

**IN THE MATTER** of the Resource Management Act 1991  
**AND**  
**IN THE MATTER** of the hearing of submissions on  
Proposed Plan Change 3 to the Land and  
Water Regional Plan

**BY** **OTAIO WATER USERS GROUP**  
**Submitters**

**TO** **CANTERBURY REGIONAL COUNCIL**  
**Local Authority**

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**BRIEF OF EVIDENCE OF ROSS RATHGEN**

Dated: 10 November 2015

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**GALLAWAY COOK ALLAN  
LAWYERS  
DUNEDIN**

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## **SUBMISSION**

1. My name is Ross Rathgen and I have lived in this area all my life and farm several properties in the mid to lower Otaio River catchment. I hold the current positions:
  - Deputy Chairman of Hunter Downs Irrigation Ltd (HDIL)
  - Director of Hunter Downs Development Company Ltd (HDDCL)
  - Member of the NARG (Nitrogen Allocation Reference Group)
2. Our properties are one of 7 monitor farms throughout Canterbury participating in a programme to reduce nitrogen leaching while sustaining production and profit. There are 50 scientists working with this challenge on the Forages for Reduced Nitrate Leaching (FRNL) programme. This programme is combining their expertise and resources from six organisations – Dairy NZ, AgResearch, Plant & Food Research, Landcare Research, Lincoln University and the Foundation for Arable Research.
3. Our properties have been chosen because we are able to supply information for cropping and dairying, this cross-sector project is focusing on three areas – alternative pasture species, crops and farm systems. We are contributing information to the programme for 5 seasons.
4. Information collected includes daily grazing and supplementary feed records, application levels of effluent, fertiliser and irrigation and stock and feed movements. This will help determine the effects of management on crop and pasture yield and quality, the farm's nutrient budget, and profit.
5. We are actively trying to reduce Nitrate Leaching by using lesser amounts of water when irrigating, and increasing the frequency of irrigating. Our fertiliser programme has also been changed, we are now using a slow release product.

6. The introduction of feed pads at the dairy units ensures all supplements are restricted to just these areas and our development of pastures has enabled us to introduce herbs into the replacement pastures which is possibly reducing nitrogen leaching.
7. Approximately 33 years ago we bought our first farm beside the Otaio River at Grays Crossing. It was 2,200 ha and had a small consent to take water from the Otaio River. This was the reason we purchased the farm, to enable us to irrigate. Over the next four years we increased our consent (CRC920874) to take up to 32,500 cubic metres per week at a maximum rate of 60 l/s. We invested in infrastructure to irrigate more land and so we could grow more intensive crops.
8. As time went on we purchased more property in the immediate area and down towards the coast. We now own 1,300 ha of land in total. On these properties we put deep bores down about 120-130 metres deep to provide a reliable water supply.
9. This enabled us to complete two dairy farm conversions. We completed the first one 8 years ago and the other 2 years ago. We milk 1100-1200 cows on each platform.
10. In 2012 we purchased another property beside the Otaio River, on Bluecliffs Road, which has a consent (CRC136604) to take up to 27,720 cubic metres of water per week at a maximum rate of 55 l/s. This consent to take water enables us to grow specialty crops on this property such as rye grass, carrots and beet seed. To secure growing contracts for these crops having irrigation is paramount. The difference of having water is on these crops is shown in Appendix 1. You can see by these figures that for these crops it is important to keep the water up to them. With the ryegrass crops they are of value after harvest, and by keeping the water on them they will grow high levels of dry matter as shown on the pasture growth data.

11. Our other crops are starting to ripen off from December onwards, so do not require as much water. This then allows us to concentrate on the specialty crops as they usually mature later. The report from Simon Harris completed for ECan dated 2 March 2015 illustrates the impact of the proposed minimum flow rules, for the Otaio catchment. From my perspective, this report shows how unreliable water supply will be at crucial times of the year. The proposed minimum flow will make the specialty crops we grow at Grays Crossing not a viable option unless an alternative water source can be found.
12. We have obtained consents to change from shallow water to deep water bores at our Grays Crossing property. We did not know whether we would be successful this far inland as there had been limited success in the past for deep water in this area. We drilled 5 deep bores costing approx. \$300,000 without any success. That is no longer an option for us.
13. The repercussions of a minimum flow at the Otaio Gorge will have a huge impact on us. It would have stopped us irrigating completely in December last year. It looks like the same situation this year with the river levels being less now than they were at the same time last year.
14. Under Plan Change 3 we have negotiated to have the facility to change our river water consents to deep bore water. We think we can do this on the property at Bluecliffs Road, as we have other deep water bores in the same area. To achieve this there will be a high cost involved and no real guarantee of water, I have set this out at Appendix 2. This shows the level of capital cost that would be required to do the install, setup and power for two different bores at 120 metres, taking different rates (l/s).
15. Even though this has been provided for under the new Plan ECan are now stating that we can only change over what we can demonstrate we have used in the last 5 seasons. We have not been monitoring for that

long so will not have that information. Further to that, I don't think this is a fair way to determine water demand. The two seasons of data we do have are wildly different. The first season was not a dry season and consequently water was not needed as much, the second season (last year) we could not get our full allocation due to low flows. To offset the increased costs of a deep water supply we need our full allocation of river water every season just to maintain our profitability. The operating cost of power will be approximately 3 times more than using shallow water.

16. If it has been a dry summer our limited shallow water for our cropping farm is of great use in the autumn. This is after our specialty crops come out and ground is re-sown to grow winter feed for our dairy stock. Most of our winter feed crops are grown on dryland, they do not grow enough feed for our winter grazing requirements.
17. We have been actively doing nutrient budgets for the last two years. On both our dairy units we have put in feed pads to reduce the nitrogen leaching and to save our pastures when it is wet. All supplement feeding is fed to cows on these feed pads in wet conditions.
18. We have developed our irrigation systems with efficient pivot irrigators, changing away from laterals and guns. This enables us to put on a very small amount of water each round, 5mm/ha at a time, which ensures minimal run off and maximum water use efficiency.
19. Under OVERSEER Version 6.1.1 for one of our dairy units, St Andrews Dairy, we were 15kg/ha of N under OVERSEER Version 6.2 we are now 28kg/ha of N, despite nothing about the farming system changing. Refer to Appendix 3A, 3B, 4A, 4B, 4C and 4D.
20. Our cropping land which has some irrigation went from 13 kg/ha/year of N under OVERSEER 6.1.1 to 17 kg/ha/year of N under OVERSEER 6.2. Refer to Appendix 5.

