BEFORE THE CANTERBURY REGIONAL COUNCIL

In the matter of The Resource Management Act 1991

Between

CANTERBURY REGIONAL COUNCIL

Consent Authority

And

IRRICON RESOURCE SOLUTIONS LIMITED

PYE PARTERNHIP, SOUTH STREAM, GRANTLEA & CLOVERDENE DAIRIES, AND HIGHFIELD FARM HOLDINGS

ME MULLIGAN

I KERSE

TURLEY FARMS LIMITED

Submitters

EVIDENCE OF NICOLE IRENE PHILLIPS FOR HEARING TWO (FARMING RULES)

INTRODUCTION

1. My full name is Nicole Irene Phillips

2. I graduated from Lincoln University in 2002 with a Bachelor of Science, with an environmental monitoring, management and soils science emphasis.

3. I achieved a certificate of completion from Massey University in 2010 for satisfying the course requirements for the Certificate in Sustainable Nutrient Management in New Zealand and followed this in 2011 with a certificate of completion for the Advanced Sustainable Nutrient Management– these are essentially the 'OVERSEER®' qualifications.

4. Having obtained the required OVERSEER ® qualifications as outlined above in 2011, I have spent the last 12 months completing OVERSEER ® modelling and auditing OVERSEER ® for clients throughout Canterbury and have a good understanding of OVERSEER ® v6.0, using this modelling tool on a daily basis.

SCOPE OF EVIDENCE

5. My evidence covers the following topics:
    a. OVERSEER ® v6.0 modelling - farm scenarios where issues were apparent with the use of OVERSEER ®
    b. The definition of "stock unit".

OVERSEER ® V6.0 MODELLING

6. OVERSEER® is an agricultural management tool which assists farmers and their advisers to assess nutrient use and movements within a farm to identify possible environmental effects (and to optimise farming outcomes). The computer model calculates and estimates the nutrient flows in a productive farming system and identifies risk for environmental impacts through nutrient loss, including both run off and leaching.

7. The model is now in widespread use throughout New Zealand.

8. There are 3 main assumptions underpinning the use of OVERSEER ® as a modelling tool. They are:

    a. <u>Annual Average</u> – The model uses annual average inputs (e.g averaged over a number of years) and produces annual average outputs.
    b. <u>Near equilibrium conditions</u> – Model assumes that the farm is at a state where there is minimal change each year.
    c. <u>Actual and reasonable inputs</u> – Also assumes Best Management Practices.

9. OVERSEER ® uses animal stocking rate and productivity to estimate animal requirements (MJME) which is then in turn used to estimate pasture production. <u>It is an animal driven model.</u>

10. Since August 2012, I have audited or prepared over 100 OVERSEER ® files in my role as a Consultant, generally to determine if the particular application for resource consent is a 'change' in land use as defined in the pLWRP. This has given me a good understanding of the complexity of the input data required in OVERSEER ® v6.0 and also how sensitive the model is to particular input data.

11. The following examples have been selected to show the complexity of OVERSEER ® as a modelling tool and also the constant changes to outputs from the model as maintenance releases are required to the engine driving the model due to reported problems with the

model operation, as well as the difficulties and complexity with using OVERSEER ® as a limit setting tool within a consenting framework.

12.

13. It is not debated that OVERSEER ® as a tool to compare/assess the effects of changes in a farming operation is useful but the constant updates to the model ensure that the outputs generated on any given day may not be comparable to outputs generated on another day due to changes in the model operation.

Farm 1 – Increase in annual volume and cow numbers

14. I was requested to audit files for an applicant that received a request for further information, to consider if their application increase their annual volume to ensure greater reliability of supply of irrigation water and to increase cow numbers triggered the requirement for land use consent.

15. The applicant began the conversion process to dairy in mid 2012 and commenced milking in August 2012.

16. Prior to this the property was a dairy grazing and cropping farm.

17. I received three OVERSEER ® files from the applicants Fertiliser Representative; being previous, current and proposed.

