through smaller gaps, so fences require more materials than a fence for dairy cattle for example.
Estimated current cost for 2-wire dairy fencing in moderate rolling country $15-20m per metre +GST,
Estimated current cost for 7 wire sheep fencing in moderate rolling country $25-30/m +GST

Fencing in certain areas may be impractical due to topographic limitations.

Earthworks could also be required at the time of fencing that may have associated impacts on freshwater ecosystem health and will increase costs.

T.S has no opinion
K.M has no opinion
J.K has no opinion
D.D has no opinion
C.D has no opinion
A.W defers to those with greater expertise in this matter.

Attachment Two

Appendix N – Farm Environmental Management Plan Requirements

A Farm Environmental Management Plan must be:

(1) A Freshwater Farm Plan prepared, implemented and audited in accordance with regulations prepared under Part 9A of the RMA and which apply within the Southland region, plus any additional information or components required by Parts B (3) and (6)(b) as below; or

(2) if Freshwater Farm Plans, under Part 9A of the RMA, are not yet required in the Southland region, a Farm Environmental Management Plan prepared and implemented in accordance with Parts A to C below.

Part A – Farm Environmental Management Plans

A Farm Environmental Management Plan (FEMP) can be based on either of:

1. the ~~material~~ default content set out in Part B below; or
2. industry prepared FEMP templates and guidance material, with Southland-specific supplementary material added where relevant, so that it includes the default ~~material~~ content set out in Part B below; or
3. A management plan and nutrient budget prepared in accordance with a condition of resource consent to discharge industrial wastewater onto land that is also used for farming activity, provided it includes the material set out in Part B below in relation to each farm receiving industrial wastewater'.

Part B – Farm Environmental Management Plan Default Content

~~1.~~ ~~A written FEMP that is:~~

~~(a) prepared and retained, identifying the matters set out in clauses 2 to 56 below; and~~

~~(b) reviewed at least once every 12 months by the landholding owner or their agent and the outcome of the review documented; and~~

~~(c) provided to the Southland Regional Council upon request.~~

2. The FEMP contains the following landholding details:
   (a) physical address; and
   (b) description of the landholding ownership and the owner's contact details; and
   (c) legal description(s) of the landholding; and
   (d) a list of all resource consents held for the landholding and their expiry dates~~.~~; and
   (e) The type of farming activities being undertaken on the property, such as "dairy" or "sheep and beef with dairy support".
3. The FEMP contains a map(s) or aerial photograph(s) of the landholding at a scale that clearly shows the locations of:
   (a) the boundaries; and
   (b) the physiographic zones (and variants where applicable) and soil types (or Topoclimate South soil maps); and
   (c) all lakes, rivers~~,~~/streams (including ~~ephemeral or~~ intermittent ~~flow paths~~ rivers/~~streams~~), ponds, artificial watercourses, modified watercourses and natural wetlands; and
   (d) all existing and proposed riparian vegetation and fences (or other stock exclusion methods) adjacent to waterbodies; and
   (e) places where stock access or cross water bodies (including bridges, culverts and fords); and
   (f) the location of all known subsurface drainage system(s) and the locations and depths of the drain outlets; and
   (g) all land that may be cultivated and land to be cultivated over the next 12-month period; and

(h) ~~all land that may be break fed and/or intensively winter grazed and the land to be planted for winter grazing for the next period 1 May to 30 September; and~~

(ha) all critical source areas not already identified above; and

(i) ~~for~~ land to be cultivated or intensively winter grazed, or break fed on pasture between 1 June and 31 July, ~~shows~~ and the slope[2] of the land and intended setbacks from any lake, river, artificial watercourses, modified watercourse or natural wetland and any other critical source areas; and~~:~~

~~(i) critical source areas; and~~

~~(ii) intended setbacks from any lake, river (excluding ephemeral or intermittent rivers), artificial watercourses, modified watercourse or natural wetland; and~~

~~(iii) land with a slope greater than degrees~~

(j) any areas of the land within a degraded catchment identified in Schedule X; and

(k) any heritage site recorded in the relevant district plan, on the New Zealand Heritage List/Rārangi Kōrero or on the New Zealand Archaeological Association website; and

(l) the presence of taonga species listed in Appendix M within water bodies on the farm (if known).