21. Under Plan Change 3 we will have to take our stock water out of our consented irrigation water, which works out at 84,000 litres per day per dairy unit. This change will further reduce our irrigation reliability.
22. As I said earlier, I have lived in this area all my life and know the characteristics of the Otaio River very well. Prior to there being much irrigation water being taken from the river it would stop flowing on the surface and run amongst the shingle pans. I have not noticed any deterioration in the water quality over the years as more side streams are being fenced off. There are always pools of water left in the river when it dries up, consequently we keep an eye out for stranded fish. Last year we found the most stranded fish than we have in a long time, given it was an extremely dry season.
23. We do look out for our environment as we do not want it to get any worse, and do want it to improve. We have set aside some land on Lyalls Road, St Andrews for the community to contribute to saving the Mudfish, as their habitat is fed from springs on the property. When we purchased this property 8 years ago it came with irrigation rights but we have chosen not to use it in the past and will not use it in the future. We are actively working in partnership with Working Waters Trust, St Andrews School, ECan, and DOC to ensure the longevity of this project. To look after the Mudfish and their habitat, we have spent money on developing new ponds to increase numbers, plus fencing, planting native riparian plants and made access easier for the public to view.
24. By restricting our water use from the Otaio River, I cannot see what benefits it will have as the river will still dry up and put additional high costs onto us. This means that we have less funds to put towards other environmental improvements that have tangible benefits.

**Ross Rathgen**

10 November 2015

**APPENDIX 1**  
**(to Evidence of Ross Rathgen)**

## Gross Figures

### Irrigation

Ryegrass 150mm water applied

Seed	1500	\$	2.30	\$	3,450.00
Bales	20	\$	65.00	\$	1,300.00
Pre Harvest DM Grazed	2000	\$	0.22	\$	440.00
Post Harvest DM grazing to date	500	\$	0.22	\$	110.00
GROSS PROFIT				\$	5,300.00

Winter Wheat heavy ground 125mm water applied

Seed	10.5	\$	400.00	\$	4,200.00
Bales	8	\$	35.00	\$	280.00
				\$	4,480.00

Winter Wheat light ground 125mm water applied

Seed	10	\$	400.00	\$	4,000.00
Bales	8	\$	35.00	\$	280.00
				\$	4,280.00

Spring Wheat 90mm water applied

Seed	8	\$	400.00	\$	3,200.00
Bales	8	\$	35.00	\$	280.00
				\$	3,480.00

Carrots 125mm water applied

Seed	900	\$	12.50	\$	11,250.00
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### Dryland

Ryegrass 0mm water applied

Seed	1100	\$	2.30	\$	2,530.00
Bales	8	\$	65.00	\$	520.00
Pre Harvest DM Grazed	1200	\$	0.22	\$	264.00
Post Harvest DM grazing to date	100	\$	0.22	\$	22.00
GROSS PROFIT				\$	3,336.00

Winter Wheat Heavy ground 0mm water applied

Seed	9.5	\$	400.00	\$	3,800.00
Bales	6	\$	35.00	\$	210.00
				\$	4,010.00

Winter Wheat light ground 0mm water applied

Seed	7	\$	400.00	\$	2,800.00
Bales	4	\$	35.00	\$	140.00
				\$	2,940.00

Spring Wheat 90mm water applied

Seed	5	\$	400.00	\$	2,000.00
Bales	5	\$	35.00	\$	175.00
				\$	2,175.00

Carrots 0mm applied

seed	600	\$	12.50	\$	7,500.00
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Beet 125mm water applied  
Seed

2000 \$ 3.40 \$ 6,800.00

Beet 0mm water applied  
Seed

1100 \$ 3.40 \$ 3,740.00

Oats 75mm water applied

Seed 6.5 \$ 625.00 \$ 4,062.50  
Bales 6 \$ 40.00 \$ 240.00  
\$ 4,302.50

Oats 0mm water applied

Seed 5 \$ 625.00 \$ 3,125.00  
Bales 4 \$ 40.00 \$ 160.00  
\$ 3,285.00

Pasture 2.1mm/day applied

Pasture growth 70KgDM/ha day Based on St Andrews dairy figures

	DM	Cents/kg
october 70KgDM/ha	2170	\$ 0.22 \$ 477.40
november 70KgDM/ha	2100	\$ 0.22 \$ 462.00
december 70KgDM/ha	2170	\$ 0.22 \$ 477.40
january 70KgDM/ha	2170	\$ 0.22 \$ 477.40
		\$ 1,894.20

Pasture 2.1mm/day applied

Pasture growth 70KgDM/ha day Based on St Andrews dairy figures

	DM	Cents/kg
october 50kgDM/ha	1550	\$ 0.22 \$ 341.00
november 30kgDM/ha	900	\$ 0.22 \$ 198.00
december 1Kg/DM/ha	31	\$ 0.22 \$ 6.82
january 1Kg/DM/ha	31	\$ 0.22 \$ 6.82
		\$ 552.64

Winter Feed after crop 75mm applied

5000 \$ 0.22 \$ 1,100.00

Winter Feed after crop 0mm applied

2000 \$ 0.22 \$ 440.00

**APPENDIX 2**  
**(to Evidence of Ross Rathgen)**

35lts/sec			
Bore	120mtrs	\$60,000.00	Cost of drilling five bores
Pump		\$41,000.00	
Stater		\$27,000.00	
Filter		\$15,000.00	
Power		\$20,000.00	
		\$163,000.00	\$300,000.00
80lts/sec			
Bore	120mtrs	\$60,000.00	
Pump		\$150,000.00	
Starter/Filter		\$93,000.00	
Power		\$20,000.00	
		\$323,000.00	

**APPENDIX 3A**  
**(to Evidence of Ross Rathgen)**

St Andrews Dairy

Angela Darke

St Andrews Dairy

Ballance Key Accounts

Client reference: 4036155

Farm name: St Andrews Dairy 2012/2013 (2012/2013)

## Farm Nutrient Budget - Whole farm



	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
<b>Nutrients added</b>							
Fertiliser, lime & other	218	68	0	71	106	0	0
Rain/clover N fixation	111	0	3	5	2	5	33
Irrigation	11	0	7	11	40	10	41
Supplements imported	65	13	46	6	9	6	3
<b>Nutrients removed</b>							
As products	165	29	38	10	39	3	11
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	83	0	0	0	0	0	0
To water	15	0.8	15	75	42	1	4
<b>Change in internal pools</b>							
Plant material	0	0	0	0	0	0	0
Organic pool	143	12	5	11	1	1	0
Inorganic mineral	0	7	-28	0	-1	-1	-1
Inorganic soil pool	0	33	26	0	79	29	64

