IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of the Proposed Canterbury Land and Water Regional Plan

SUPPLEMENTARY EVIDENCE OF MATHEW JOHN CULLEN RESPONDING TO QUESTIONS FROM THE GROUP 2 HEARING

1. INTRODUCTION

1.1 My name is Mathew John Cullen and I have the qualifications and experience described in my Evidence in Chief for the Group 1 Hearing.

1.2 I have prepared this supplementary evidence in response to questions asked by Hearing Commissioners during the Group 2 hearings, specifically:

(a) Commissioner Van Voorthuysen asked Ms Campbell whether the materiality of the effects of those dairy conversions that were being undertaken at the time of notification of the Plan on water quality within the Red and Orange zones had been considered; and

(b) Commissioner Van Voorthuysen asked Mr Willis whether it would be beneficial to place some additional spatial constraint on the consideration of the calculation of the top 10% or 25% of nutrient leaching performance (as well as soil type) for the purposes of Policy 4.31 and 4.32.

2. ESTIMATED NUTRIENT LOSSES FROM DAIRY CONVERSIONS

2.1 In order to estimate the losses of Nitrogen within Red and Orange Zones I have utilised the information provided (as Appendix 1) by Mr Griffiths in his Group 2 evidence. In addition to this information Mr Griffiths has also provided me with the following information for those farms which he cites in his Group 2 evidence:

(a) The location of these farms, (to determine which nutrient allocation zone they are located within);

(b) Proposed area of milking platform[1];

(c) Proposed cow numbers[1]

(d) Estimation of soil type (light/medium/heavy) as classified by Canterbury Regional Council Report[2].

2.2 Appendix 1 to this evidence records the circumstances of these farms.

2.3 I have entered this information into the OVERSEER model. For each nutrient allocation zone I have entered a representative scenario based on soil type and stocking rate.

2.4 Given that the OVERSEER model requires a range of inputs based on farm system information (which I have not been able to obtain); I have made a number of assumptions, (largely based on the New Zealand Dairy Industry protocol for the use of OVERSEER). A list of these assumptions is attached as Appendix 2.

2.5 My analysis generates an estimate of totalised Nitrogen losses at a farm level, which can subsequently be applied at a catchment level. This analysis is discussed further by Shirley Hayward in her supplementary evidence.

3. SPATIAL CONSTRAINTS ON NUTRIENT LEACHING PERFORMANCE

3.1 The main inputs that have the greatest influence on nutrient loss estimates from the OVERSEER model are those that influence the size of the source of the nutrient (e.g. stocking rate, fertiliser inputs) and those that influence the transport of a nutrient (e.g. soil drainage).

3.2 Drainage is a key driver of N losses and therefore it is important to recognise that loss estimates are sensitive to climate inputs (predominantly rainfall and evapotranspiration) and soil characteristics that affect available water holding

1. The main inputs into the OVERSEER model that have most influence on nutrient loss estimates are those that influence the size of the source of a nutrient. Cow numbers and milking platform area are critical inputs into the OVERSEER model as stocking rate has a significant influence on the size of the source of Nitrogen.
2. Lilburne L, Webb T, Ford R & Bidwell V. Estimating nitrogen leaching rates under rural land uses in Canterbury. Report no. R10/127. 2010.

capacity (such as soil order, texture, sand or stony subsoils and the depth to those subsoils).

3.3 In the context of Policies 4.31 and 4.32 of the Plan, those environmental factors identified at para 3.2 are outside the scope of control of farm management for an existing land owner. However for a potential purchaser of land for conversion these could be considered as part of due diligence in the context of whether it is feasible that advanced farm infrastructure/management strategies are sufficient to overcome these environmental variables in terms of achieving top 10% of 25% in terms of N leaching performance.