18. The definition of 'change' in the pLWRP stated that the baseline to determine if a proposed activity was an increase in nitrogen lost to water was from 1 July 2011to 30 June 2013. This was the sole reason why an OVERSEER ® nutrient budget was completed for the previous land use.

19. The outputs generated by OVERSEER ® on the **15th March** based on the above information are detailed below:

OVERSEER ® v6.0.2	Previous	Current	Proposed
Nitrogen lost to water kg/ha/yr	32	40	37
Total N losses kg/farm	7006	8820	8226

20. A Nitrogen loss report was provided to ECAN on the 15th March along with the OVERSEER ® xml files to audit. XML files are the electronic files of the OVERSEER ® modelling.

21. An email was received from ECAN on the 19th March, indicating that the reports from the OVERSEER ® v6.0.2 files supplied on the 15th March were unable to be generated due to errors.

22. An email received from Agresearch on Monday 18th March indicated that a maintenance release of OVERSEER ® had been made to the internet version on the 17th March to address known errors and changes to the engine system of OVERSEER ®.

23. The OVERSEER ® files for the current and proposed files were amended on the 19th March based on the error messages that were ensuring that the output reports could not be generated. No other changes were made to the files, other than those changes that were required to remove the error messages that were stopping the generation of the output reports. These are as follows:
    a. Changes made: Current file – checked the final harvest box in previous year kale crop, removed milk shed feeding in May

b. Proposed file – removed milk shed feeding in May

24. The outputs generated by OVERSEER ® v6.0.3 on the **19th March** after the amendments to the current and proposed files are detailed below:

OVERSEER ® v6.0.3	Previous	Current	Proposed
Nitrogen lost to water kg/ha/yr	31	36	31
Total N losses kg/farm	6892	7857	6897

25. As can be seen in the tables above due to the maintenance release on the 17th March the outputs generated from OVERSEER ® v6.0.3 changed for all three scenarios. This included the previous scenario when no changes were made to the input data.

26. Whilst OVERSEER ® version 6 is still a relatively new system, it will require on-going maintenance releases to address issues with the engine of the model. This in turn creates changes to the outputs. If nitrogen limits are applied to resource consent as a condition of consent, the constant upgrading of OVERSEER ®, and consequently the outputs, means that a "limit" calculated on any given day and time may bear no resemblance to that calculated tomorrow, therefore it should not be used at this stage to set nutrient loss limits on resource consents.

27. I agree with the s42a report that states that there is an opportunity to 'step back from OVERSEER ® in the interim period to enable it to be developed more fully and gain the required confidence' (page 73).

Farm 2 – Dairy Conversion

28. In March I was asked to audit two OVERSEER ® files for an applicant in Southland that was proceeding to a council hearing after an application to convert to dairying was notified.

29. My brief was to audit the files for consistency and accuracy.

30. The modelling scenarios were completed by 2 different consultants for the applicant.

31. The following outputs were generated in the initial modelling provided to me:

OVERSEER ® v6.0.2	Current	Proposed
Nitrogen lost to water kg/ha/yr	48	33

32. After auditing the files, I noticed that there were some fundamental differences in several of the inputs between the files, especially relating to soil profile, climate and irrigation method, and the method in which stock numbers were entered.

33. This in effect created two files that were not comparing the same farm, although the applicant's consultants were both modelling their own opinions of the applicant's farm.

34. I was asked to amend the files to ensure consistency and accuracy of the files for the hearing process. I completed this and the outputs changed to the following:

OVERSEER ® v6.0.2	Current	Proposed
Nitrogen lost to water kg/ha/yr	35	38

35. As you can see, the amendments dramatically changed the outputs and also showed that in the proposed scenario was losing more Nitrogen to water than the current scenario, a complete contrast to results of the original modelling.

36. This audit process significantly changed the applicant's evidence that was needed to be presented at their hearing.

37. Even with two qualified OVERSEER ® users completing the modelling, the inputs required in OVERSEER ® v6.0 are so complex and different techniques or understanding of the input data required can lead to very different outputs.