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**APPENDIX 3B**  
**(to Evidence of Ross Rathgen)**

St Andrews Dairy

Angela Darke

St Andrews Dairy

Ballance Key Accounts

Client reference: 4036155

Farm name: St Andrews Dairy 2012/2013 (2012/2013)



## Parameters

### Farm details

Type	Farm type	Full range
Assessment	Assessment year	Not entered
Region	Region	Timaru

### Farm blocks

Pasture1-Old Effluent Block	Pastoral	69
Pasture1-Non Effluent Area	Pastoral	83
Pasture3-New Effluent Area	Pastoral	62
Pasture4-West End Non Effluent	Pastoral	63
Stock Excluded	Trees and Scrub	10
Total farm area declared in blocks	ha	287
Total farm area	ha	287
Non-productive area	ha	0

### Farm animals

#### Stock numbers

Stock numbers entered via RSU - Dairy

Peak number of cows milked	1250
Breed	F x J cross
Replacements grazed off farm from	Off farm from weaning
Replacement grazing	% Not entered

#### Production

Milk solids	kg/yr	620000
Milk volume yield	l/yr	Not entered
Fat yield	kg/yr	Not entered
Lactation length	days	Not entered
Average weight	kg/animal	Not entered

#### Calving times

Default calving times used

#### Winter grazing off of breeding stock

Grazed out most of farm prior to removal of animals	False
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#### Months grazing off

June	%	100
July	%	100
August	%	50

#### Stock management

##### Time spent on structure

January	100	0
February	100	0
March	100	0
April	100	0

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St Andrews Dairy

Angela Darke

St Andrews Dairy

Ballance Key Accounts

Client reference: 4036155

Farm name: St Andrews Dairy 2012/2013 (2012/2013)



## Parameters

August	100	0
September	100	0
October	100	0
November	100	0
December	100	0

Dairy - Feed pad

Effluent management

Manure removal method	Scraping (no water)
Solid disposal method	Spread on selected blocks
Solid storage method	Open (to rain)
Time in storage	months 12

Time spent on structure

January	70	1
February	85	1
March	100	1
April	100	2
August	30	1
September	80	1
October	70	1
November	70	1
December	70	1

Animal excreta distribution

Relative productivity assessment method	No difference between blocks
All blocks have a relative productivity value of 1	
Ratio of stock types on pastoral blocks is the same as the farm stock ratios	

Farm dairy effluent disposal system

Effluent disposal method	Spray from sump
Solid separation and disposal	False

Animal health supplements

Animal - Dairy

Total amount of product applied per years for drenching, pasture dusting or adding to supplements

Magnesium oxide	kg/yr	5000
Magnesium sulphate	kg/yr	5000
Magnesium chloride	kg/yr	0
Salt	kg/yr	1000
Lime flour	kg/yr	2000

Animal - DairyReplacement

No animal supplementation has been entered

Left over feeding

No left over feeding specified  
No supplements from storage added to this farm

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St Andrews Dairy  
 St Andrews Dairy  
 Client reference: 4036155  
 Farm name: St Andrews Dairy 2012/2013 (2012/2013)

Angela Darke  
 Ballance Key Accounts



# Parameters

## Imported supplements

### Supplement information

Conservation type  
 Name  
 Pasture type

Straws  
 Ryegrass straw

### Supplement amount

Dry weight basis T  
 Utilisation  
 Destination  
 Animal

50  
 Very good  
 Feed pad  
 Dairy

### Supplement information

Conservation type  
 Name  
 Pasture type

Grains  
 Wheat grain

### Supplement amount

Dry weight basis T  
 Utilisation  
 Destination  
 Animal

600  
 Very good  
 Milking shed feeding  
 Dairy

### Supplement information

Conservation type  
 Name  
 Pasture type

Silage  
 Maize silage

### Supplement amount

Fresh weight basis T  
 Silage cutting method  
 Utilisation  
 Destination  
 Animal

500  
 Very good  
 Feed pad  
 Dairy

### Supplement information

Conservation type  
 Name  
 Pasture type

Process byproducts  
 Molasses

### Supplement amount

Dry weight basis T  
 Utilisation  
 Destination  
 Animal

120  
 Very good  
 Milking shed feeding  
 Dairy

### Supplement information

Conservation type

Silage

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St Andrews Dairy  
 St Andrews Dairy  
 Client reference: 4036155  
 Farm name: St Andrews Dairy 2012/2013 (2012/2013)

Angela Darke  
 Ballance Key Accounts

## Parameters



Conservation type		
Name		Silage
Pasture type		Pasture good quality silage
Supplement amount		
Fresh weight basis	T	600
Silage cutting method		Wilted
Utilisation		Very good
Destination		Feed pad
Animal		Dairy
<b>Block Information</b>		
Block - Pasture1-Old Effluent Block		
Block name		Pasture1-Old Effluent Block
Block type		Pastoral
Area	ha	69
Relative productivity		1
Pasture block type		No
Topography		Flat
Distance from coast	km	3
Cultivated in last 5 years		False
Climate		
Annual average rainfall	mm/yr	550
Mean annual temperature		11.2
Seasonal variation in rainfall		< 730 mm, None to weak
Annual potential evapotranspiration		801-950 mm/yr
Seasonal variation in PET		Moderate
Soil description		
Soil type		CLAREMONT
Soil order (default)		Recent/YGE/BGE
Soil group (default)		Pallic
Top soil texture		
Stony top soil		False
Compacted top soil		False
Sub-soil textural group		Medium
Soil drainage		
Profile drainage class		Use default
Hydrophobic condition		Use default
Drainage method		
Method		None
Soil settings		
K leaching (‰s)		Low
N immobilisation status		Standard

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St Andrews Dairy  
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 Client reference: 4036155  
 Farm name: St Andrews Dairy 2012/2013 (2012/2013)

Angela Darke  
 Ballance Key Accounts

## Parameters



Soil tests					
Olsen P	QT K	QT Ca	QT Mg	QT Na	
27	12	11	35	38	
Organic S					6
Anion storage capacity or phosphate retention					27
TBK reserve K test					Not entered
K reserve status					Use default
Pasture					
Pasture type					Ryegrass/white clover
Supplements removed					
No supplements removed from this block					
Fertiliser application					
Fertiliser products - August					
Category					Ballance other
Product					N-rich ammo 36N
Amount					100