APPENDIX ONE

Nutrient allocation zone	Zone status	Farm Id	Stocking Rate (cows/ha)	Farm size (ha)	Soil drainage category	Previous Land Use	Estimated total N loss to water (OVERSEER) (kgN/ha/yr)
Ashburton-Rakaia	**Red**		total	640			
		1	3.6	110	MEDIUM	Mixed	**26**
		2	2.0	200	MEDIUM	Grazing	**16**
		4	3.0	330	MEDIUM	Crop	**22**
Valetta-Mayfield-Hinds	**Red**			755			
		5	2.2	275	MEDIUM	Crop	**16**
		8	3.0	200	LIGHT	Grazing	**49**
		9	3.6	280	LIGHT	Grazing	**49**
Rangitata Orari	**Red**			200			
		13	4.0	200	LIGHT	Grazing	**55**
Ashley - Waimakariri	**Red**			470			
		16	3.2	250	LIGHT	Dryland sheep	**43**
		17	2.7	220	MEDIUM	Grazing	**15**
Selwyn Waihora	**Red**			1100			
		14	2.9	700	LIGHT	Dryland sheep	**39**
		15	2.0	400	LIGHT	Grazing	**29**
Ashburton	**Orange**			870			
		18	2.8	300	Medium	Grazing	**21**
		7	3.8	330	HEAVY	Crop	**25**
		3	2.1	240	Medium	Mixed	**16**
Orari	**Orange**			720			
		10	3.3	200	LIGHT	Grazing	**39**

		11	2.8	320	LIGHT	Grazing	**49**
		12	2.5	200	LIGHT	Grazing	
Makikihi	**Orange**						
		19	2.3	300	HEAVY	Mixed	**9**
Waihao	**Orange**						
		20	2.5	200	HEAVY	Grazing	**9**
Washdyke	**Orange**			670			
		6	3.0	100	HEAVY	Grazing	**20**
		21	3.3	300	HEAVY	Crop	**13**
		22	1.7	270	HEAVY	Grazing	**9**
Pareora	**Orange**						
		23	2.7	300	Medium	Grazing	**12**
Upper Waitaki	**Orange**						
		24	3.3	200	Medium	Grazing	**12**
Opihi	**Orange**						
		25	2.9	120	Light	Grazing	**40**
Ashley	**Orange**						
		26	1.1	220	Light	Grazing	**36**
Hakataramea	**Orange**						
		27	2.4	220	Medium	Grazing	**12**

Land use description
Dryland Sheep
Grazing = Irrigated - 60% Grazing (sheep) 40% crop
Mixed = Irrigated - 70% crop 30% sheep
Crop = Irrigated - 100% arable

APPENDIX TWO - Assumptions in OVERSEER.

Dairy conversions in 'Red' and 'Orange' zones (Canterbury).

1. Nearest town used to determine ET + Temp. For Ashburton Zone have used Timaru. (Option is between Timaru and Christchurch).
2. Effluent Block sized to achieve 100kgN/ha/yr (in effluent). Effluent application depth <12mm.
3. Dairy replacements are grazed off the milking platform.
4. Effluent system consists of holding pond and operating at good practice. Pond solids spread onto main pasture block every 2 years.
5. Imported silage @ 400kgDM/cow, fed on paddocks. No supplements made on milking platform.
6. Friesian cows - Twice a day milking.
7. All cows grazed off platform for June & July.
8. Production @ 400kg Ms/cow.
9. Flat topography
10. Distance from coast – used optional default (from dairy industry protocol) of '30'.
11. Annual Rainfall – Taken from Massey University Effluent Pond Calculator (30 year annual average).
    a. Ashburton Zone – 682mm (Ashburton City Council Recorder)
    b. Selwyn Waihora – 600mm (Lincoln Recorder)
    c. Waimakariri – 598mm (Christchurch Aero club Recorder)
    d. Orari-Opihi-Pareora – 543mm (Timaru Aero club Recorder)
    e. Waitaki – 566mm (Waimate Recorder)
12. Soil types (classified as per Canterbury Regional Council technical report)
    a. Light – Lismore stony silt loam (stony topsoil texture +Lower profile = Light)
    b. Medium – Templeton silt loam
    c. Heavy – Temuka silt loam
    d. Soil texture – Medium (for all soil types).
13. Pugging – Occasional.
14. Ryegrass/white clover pasture.
15. Inputs from effluent (where applicable) and fertiliser of 250kg N/ha/year across all blocks. Applied as combination of Urea and (where applicable) farm dairy effluent. Urea spread in Sept, Oct, Dec, Feb, Mar
16. Pastoral Irrigation from October-April via pivot/lateral irrigation system. Method only entered into model.