38. It also shows that a National and a Canterbury Regional Protocol needs to be developed prior to OVERSEER ® being used as a nutrient limit setting tool in Resource Consents, to ensure that the same input data is being used across Canterbury.

<u>Farm 3 – Pahau Flats Dairy Ltd (in support of Keri Johnston's evidence)</u>

39. Pahau Flats Dairy Ltd are purchasing a 380ha irrigated property. A dairy conversion is proposed and also a conversion from borderdyke irrigation to primarily centre pivot spray irrigation.

40. Ms Johnston evidence has provided the background detail on this property.

41. Two OVERSEER ® scenarios were required to be modeled; an existing scenario and then a proposed scenario. The existing scenario was a primarily borderdyke irrigated sheep, beef and grain crop property and the proposed scenario was a dairy farm with a spray irrigation conversion.

42. Within OVERSEER® irrigation application rates are entered on a monthly basis. The irrigation type e.g. borderdyke or centre pivot is selected, the month is selected and then the application rate for that month is entered.

43. OVERSEER ® assumes best practice is adhered too when applying irrigation water.

44. The application rate per month for a borderdyke system when compared to a spray irrigation system will, in most instances, be very similar. The issue is that in a borderdyke system such as that at Pahau Dairy Flats Ltd, the monthly application rate is applied in approximately 2 applications/month (17 day return period) whereas the application rate for a centre pivot system is applied evenly across the whole month.

45. The application rate at Pahau Flats Dairy Ltd is 150mm/month. This equates to 5mm/day (applied at a rate of 15mm every three days) in a centre pivot system, whereas for a borderdyke system, it is still 5mm/day, but applied at a rate of 75mm once every 17 days. By only entering application rates on a monthly basis in Overseer, the application rate for both systems is the same, at 150mm per month.

46. The drainage rates under the 2 systems should be significantly different due to the very different volumes of water per application.

47. The PAW_{30} of the Pahau soil type is 62mm. Applying 15mm every three days under a centre pivot system ensures that the PAW_{30} is not exceeded and the water application is even and uniformly distributed.

48. Under the borderdyke system the application rate is 75mm per application every 17 days then the PAW_{30} of the Pahau soil is exceeded by 13mm every application and therefore significantly more drainage over the course of a year should be occurring than that under centre pivot irrigation.

49. The drainage volumes modelled by OVERSEER ® for the two different systems are shown below. It is noted that OVERSEER only models a difference in drainage of 59mm/year between the two irrigation systems

Drainage volumes Pahau Soils	Existing – borderdyke	Proposed-spray irrigation
Drainage mm/yr	263	204
Outwash mm/yr	63	

50. ECan report R10/127 'Estimating nitrate-nitrogen leaching rates under rural land uses in Canterbury' clearly shows that the estimated long term annual average drainage rates under borderdyked land is significantly more (at least four times as much) as under spray irrigation (Pahau medium soil, spray irrigation drainage = 150mm, borderdyke irrigation drainage = 610).

51. OVERSEER ® does not model the difference in the drainage as would be expected when converting from borderdyke irrigation to spray due to the ability to only input irrigation application rates per month.

STOCK UNIT DEFINITION

52. It is noted that the s42a report for the farming rules has recommended significant changes to the definition of 'change' (page 82).

53. The most significant recommendation is the removal of OVERSEER ® modelling to determine a change and the introduction of a stock unit and arable yield component.

54. Whilst these changes are agreed with in principle, there is a need for the pLWRP rules to define the value that will be attributed to each stock type, in order that all applicants and the Regional Council are using the same figures for stock type to calculate whether there is an increase of greater than 10%.

55. The basic stock unit is one breeding ewe that weighs 55kg and produces one lamb, this assumes that this ewe consumes 550 kg dry matter over a year (this includes the feed her lamb consumes up until weaning.

56. A beef breeding cow is then given a value of 6.0 stock units assuming she consumes 6 times more feed that the ewe.

57. Different organisations and consultants have adopted different ways to measure stock units, so it is imperative that the value attributed to each stock type, from lambs to milking and dry dairy cows is defined in the pLWRP.