Irrigation	
January	Centre pivot/lateral
February	Centre pivot/lateral
March	Centre pivot/lateral
October	Centre pivot/lateral
November	Centre pivot/lateral
December	Centre pivot/lateral

Irrigation concentrations							
N	P	K	S	Ca	Mg	Na	H
2.5	0.1	1.6	2.5	9.3	2.2	9.5	0

Animals on block  
 Ratio and type of stock based on whole farm values due to this option being selected on block set up

Animals grazing	
Dairy	% 0

Water connectivity	
Direct access to streams	False

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St Andrews Dairy

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Ballance Key Accounts

Client reference: 4036155

Farm name: St Andrews Dairy 2012/2013 (2012/2013)



## Parameters

### Animal grazing

January	True
February	True
March	True
April	True
May	True
September	True
October	True
November	True
December	True

### Effluent application

#### Liquid effluents

Receives farm dairy effluent	
Effluent application depth	Low application method
Percentage of block effluent applied to	100

### Block - Pasture1-Non Effluent Area

Block name	Pasture1-Non Effluent Area
Block type	Pastoral
Area	83
Relative productivity	1
Pasture block type	No
Topography	Flat
Distance from coast	3
Cultivated in last 5 years	False

### Climate

Annual average rainfall	mm/yr	550
Mean annual temperature		11.2
Seasonal variation in rainfall		< 730 mm, None to weak
Annual potential evapotranspiration		801-950 mm/yr
Seasonal variation in PET		Moderate

### Soil description

Soil type	CLAREMONT
Soil order (default)	Recent/YGE/BGE
Soil group (default)	Pallic

### Top soil texture

Stony top soil	False
Compacted top soil	False
Sub-soil textural group	Medium

### Soil drainage

Profile drainage class	Use default
Hydrophobic condition	Use default

### Drainage method

Method	None
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Ballance Key Accounts

Client reference: 4036155

Farm name: St Andrews Dairy 2012/2013 (2012/2013)



## Parameters

Method

None

### Soil settings

K leaching (%)

Low

N immobilisation status

Standard

### Soil tests

Olsen P

QT K

QT Ca

QT Mg

QT Na

23

13

9

30

38

Organic S

6

Anion storage capacity or phosphate retention

43

TBK reserve K test

Not entered

K reserve status

Use default

### Pasture

Pasture type

Ryegrass/white clover

### Supplements removed

No supplements removed from this block

### Fertiliser application

#### Fertiliser products - August

Category

Ballance other

Product

N-rich ammo 36N

Amount

100

### Irrigation

January

Centre pivot/lateral

February

Centre pivot/lateral

March

Centre pivot/lateral

October

Centre pivot/lateral

November

Centre pivot/lateral

December

Centre pivot/lateral

### Irrigation concentrations

N

P

K

S

Ca

Mg

Na

H

2.5

0.1

1.6

2.5

9.3

2.2

9.5

0

### Animals on block

Ratio and type of stock based on whole farm values due to this option being selected on block set up

#### Animals grazing

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Ballance Key Accounts

Client reference: 4036155

Farm name: St Andrews Dairy 2012/2013 (2012/2013)



## Parameters

Animals grazing		
Dairy	%	0
Water connectivity		
Direct access to streams		False
Animal grazing		
January		True
February		True
March		True
April		True
May		True
September		True
October		True
November		True
December		True
Effluent application		
Solid effluents		
Effluent type added	April	Solids from feed pad
Block - Pasture3-New Effluent Area		
Block name		Pasture3-New Effluent Area
Block type		Pastoral
Area	ha	62
Relative productivity		1
Pasture block type		No
Topography		Flat
Distance from coast	km	3
Cultivated in last 5 years		False
Climate		
Annual average rainfall	mm/yr	550
Mean annual temperature		11.2
Seasonal variation in rainfall		< 730 mm, None to weak
Annual potential evapotranspiration		801-950 mm/yr
Seasonal variation in PET		Moderate
Soil description		
Soil type		CLAREMONT
Soil order (default)		Recent/YGE/BGE
Soil group (default)		Pallic
Top soil texture		
Stony top soil		False
Compacted top soil		False
Sub-soil textural group		Medium
Soil drainage		
Profile drainage class		Use default

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St Andrews Dairy  
 St Andrews Dairy  
 Client reference: 4036155  
 Farm name: St Andrews Dairy 2012/2013 (2012/2013)

Angela Darke  
 Ballance Key Accounts

## Parameters



Hydrophobic condition					Use default		
Drainage method					None		
Method							
Soil settings					Low		
K leaching (%s)							
N immobilisation status					Standard		
Soil tests							
Olsen P	QT K	QT Ca	QT Mg	QT Na			
19	10	11	34	38			
Organic S					4		
Anion storage capacity or phosphate retention					27		
TBK reserve K test					Not entered		
K reserve status					Use default		
Pasture							
Pasture type					Ryegrass/white clover		
Supplements removed							
No supplements removed from this block							
Fertiliser application							
Fertiliser products - August							
Category					Ballance other		
Product					N-rich ammo 36N		
Amount					100		
Irrigation							
January	Centre pivot/lateral						
February	Centre pivot/lateral						
March	Centre pivot/lateral						
October	Centre pivot/lateral						
November	Centre pivot/lateral						
December	Centre pivot/lateral						
Irrigation concentrations							
N	P	K	S	Ca	Mg	Na	H
2.5	0.1	1.6	2.5	9.3	2.2	9.5	0

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St Andrews Dairy  
 St Andrews Dairy  
 Client reference: 4036155  
 Farm name: St Andrews Dairy 2012/2013 (2012/2013)

Angela Darke  
 Ballance Key Accounts



## Parameters

### Animals on block

Ratio and type of stock based on whole farm values due to this option being selected on block set up

