BEFORE THE HEARING PANEL OF SOUTHLAND REGIONAL COUNCIL

In the matter of sections 88 to 115 of the Resource Management Act 1991

And

In the matter Applications for resource consents by:

WOLDWIDE ONE LIMITED, WOLDWIDE TWO LIMITED, WOLDWIDE FOUR LIMITED, AND WOLDWIDE FIVE LIMITED,

Applicants

BRIEF OF EVIDENCE OF DR. MICHAEL FREEMAN

Addendum – Wintering Barns and water quality

30 September 2019

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PURPOSE OF REPORT

1 This brief addendum has been prepared to respond to a request by commissioners in a minute issues on 26 September 2019:

> *"Nicole Phillips in evidence at [55]-[106] identifies that installation of winter barns may mitigate nutrient losses (and therefore water quality effects) of all relevant proposals. What is Dr Freeman's position on this issue? In particular we are interested in the water quality benefits or otherwise of earlier installation of wintering barns for the Woldwide Four and Woldwide Five farms. This information may be provided at the time Dr Freeman gives evidence."*

WINTERING BARNS

2 The potential limitations of some forms of winter-feeding options for dairy herds has been recognised for many years. A detailed assessment of the advantages of wintering barns over the more generally used intensive wintering grazing systems in Southland was undertaken by de Wolde[1] who identified significant financial, animal health/welfare, farm system benefits with two wintering sheds. This study also reviewed the NZ research that identified winter as the time of major N loss to water.

3 Similarly, Judson *et al*[2] identified indoor wintering as one method to address many issues including soil health, animal welfare, and nutrient loss. The potential benefits of wintering barns to reduce nitrogen and phosphorus loss to water has also been established with field investigations in New Zealand. For example, de Klein and Ledgard[3] showed that nitrate leaching losses could be reduced by 35-50% with 'restricted grazing' systems achieved with barns or sheds. These studies have been confirmed by later field studies e.g., Christensen *et al*[4] that compared actual nitrogen loss measurements with Overseer modelled losses to develop confidence in the ability of Overseer to estimate losses associated with 'duration controlled' grazing. This latter study concluded that "*There was good agreement between the Overseer predictions of N leaching and values measured at the trial site for both the SG and DC grazing treatments*."

4 These reductions are essentially achieved because cow dung and urine that would otherwise be deposited onto/into soils prior to and during the peak drainage and runoff periods, principally late autumn and winter, is collected and applied to these same soils/land under more favourable conditions (spring and summer) that minimise the loss of contaminants[3]. In particular, the effluent is applied evenly under controlled conditions and not as urine hotspots[3].

5 The wider benefits of restricted pasture grazing have been summarised by Longhurst and Luo[5] as follows:

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[1] de Wolde A (2006) An alternative wintering system for Southland, A comparison of wintering cows outside, on brassica crops versus inside, in a free stall barn in Southland, New Zealand. A dissertation submitted in partial fulfilment of the requirements for the Degree of Master of Professional Studies, Lincoln University.

[2] Judson H, Dalley D, Edwards G, Stevens D & Gibbs S (2010) Improving winter feeding outcomes in South Island dairy herds, Proceedings of the 4th Australasian Dairy Science Symposium 2010

[3] de Klein C & Ledgard S (2001) An analysis of environmental and economic implications of nil and restricted grazing systems designed to reduce nitrate leaching from New Zealand dairy farms. I. Nitrogen losses, New Zealand Journal of Agricultural Research, 44:2-3, 201-215

[4] Christensen, C, Hanly J, Hedley, M, & Horne, D (2010) Using Duration-Controlled Grazing to Reduce Nitrate Leaching from Dairy Farms. In: Farming's future: Minimising footprints and maximising margins. (Eds L.D. Currie and C.L. Christensen) Occasional Report No. 23. Fertiliser and Lime Research centre, Massey University, Palmerston North. Pp46-52

[5] Longhurst, B & Luo J, (2007) On-off farm winter management practices: potential Environmental benefits and issues. In: Designing sustainable farms: Critical aspects of soil and water management. (Eds L.D. Currie and L.J. Yates). Occasional Report No. 20. Fertilizer and Lime Research Centre, Massey University, Palmerston North, New Zealand.

Parameter	Benefit
Soil	Physical properties protected (hydraulic conductivity, macroporosity), Soil structure (pore size)
Water quality	Reduced nutrient leaching (nitrates), reduced surface runoff (phosphorus, sediment, faecal contamination)
Pasture	Less treading damage (increased canopy cover, higher leaf area index, plant crowns not damaged, more tillers)
Feed	Less pasture wastage through trampling into mud, better feed utilisation if supplements fed at wintering system
Stock	Cow condition maintained in most systems. Farmers report increased CS 0.5 with Herd Homes

6 Most of the New Zealand research into environmental benefits of wintering barns has looked at nitrogen losses to water. However, Longhurst and Luo (2007)[4] found evidence to indicate that restricted grazing practices, including wintering barns, reduced risks of faecal contamination of water.

7 There have also been some detailed investigations into the financial as well as environmental aspects of wintering barns. For example, Journeaux and Newman[6] concluded that "*Overall the decision around a barn tends to be either you make money out of it, or you reduce the environmental footprint of the farm. It is difficult to achieve both. Having said that, the reasons farmers invested in barns were for farm management and having more control over their farming system, not necessarily financial or environmental*."

8 An important consideration that Journeaux and Newman highlight is that are some limitations in the ability of Overseer to model wintering barns that require understanding of the farm systems and Overseer to address. They also noted the need to 'compare apples with apples' so that when the effectiveness of wintering barns are assessed that is done consistently e.g., including support blocks. Durie *et al*[7] have suggested various approaches to addressing the Overseer limitations to accurately model composting barn systems that have many similarities to wintering barns. Mr Duncan and Mr Crawford will be able to provide more detail on the methods that they used to model the wintering barns for Woldwide One, Woldwide Two, Woldwide Four and Woldwide Five.

WATER QUALITY BENEFITS OF EARLIER WINTERING BARN INSTALLATION

9 The earlier that wintering barns could be installed the sooner the reduction in contaminant losses and resultant small improvements in water quality would occur. However, the applicants are in the best position to comments on the wider considerations that dictate the speed with which the proposed new wintering barns can be constructed and made operational.

Mike Freeman

Dr Michael Freeman, 30 September 2019

[6] Journeaux P, & Newman M (2015) Economic & Environmental Analysis of Dairy Farms with Barns, Cost Benefit Analysis of 14 NZ Dairy Farms with Barns, Agfirst & DairyNZ Publication, 63 pages

[7] Durie, R., Woodford, K., and Trafford, G., 2019. Modelling of nitrogen leaching within farming systems that incorporate a composting barn: a case study of the Lincoln University Dairy Farm. In: Nutrient loss mitigations for compliance in agriculture. (Eds L.D. Currie and C.L. Christensen). http://flrc.massey.ac.nz/publications.html. Occasional Report No. 32. Fertilizer and Lime Research Centre, Massey University, Palmerston North, New Zealand.