4. Nutrient Budget/Nutrient Loss Risk Assessment

For all landholdings over 20ha, the FEMP contains either:

(a) a nutrient budget (which includes nutrient losses to the environment) calculated, using a ~~the latest version of the OVERSEER~~ model ~~in accordance with the latest version of the OVERSEER Best Practice Data Input Standards (or an alternative model nutrient loss assessment tool~~ approved by the Chief Executive of Southland Regional Council); or

(b) a nutrient loss risk assessment undertaken using a nutrient loss risk assessment tool approved by the Chief Executive of Southland Regional Council~~);~~

and the Nutrient Budget or Nutrient Loss Risk Assessment is repeated: ~~which is repeated:~~

(~~a~~1) where a material change in land use associated with the farming activity occurs (including a change in crop area, crop rotation length, type of crops grown, stocking rate or stock type) at the end of the year in which the change occurs, and also every three years after the change occurs; and

(~~b~~2) each time the nutrient budget or nutrient loss risk assessment is repeated all the input data used to prepare it shall be reviewed by or on behalf of the landholding owner, for the purposes of ensuring the nutrient budget or nutrient loss risk assessment accurately reflects the farming system. A record of the input data review shall be kept by the landholding owner; and

(~~c~~3) the nutrient budget or ~~must be prepared by a Certified Nutrient Management Advisor and the~~ nutrient loss risk assessment must be prepared by a suitably qualified person that has been approved as such by the Chief Executive of Southland Regional Council.

5. Objectives of Farm Environmental Management Plans

A description of how each of the following objectives will, where relevant, be met:

(a) Irrigation system designs and installation: To ensure that all new irrigation systems and significant upgrades meet Industry best practice standards;

(b) Irrigation management: To ensure efficient on-farm water use that meets crop demands ~~and minimises losses~~, including through upgrading existing systems to meet Industry best practice standards, and ensuring that water and contaminant losses to waterbodies are avoided where practicable or otherwise minimised;

[2] Slope is the average slope over any 20 metre distance.

(c) Nutrient and soil management: To avoid where practicable, or otherwise minimise, nutrient and sediment losses from farming activities to ground and surface water, to maintain or improve water quality;

(d) Waterways and wetland management: To manage activities within waterways, critical source areas, natural wetlands, and their margins, ~~to~~by avoiding stock damage, and avoiding where practicable, or ~~and to~~ otherwise minimising inputs of nutrients, sediment and faecal contaminants to ground and surface water~~, to maintain or improve water quality~~

(e) Collected ~~animal~~ agricultural effluent management: ~~To manage the operation of animal effluent systems to avoid adverse effects on water quality avoid contaminant losses to water bodies do not have …adverse effects on water quality; contaminant losses to water bodies do not occur;~~ To manage ~~the operation of~~ collected agricultural effluent ~~management systems~~ in accordance with best industry practice, to ensure contaminants derived from collected ~~animal~~ agricultural effluent do not cause adverse effects on water quality.

(f) Drainage maintenance: To manage drainage maintenance activities to ensure contaminant losses to water bodies and damage to aquatic habitats are avoided where practicable, or otherwise minimised ~~significant adverse effects on water quality and aquatic habitat~~.

The FEMP may also identify additional objectives relevant to the farming activities or to address environmental risks identified in accordance with Part (6) below.

6. The description for (5) above shall include, for each relevant objective in 5 above:

(a) an ~~assessment~~ identification of the adverse environmental effects, and risks associated with the farming activities on the property, including, ~~where relevant,~~ consideration of the risks associated with the relevant physiographic zone/s ~~characteristics of the property,~~ and how the identified effects and risks will be managed ~~or~~ and mitigated ~~(i.e., 'mitigations')~~; and

~~and risks associated with the farming activities on the property and how the identified effects and risks will be managed; and~~

(b) where the farm is located within a degraded waterbody identified in Schedule X, the ~~measures~~ mitigations that ~~to demonstrate how farming activities~~ will achieve a reduction in the discharge of the contaminants where relevant to the farming activity that trigger the degraded status of the catchment; and

(c) defined mitigations that clearly set a pathway and timeframe for achievement of the objective; and

(d) the records to be kept for measuring performance and achievement of the objective; ~~target;~~ and

(e) identification of any specific mitigations ~~measures~~ required by a resource consent held for the property.