Animals grazing  
 Dairy

% 0

Water connectivity  
 Direct access to streams

False

### Animal grazing

January

True

February

True

March

True

April

True

May

True

August

True

September

True

October

True

November

True

December

True

### Effluent application

#### Liquid effluents

Receives farm dairy effluent

Effluent application depth

Low application method

Percentage of block effluent applied to

% 100

### Block - Pasture4-West End Non Effluent

Block name

Pasture4-West End Non  
 Effluent

Block type

Pastoral

Area

ha 63

Relative productivity

1

Pasture block type

No

Topography

Flat

Distance from coast

km 3

Cultivated in last 5 years

False

### Climate

Annual average rainfall

mm/yr 550

Mean annual temperature

11.2

Seasonal variation in rainfall

< 730 mm, None to weak

Annual potential evapotranspiration

801-950 mm/yr

Seasonal variation in PET

Moderate

### Soil description

Soil type

CLAREMONT

Soil order (default)

Recent/YGE/BGE

Soil group (default)

Pallic

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St Andrews Dairy  
 St Andrews Dairy  
 Client reference: 4036155  
 Farm name: St Andrews Dairy 2012/2013 (2012/2013)

Angela Darke  
 Ballance Key Accounts



## Parameters

October	Centre pivot/lateral						
November	Centre pivot/lateral						
December	Centre pivot/lateral						
Irrigation concentrations							
N	P	K	S	Ca	Mg	Na	H
2.5	0.1	1.6	2.5	9.3	2.2	9.5	0

### Animals on block

Ratio and type of stock based on whole farm values due to this option being selected on block set up

Animals grazing		
Dairy	%	0
Water connectivity		
Direct access to streams		False
Animal grazing		
January		True
February		True
March		True
April		True
May		True
August		True
September		True
October		True
November		True
December		True

### Effluent application

Solid effluents		
Effluent type added	April	Solids from feed pad

### Block - Stock Excluded

Block name		Stock Excluded
Block type		Trees and Scrub
Area	ha	10
Rainfall	mm/yr	550
Distance from coast	km	3
Bush type		Native

### Report settings

Greenhouse gas emission report units: CO2 equivalents (kg/ha)  
 Target N application rate as effluent: kg N/ha/yr

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**APPENDIX 4A**  
**(to Evidence of Ross Rathgen)**

St Andrews

Client reference:

Farm name: St Andrews 36653 v6.2 - Changes AH (2014-15)

## Farm Nutrient Budget - Whole farm



	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
<b>Nutrients added</b>							
Fertiliser, lime & other	300	24	0	34	46	1	0
Rain/clover N fixation	72	0	3	5	2	5	31
Irrigation	9	0	6	9	35	8	36
Supplements imported	67	12	36	7	6	5	3
<b>Nutrients removed</b>							
As products	116	20	26	7	28	2	8
Exported effluent	0	0	0	0	0	0	0
As supplements	0	0	0	0	0	0	0
To atmospheric	142	0	0	0	0	0	0
To water	28	0.9	10	34	43	2	5
<b>Change in internal pools</b>							
Plant material	0	0	0	0	0	0	0
Organic pool	162	16	4	14	1	1	0
Inorganic mineral	0	4	-51	0	0	-1	-1
Inorganic soil pool	0	-5	55	0	17	15	57

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**APPENDIX 4B**  
**(to Evidence of Ross Rathgen)**

St Andrews

Client reference:

Farm name: St Andrews 36653 v6.2 - Changes AH (2014-15)

## Block Nitrogen



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)
Pivot Effluent - Claremont	1998	28	<b>35.7</b>	519	555
Hard-hose - Waitohi	2268	54	<b>12.3</b>	242	300
Pivot non-effluent - Claremont	2750	18	<b>23.6</b>	275	300
Hard-hose - Claremont	788	46	10.4	242	300
K-line - Claremont	191	19	<b>23.2</b>	275	300
Dryland	385	21	<b>33.3</b>	270	300
Other farm sources	478				
Whole farm	8858	28			
Less N removed in wetlands	0				
Farm output	8858	28			

\* Estimated N concentration in drainage water at the bottom of the root zone. Maximum recommended level for drinking water is 11.3 ppm (note that this is not an environmental water quality standard).

\*\* Sum of fertiliser and external factory effluent inputs.

N/A: N in drainage not calculated for easy and steep pastoral blocks, or for tree and shrubs, riparian, wetland or house blocks.

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**APPENDIX 4C**  
**(to Evidence of Ross Rathgen)**

Nigel Rathgen  
Greys, St Andrews, Bells, Lysarts & Collins  
Client reference:  
Farm name: Rathgen Cropping SAP# 2014-2015 - Greys, St Andrews,  
Bells, Lysarts & Collins (2014-2015)

Aimee Robinson  
Ballance Agri-nutrients  
August 2015

## Farm Nutrient Budget - Whole farm



	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
<b>Nutrients added</b>							
Fertiliser, lime & other	185	29	31	67	63	0	0
Rain/clover N fixation	32	0	3	5	2	5	29
Irrigation	2	0	1	2	7	2	7
Supplements imported	14	2	14	2	3	2	1
<b>Nutrients removed</b>							
As products	91	21	18	9	17	4	2
Exported effluent	0	0	0	0	0	0	0
As residues and defoliation	188	23	155	13	31	14	8
To atmospheric	34	0	0	0	0	0	0
To water	14	0.2	5	69	34	1	2
<b>Change in internal pools</b>							
Plant material	15	0	2	3	1	0	6
Organic pool	-172	-17	0	-18	0	0	0
Inorganic mineral	0	4	-42	0	-1	-1	-1
Inorganic soil pool	63	1	-89	0	-6	-10	21

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Nigel Rathgen

Greys, St Andrews, Bells, Lysarts & Collins

Client reference:

Farm name: Rathgen Cropping SAP# 2014-2015 - Greys, St Andrews,  
Bells, Lysarts & Collins (2014-2015)