Nicole Phillips

Dated: 2 April 2013

Annexure 1 – Farm 1 – OVERSEER ® Nitrogen output reports

Previous scenario – 15th March

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview
Phosphorus overview | Greenhouse gases | Energy | Footprint units | Footprint product
Pasture production | Other values | Full parameter report

Block name	Total N lost kg N/yr	N lost to water kg N/ha/yr	N in drainage * ppm	N surplus kg N/ha/yr	Added N ** kg N/ha/yr
Wheat	412	12	5	129	264
Oats	1017	27	11.3	230	260
Clover	109	5	2	452	205
Peas	350	17	6.6	-29	54
Kale	1451	44	18.5	312	228
Pasture	3652	53	17.8	284	138
Other sources	16				
Whole farm	7006	32			
Less N removed in wetland	0				
Farm output	7006	32			

Previous Scenario 19th March

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview
Phosphorus overview | Greenhouse gases | Energy | Footprint units | Footprint product
Pasture production | Other values | Full parameter report

Block name	Total N lost kg N/yr	N lost to water kg N/ha/yr	N in drainage * ppm	N surplus kg N/ha/yr	Added N ** kg N/ha/yr
Wheat	411	12	5.6	129	264
Oats	976	26	**12.1**	228	260
Clover	128	6	2.4	450	205
Peas	391	20	7.8	-30	54
Kale	1398	42	**19.4**	310	228
Pasture	3572	52	**20.7**	284	138
Other sources	16				
Whole farm	6892	31			
Less N removed in wetland	0				
Farm output	6892	31			

Current scenario 15th March

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Greenhouse gases | Energy | Footprint units | Footprint product | Effluent | Pasture production | Other values | Full parameter report

Block name	Total N lost	N lost to water	N in drainage *	N surplus	Added N **
	kg N/yr	kg N/ha/yr	ppm	kg N/ha/yr	kg N/ha/yr
Effluent	4708	67	22.6	312	305
Non Effluent	2928	62	21	261	249
Grass Seed	244	5	2.3	307	171
Wheat	53	4	1.8	134	264
Kale	705	39	16.1	190	241
Canola	108	5	2	150	280
Other sources	75				
Whole farm	8820	40			
Less N removed in wetland	0				
Farm output	8820	40			

Current Scenario 19th March

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Greenhouse gases | Energy | Footprint units | Footprint product | Effluent | Pasture production | Other values | Full parameter report

Block name	Total N lost	N lost to water	N in drainage *	N surplus	Added N **
	kg N/yr	kg N/ha/yr	ppm	kg N/ha/yr	kg N/ha/yr
Effluent	3962	57	**22.6**	311	304
Non Effluent	2480	53	**21.1**	260	249
Grass Seed	339	7	3.3	307	171
Wheat	60	5	2.2	126	264
Kale	841	47	**19.8**	216	241
Canola	100	5	2.2	150	280
Other sources	74				
Whole farm	7857	36			
Less N removed in wetland	0				
Farm output	7857	36			

Proposed scenario 15th March

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Greenhouse gases | Energy | Footprint units | Footprint product | Effluent | Pasture production | Other values | Full parameter report

Block name	Total N lost	N lost to water	N in drainage *	N surplus	Added N **
	kg N/yr	kg N/ha/yr	ppm	kg N/ha/yr	kg N/ha/yr
Effluent	3104	44	14.9	208	200
Non Effluent	4697	43	14.4	191	184
Barley	330	9	3	73	165
Other sources	95				
Whole farm	8226	37			
Less N removed in wetland	0				
Farm output	8226	37			

* N concentration due to leaching in drainage water at the bottom of the root zone. Maximum recommended level for drinking water

Proposed scenario 19th March

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen overview | Phosphorus overview | Greenhouse gases | Energy | Footprint units | Footprint product | Effluent | Pasture production | Other values | Full parameter report