7. If any Intensive Winter Grazing is occurring on the landholding, the Farm Environmental Management Plan must also include an intensive winter grazing plan that ~~addresses~~ takes into account and responds to the risk pathways for the relevant physiographic zones. ~~that includes:~~

~~(a) downslope grazing or a 20 metre 'last-bite' strip at the base of the slope; and~~

~~(b) back fencing to prevent stock entering previously grazed areas; and~~

~~(c) transportable water troughs; and~~

~~(d) supplementary feed (including baleage, straw or hay) being fed in such a way as to prevent the supplementary feed being trampled into the ground, such as by placing the supplementary feed in portable feeders or behind an electrified wire; and~~

~~(e) limiting the mob size to no more than 120 cattle or 250 deer; and~~

~~5. Good Management Practices~~

~~The FEMP contains a good management practices section which identifies:~~

~~(a) the good management practices implemented since 3 June 2016; and~~
~~(b) the good management practices which will be undertaken over the coming 12-month period. These must include practices for:~~
~~(i) the reduction of sediment and nutrient losses from critical source areas, particularly those associated with overland flow;~~
~~(ii) cultivation (including practices such as contour ploughing, strip cultivation or direct drilling);~~
~~(iii) the use of land for intensive winter grazing (including those practices specified in Rule 20(a)(iii);~~
~~(iv) riparian areas (including those from which stock are excluded under Rule 70) and the type of riparian vegetation to be planted, how it will be maintained and how weeds will be controlled;~~
~~(v) minimising of the discharge of contaminants to surface water or groundwater, with particular reference to the contaminant pathways identified for the landholding.~~
~~Examples of general good management practices are provided on the Southland Regional Council, Dairy NZ and Beef and Lamb New Zealand websites and in the document146 titled "Industry-agreed Good Management Practices relating to water quality, Version 2, 18 September 2015".~~

Part C – Farm Environmental Management Plan Certification, Auditing, Review and Amendment

1. Farm Environmental Management Plan Certification
   (a) The FEMP must be certified, prior to implementation on the farm, by a Suitably Qualified Person (SQP) that has been approved as such by the Chief Executive of Southland Regional Council.
   (b) The purpose of FEMP certification is to confirm that the farming activities on the farm will be carried out in a way that will achieve the Objectives in this Appendix and will comply with any resource consent for the property.
   (c) The FEMP must be re-certified, prior to implementation, following any amendments to the FEMP carried out in accordance with Part C(3)(a) of this appendix.
   (d) Within one month of a FEMP being certified, a copy of the certified FEMP must be provided to the Southland Regional Council.

2. Auditing of the certified Farm Environmental Management Plan

   (a) Within 12 months of the landholding's first FEMP being certified, the landholding owner must arrange for an audit of the farming activities' compliance with the certified FEMP. Thereafter, the frequency of auditing will be in accordance with ~~the~~ any conditions of consents held for the landholding, or alternatively, where there are no consent or consent conditions requiring auditing, auditing timeframes associated with the audit grade assigned. *Note: Southland Regional Council will provide, on its website, a schedule of the auditing frequency required for ~~each~~ FEMP's based on the audit grade assigned to each landholding.*

   (b) The auditor must be a Suitably Qualified Person (SQP) that has been approved as such by the Chief Executive of Southland Regional Council and must not be the same person or from the same organisation that prepared the FEMP.
   (c) The auditor must prepare an audit report that:
      (i) sets out the auditor's findings;
      (ii) stating whether compliance has been achieved and the final compliance grade; and
      (iii) any other recommendations from the auditor.

(d) Within one month, of the final audit report being prepared, the audit report must be provided to the Southland Regional Council by the auditor.

3. Review and Amendment of the Farm Environmental Management Plan

The FEMP must be reviewed, by the landholding owner, or their agent, as follows:

(a) when there is a material change to the nature of the farming activities occurring on the landholding, and where that material change is not provided for within the landholding's certified FEMP; and

(b) at least once every 12 months; and

(c) to respond to the outcome of an audit.

The outcome of the review is to be documented and amendments to the FEMP must be made where Part C(3)(a) applies and in circumstances where the annual review identifies that amendments are required.