Aimee Robinson

Ballance Agri-nutrients

August 2015

## Block Nitrogen



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)
G1/G3 - Ryegrass, Wheat - Dryland, Tin	148	7	9.1	39	221
STA1/STA5/S1/S2 - Ryegrass, Wheat - D	376	11	<b>16.2</b>	40	221
G2/G4/G5 - Wheat, Ryegrass - Dryland,	78	3	4.0	445	176
STA2 - Wheat, Ryegrass - Dryland, Clar	23	2	3.8	582	176
G6 - Ryecorn, Ryegrass - Dryland, Ytoat	23	3	3.6	480	176
G7 - Ryecorn, RapeSeed - Dryland, Ytol	23	2	2.5	345	75
G8 - Cloverseed - Dryland, Ytoh_1a.1	251	31	<b>39.3</b>	376	24
G9 - Kale, Fodderbeet - Dryland, Drylan	546	32	<b>26.0</b>	344	136
G10 - Kale, Kale - Dryland, Raka_2a.1	351	32	<b>25.9</b>	81	92
STA3/B1/B2/B4 - Ryegrass - Dryland, C	405	8	<b>12.9</b>	520	302
STA4 - BeetSeed, Wheat - Dryland, Clar	237	23	<b>33.4</b>	40	221
S3/S4/S5 - OatSeed, Ryegrass - Dryland	28	2	3.3	671	176
B3 - Peas, Wheat - Dryland, Clar_1a.1	38	2	2.5	94	221
B5 - GFO, Maize, Barley - Dryland, Clar	270	19	<b>22.3</b>	136	239
B6 - Ryegrass, Ryecorn - Dryland, Clar_	294	13	<b>16.8</b>	146	129
B7 - Ryegrass, Ryecorn - Dryland, Timu	43	9	11.2	146	129
B8 - Pasture, Dryland, Clar_1a.1	55	14	<b>21.1</b>	294	0
L16 - Pasture, Kline, Clar_1a.1	77	22	5.0	337	0
L17/L18 - Ryegrass - Gun, Clar_1a.1	234	14	<b>11.5</b>	544	302
L19/L20 - Maize, Triticale - Gun, Clar_1	154	7	3.7	537	152
L21/L22 - Ryegrass, Oat Seed - Gun, Cla	420	30	<b>12.0</b>	98	157
C1 - ExBlackcurrent, GFO, Oats - Pivot,	447	19	<b>29.1</b>	279	198
C1 - ExBlackcurrent, GFO, Oats - Pivot,	581	20	<b>29.9</b>	278	198

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Nigel Rathgen

Greys, St Andrews, Bells, Lysarts & Collins

Client reference:

Farm name: Rathgen Cropping SAP# 2014-2015 - Greys, St Andrews, Bells, Lysarts & Collins (2014-2015)

Aimee Robinson

Ballance Agri-nutrients

August 2015

## Block Phosphorus



Block name	Total P (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
G1/G3 - Ryegrass, Wheat - Dryland, Tin	1	0.1	n/a	n/a	n/a
STA1/STA5/S1/S2 - Ryegrass, Wheat - f	2	0.1	n/a	n/a	n/a
G2/G4/G5 - Wheat, Ryegrass - Dryland,	2	0.1	n/a	n/a	n/a
STA2 - Wheat, Ryegrass - Dryland, Clar	1	0.1	n/a	n/a	n/a
G6 - Ryecorn, Ryegrass - Dryland, Ytoal	1	0.1	n/a	n/a	n/a
G7 - Ryecorn, RapeSeed - Dryland, Ytol	1	0.1	n/a	n/a	n/a
G8 - Cloverseed - Dryland, Ytoh_1a.1	1	0.1	n/a	n/a	n/a
G9 - Kale, Fodderbeet - Dryland, Drylan	1	0.1	n/a	n/a	n/a
G10 - Kale, Kale - Dryland, Raka_2a.1	1	0.1	n/a	n/a	n/a
STA3/B1/B2/B4 - Ryegrass - Dryland, C	6	0.1	n/a	n/a	n/a
STA4 - BeetSeed, Wheat - Dryland, Clar	1	0.1	n/a	n/a	n/a
S3/S4/S5 - OatSeed, Ryegrass - Dryland	2	0.1	n/a	n/a	n/a
B3 - Peas, Wheat - Dryland, Clar_1a.1	1	0.1	n/a	n/a	n/a
B5 - GFO, Maize, Barley - Dryland, Clar_	2	0.1	n/a	n/a	n/a
B6 - Ryegrass, Ryecorn - Dryland, Clar_	2	0.1	n/a	n/a	n/a
B7 - Ryegrass, Ryecorn - Dryland, Timu	0	0.1	n/a	n/a	n/a
B8 - Pasture, Dryland, Clar_1a.1	0	0	Low	n/a	n/a
L16 - Pasture, Kline, Clar_1a.1	2	0.6	Low	Low	n/a
L17/L18 - Ryegrass - Gun, Clar_1a.1	8	0.5	n/a	n/a	n/a
L19/L20 - Maize, Triticale - Gun, Clar_1	6	0.3	n/a	n/a	n/a
L21/L22 - Ryegrass, Oat Seed - Gun, Cla	11	0.8	n/a	n/a	n/a
C1 - ExBlackcurrent, GFO, Oats - Pivot,	2	0.1	n/a	n/a	n/a
C1 - ExBlackcurrent, GFO, Oats - Pivot,	2	0.1	n/a	n/a	n/a
C2 - Oats, RedBeetSeed - Pivot, Ytoh_3	4	0.2	n/a	n/a	n/a
C3 - Oats, Ryegrass - Pivot, Paha_5a.1	3	0.2	n/a	n/a	n/a

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Nigel Rathgen  
Greys, St Andrews, Bells, Lysarts & Collins  
Client reference:  
Farm name: Rathgen Cropping SAP# 2014-2015 - Greys, St Andrews,  
Bells, Lysarts & Collins (2014-2015)

Aimee Robinson  
Ballance Agri-nutrients  
August 2015

## Block Pasture



Block name	On-farm fresh pasture intake (kg DM/ha/yr)	Estimated utilisation (%)	Supplements removed (kg DM/ha/yr)	Pasture growth (kg DM/ha/yr)
G1/G3 - Ryegrass, Wheat - Dryland, Tin	0	0	0	0
STA1/STA5/S1/S2 - Ryegrass, Wheat - D	0	0	0	0
G2/G4/G5 - Wheat, Ryegrass - Dryland,	0	0	0	0
STA2 - Wheat, Ryegrass - Dryland, Clar	0	0	0	0
G6 - Ryecorn, Ryegrass - Dryland, Ytoal	0	0	0	0
G7 - Ryecorn, RapeSeed - Dryland, Yto	0	0	0	0
G8 - Cloverseed - Dryland, Ytoh_1a.1	0	0	0	0
G9 - Kale, Fodderbeet - Dryland, Drylan	0	0	0	0
G10 - Kale, Kale - Dryland, Raka_2a.1	0	0	0	0
STA3/B1/B2/B4 - Ryegrass - Dryland, C	0	0	0	0
STA4 - BeetSeed, Wheat - Dryland, Clar	0	0	0	0
S3/S4/S5 - OatSeed, Ryegrass - Dryland	0	0	0	0
B3 - Peas, Wheat - Dryland, Clar_1a.1	0	0	0	0
B5 - GFO, Maize, Barley - Dryland, Clar	0	0	0	0
B6 - Ryegrass, Ryecorn - Dryland, Clar_	0	0	0	0
B7 - Ryegrass, Ryecorn - Dryland, Timu	0	0	0	0
B8 - Pasture, Dryland, Clar_1a.1	23581	70	0	33687
L16 - Pasture, Kline, Clar_1a.1	23581	70	0	33687
L17/L18 - Ryegrass - Gun, Clar_1a.1	0	0	0	0
L19/L20 - Maize, Triticale - Gun, Clar_1	0	0	0	0
L21/L22 - Ryegrass, Oat Seed - Gun, Cla	0	0	0	0
C1 - ExBlackcurrent, GFO, Oats - Pivot,	0	0	0	0
C1 - ExBlackcurrent, GFO, Oats - Pivot,	0	0	0	0
C2 - Oats, RedBeetSeed - Pivot, Ytoh_3	0	0	0	0
C3 - Oats, Ryegrass - Pivot, Paha_5a.1	0	0	0	0
C4 - Pasture, Pivot, Eyre_1a.1	23581	70	0	33687
C4 - Pasture, Kline, Eyre_1a.1	23581	70	0	33687