Block name	Total N lost	N lost to water	N in drainage *	N surplus	Added N **
	kg N/yr	kg N/ha/yr	ppm	kg N/ha/yr	kg N/ha/yr
Effluent	2578	37	**14.7**	207	199
Non Effluent	3893	35	**14.2**	187	184
Barley	314	9	3.2	72	165
Other sources	94				
Whole farm	6879	31			
Less N removed in wetland	0				
Farm output	6879	31			

Annexure 2: Pahau Flats Dairy Ltd – other values output reports

Existing Sheep and beef borderdyke farm

Nutrient budget | Nitrogen | Phosphorus | Graph - N pools | Graph - changes in N pools
Comments | Maintenance nutrients | Relative yield | Other values

Other outputs for **Borderdyke Pahau**

This report shows calculated output values that are not reported elsewhere.

Parameter	Value
Relative yield (from soil tests & fertiliser)	93
Pasture utilisation (%)	70
Total estimated irrigation (mm/yr)	537
Total AET (mm/yr)	861
Total drainage (mm/yr)	263
Total runoff (mm/yr)	0
Total irrigation out wash (mm/yr)	63
Field capacity (mm to 60cm)	182
Wilting point (mm to 60 cm)	88
AWC (mm to 60 cm)	94
$ on fertiliser per ha	$0.00
Artifical wetland: Efficiency (%)	0
Artifical wetland: N removed (kg N/ha/yr)	0

Download this report

Existing scenario Nitrogen output report

Nutrient budget | Nitrogen | Phosphorus | Graph - N pools | Graph - changes in N pools
Comments | Maintenance nutrients | Relative yield | Other values

Block name	Total N lost	N lost to water	N in drainage *	N surplus	Added N **
	kg N/yr	kg N/ha/yr	ppm	kg N/ha/yr	kg N/ha/yr
Borderdyke Pahau	4123	27	6.9	151	0
Pivot pahau	668	17	8.2	201	83
Hardhose Gun pahau	144	14	6.4	150	0
Lucerne irr BD	216	17	3.0	533	0
Barley spring irr gun	2143	43	**20.6**	115	76
Kale irr BD - waimak	491	25	10.1	302	107
Dryland waimak	402	10	7.5	73	0
Dryland Pahau	193	6	5.8	73	0
Borderdyke Waimak	602	35	9.7	151	0
Other sources	12				
Whole farm	8993	23			
Less N removed in wetland	0				
Farm output	8993	23			

Proposed dairy and spray conversion

Nutrient budget | Nitrogen | Phosphorus | Graph - N pools | Graph - changes in N pools

Comments | Maintenance nutrients | Relative yield | Other values

Other outputs for **Milking platform pahau**

This report shows calculated output values that are not reported elsewhere.

Parameter	Value
Relative yield (from soil tests & fertiliser)	98
Pasture utilisation (%)	85
Total estimated irrigation (mm/yr)	415
Total AET (mm/yr)	861
Total drainage (mm/yr)	204
Total runoff (mm/yr)	0
Field capacity (mm to 60cm)	182
Wilting point (mm to 60 cm)	88
AWC (mm to 60 cm)	94
$ on fertiliser per ha	$0.00
Artifical wetland: Efficiency (%)	0
Artifical wetland: N removed (kg N/ha/yr)	0

Download this report

Proposed dairy conversion Nitrogen output report

Nutrient budget | Nitrogen | Phosphorus | Graph - N pools | Graph - changes in N pools

Comments | Maintenance nutrients | Relative yield | Other values

Block name	Total N lost	N lost to water	N in drainage *	N surplus	Added N **
	kg N/yr	kg N/ha/yr	ppm	kg N/ha/yr	kg N/ha/yr
Milking platform pahau	5606	35	**17.2**	264	240
Effluent area pahau	3721	37	**18.2**	322	299
Milking Platform Waimak	5731	44	**21.0**	257	240
Other sources	287				
Whole farm	15345	39			
Less N removed in wetland	0				
Farm output	15345	39			