This report gives an estimated animal intake for each block based on animal production and supplements brought on to farm information supplied. Estimated annual pasture growth is shown for the animal utilisation value shown.  
Note: the model is not sensitive to changes in utilisation.

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**APPENDIX 4D**  
**(to Evidence of Ross Rathgen)**

Nigel Rathgen

Aimee Robinson  
Ballance Agri-nutrients  
August 2015

Client reference:

Farm name: Rathgen Cropping SAP# 2014-2015 - Rathgen Home and Southburn (2014-2015)

## Farm Nutrient Budget - Whole farm



	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
<b>Nutrients added</b>							
Fertiliser, lime & other	137	22	20	43	55	0	0
Rain/clover N fixation	26	0	3	5	2	5	31
Irrigation	4	0	3	4	15	4	16
Supplements imported	2	0	3	0	1	0	0
<b>Nutrients removed</b>							
As products	70	16	15	6	11	4	1
Exported effluent	0	0	0	0	0	0	0
As residues and defoliation	33	3	31	4	5	2	2
To atmospheric	37	0	0	0	0	0	0
To water	17	0.2	4	46	32	2	8
<b>Change in internal pools</b>							
Plant material	57	6	20	10	12	2	1
Organic pool	-67	-11	0	-12	0	0	0
Inorganic mineral	0	3	-34	0	-1	-1	-1
Inorganic soil pool	22	5	-9	0	15	0	36

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Nigel Rathgen

Aimee Robinson

Ballance Agri-nutrients

August 2015

Client reference:

Farm name: Rathgen Cropping SAP# 2014-2015 - Rathgen Home and Southburn (2014-2015)

## Block Nitrogen



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)
R1 - Pasture, Gun, Raka_2a.1	303	42	<b>36.5</b>	155	0
R20/22/25 - Pasture, Kline, Timu_1a.1	1002	44	9.8	175	0
R24 - Pasture, Gun, Ytoh_1a.1	46	23	<b>27.0</b>	155	0
R2 - Wheat, Tall Fescue - Gun, Timu_1a.1	21	3	2.9	591	217
R3/4 - CarrotSeed, Wheat - Gun, Timu_1a.1	252	20	<b>21.0</b>	97	221
R5 - Wheat, Beet Seed - Gun, Timu_1a.1	28	4	2.6	634	184
R6 - Barley, Turnip Seed, GFO - Gun, Ytoh_1a.1	58	11	6.6	385	291
R7 - Tall Fescue, Oats - Gun, Timu_1a.1	254	24	<b>13.4</b>	53	129
R8 - Oats, Ryegrass Seed - Gun, Timu_1a.1	23	4	4.9	556	217
R9/12/13 - Ryegrass Seed, Wheat - Gun, Ytoh_1a.1	137	5	2.6	105	221
R10/16 - Wheat, Carrot Seed - Gun, Ytoh_1a.1	64	4	2.6	528	28
R11 - Silverbeet Seed, Wheat - Gun, Ytoh_1a.1	268	33	<b>35.4</b>	44	221
R14 - Wheat, RyegrassSeed - Gun, Timu_1a.1	46	4	2.6	550	231
R15 - Ryegrass Seed, Turnip Seed - Gun, Ytoh_1a.1	13	4	2.6	527	245
R15 - Ryegrass Seed, Turnip Seed - Gun, Ytoh_1a.1	13	4	2.6	528	245
R17 - Turnip Seed, Wheat - Gun, Ytoh_1a.1	220	29	<b>26.5</b>	45	221
R18 - Turnip Seed, Wheat, Timu_1a.1	224	22	<b>22.5</b>	44	221
R19 - Ryecorn, Dogtail Seed - Gun, Timu_1a.1	16	3	2.7	544	152
R21 - Oats Seed, Fallow, Oatseed - Gun, Ytoh_1a.1	80	15	6.2	156	129
R - Ineffective	70	3	N/A		
SB - Kale to Kale, Dryland, Paha_7a.1	53	13	<b>12.2</b>	188	138
SB - Kale to Kale, Dryland, Eyre_3a.1	987	17	<b>14.7</b>	184	138
SB - Kale to Kale, Dryland, Raka_2a.1	595	30	<b>21.3</b>	186	138

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Nigel Rathgen

Aimee Robinson  
Ballance Agri-nutrients  
August 2015

Client reference:

Farm name: Rathgen Cropping SAP# 2014-2015 - Rathgen Home and Southburn (2014-2015)

## Block Phosphorus



Block name	Total P (kg P/yr)	P lost (kg P/ha/yr)	P loss categories		
			Soil	Fertiliser	Effluent
R1 - Pasture, Gun, Raka_2a.1	0	0	Low	n/a	n/a
R20/22/25 - Pasture, Kline, Timu_1a.1	10	0.4	Low	n/a	n/a
R24 - Pasture, Gun, Ytoh_1a.1	0	0	Low	n/a	n/a
R2 - Wheat, Tall Fescue - Gun, Timu_1a.1	1	0.1	n/a	n/a	n/a
R3/4 - CarrotSeed, Wheat - Gun, Timu_1a.1	1	0.1	n/a	n/a	n/a
R5 - Wheat, Beet Seed - Gun, Timu_1a.1	2	0.2	n/a	n/a	n/a
R6 - Barley, Turnip Seed, GFO - Gun, Ytoh_1a.1	1	0.2	n/a	n/a	n/a
R7 - Tall Fescue, Oats - Gun, Timu_1a.1	2	0.2	n/a	n/a	n/a
R8 - Oats, Ryegrass Seed - Gun, Timu_1a.1	0	0.1	n/a	n/a	n/a
R9/12/13 - Ryegrass Seed, Wheat - Gun, Ytoh_1a.1	8	0.3	n/a	n/a	n/a
R10/16 - Wheat, Carrot Seed - Gun, Ytoh_1a.1	5	0.3	n/a	n/a	n/a
R11 - Silverbeet Seed, Wheat - Gun, Ytoh_1a.1	1	0.1	n/a	n/a	n/a
R14 - Wheat, RyegrassSeed - Gun, Timu_1a.1	4	0.3	n/a	n/a	n/a
R15 - Ryegrass Seed, Turnip Seed - Gun, Ytoh_1a.1	1	0.4	n/a	n/a	n/a
R15 - Ryegrass Seed, Turnip Seed - Gun, Ytoh_1a.1	2	0.5	n/a	n/a	n/a
R17 - Turnip Seed, Wheat - Gun, Ytoh_1a.1	1	0.1	n/a	n/a	n/a
R18 - Turnip Seed, Wheat, Timu_1a.1	1	0.1	n/a	n/a	n/a
R19 - Ryecorn, Dogtail Seed - Gun, Timu_1a.1	2	0.3	n/a	n/a	n/a
R21 - Oats Seed, Fallow, Oatseed - Gun, Ytoh_1a.1	1	0.2	n/a	n/a	n/a
R - Ineffective	2	0.1	n/a	n/a	n/a
SB - Kale to Kale, Dryland, Paha_7a.1	0	0.1	n/a	n/a	n/a
SB - Kale to Kale, Dryland, Eyre_3a.1	4	0.1	n/a	n/a	n/a
SB - Kale to Kale, Dryland, Raka_2a.1	1	0.1	n/a	n/a	n/a
SB - Ineffective	0	0.1	n/a	n/a	n/a
Other farm sources	11				

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Nigel Rathgen

Aimee Robinson  
Ballance Agri-nutrients  
August 2015

Client reference:

Farm name: Rathgen Cropping SAP# 2014-2015 - Rathgen Home and Southburn (2014-2015)

## Block Pasture



Block name	On-farm fresh pasture intake (kg DM/ha/yr)	Estimated utilisation (%)	Supplements removed (kg DM/ha/yr)	Pasture growth (kg DM/ha/yr)
R1 - Pasture, Gun, Raka_2a.1	15489	70	0	22127
R20/22/25 - Pasture, Kline, Timu_1a.1	15489	70	0	22127
R24 - Pasture, Gun, Ytoh_1a.1	15489	70	0	22127
R2 - Wheat, Tall Fescue - Gun, Timu_1a.1	0	0	0	0
R3/4 - CarrotSeed, Wheat - Gun, Timu_1a.1	0	0	0	0
R5 - Wheat, Beet Seed - Gun, Timu_1a.1	0	0	0	0
R6 - Barley, Turnip Seed, GFO - Gun, Ytoh_1a.1	0	0	0	0
R7 - Tall Fescue, Oats - Gun, Timu_1a.1	0	0	0	0
R8 - Oats, Ryegrass Seed - Gun, Timu_1a.1	0	0	0	0
R9/12/13 - Ryegrass Seed, Wheat - Gun, Ytoh_1a.1	0	0	0	0
R10/16 - Wheat, Carrot Seed - Gun, Ytoh_1a.1	0	0	0	0
R11 - Silverbeet Seed, Wheat - Gun, Ytoh_1a.1	0	0	0	0
R14 - Wheat, RyegrassSeed - Gun, Timu_1a.1	0	0	0	0
R15 - Ryegrass Seed, Turnip Seed - Gun, Ytoh_1a.1	0	0	0	0
R15 - Ryegrass Seed, Turnip Seed - Gun, Ytoh_1a.1	0	0	0	0
R17 - Turnip Seed, Wheat - Gun, Ytoh_1a.1	0	0	0	0
R18 - Turnip Seed, Wheat, Timu_1a.1	0	0	0	0
R19 - Ryecorn, Dogtail Seed - Gun, Timu_1a.1	0	0	0	0
R21 - Oats Seed, Fallow, Oatseed - Gun, Ytoh_1a.1	0	0	0	0
R - Ineffective	0	0	0	0
SB - Kale to Kale, Dryland, Paha_7a.1	0	0	0	0
SB - Kale to Kale, Dryland, Eyre_3a.1	0	0	0	0
SB - Kale to Kale, Dryland, Raka_2a.1	0	0	0	0
SB - Ineffective	0	0	0	0

This report gives an estimated animal intake for each block based on animal production and supplements brought on to farm information supplied. Estimated annual pasture growth is shown for the animal utilisation value shown. Note: the model is not sensitive to changes in utilisation.

It is recommended that a consultant or software such as StockPol is used to estimate farm pasture production.

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**APPENDIX 5**  
**(to Evidence of Ross Rathgen)**

Rathgen Farms

Rathgen Farms

Client reference: 3012243

Farm name: Rathgen Farms - Cropping 2012/2013 - vMK (2012/2013)

Angela Darke

Ballance Agri-nutrients

Key Accounts-CSI



## Farm Nutrient Budget - Whole farm

	N	P	K	S	Ca	Mg	Na
	(kg/ha/yr)						
<b>Nutrients added</b>							
Fertiliser, lime & other	182	28	22	62	68	0	0
Rain/clover N fixation	47	0	3	5	2	5	29
Irrigation	2	0	1	2	8	2	8
Supplements imported	0	0	0	0	0	0	0
<b>Nutrients removed</b>							
As products	106	22	16	8	19	4	2
Exported effluent	0	0	0	0	0	0	0
As residues and defoliation	87	16	82	9	9	7	6
To atmospheric	48	0	0	0	0	0	0
To water	13	0.2	4	54	33	1	2
<b>Change in internal pools</b>							
Plant material	150	18	125	16	11	30	-1
Organic pool	-261	-14	0	-18	0	0	0
Inorganic mineral	0	-2	-19	0	0	-1	-1
Inorganic soil pool	88	-11	-183	0	7	-34	30

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