Appendix 5: Farm modelling methodology

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MEMORANDUM

TO: Bay of Plenty Regional Council
FROM: Perrin Ag Consultants Ltd
DATE: 5 August 2015
SUBJECT: Methodology for farm-level modelling for Rotorua N-reduction economic impacts project

1. Background

1.1 In order to derive profit-N leaching relationships for a range of pastoral activity across the twelve geo-physical zones in the catchment in the Rotorua catchment, a two stage process was utilised.

1.1.1 These geophysical zones, as prescribed by the Bay of Plenty Regional Council ("BOPRC"), comprised the four main soil orders found in the catchment, two slope classes and, if the range in rainfall across a soil order was broad enough, a delineation for either high or low rainfall. The boundary that defined the high and low rainfall bands varied for the pumice (1,900mm) and podzol soils (2,000mm), as did the nominal delineation of the slope classes for dairy (13°) and drystock (16°) sectors. Each zone was defined on the basis of the parameters and associated nomenclature in Table 1 below i.e. the geophysical zone consisting of a podzol (Po) soil receiving 2200mm (H) of rainfall annually with an average slope of 8° (1) would be defined as **Po1H**.

Table 1: Lake Rotorua geophysical parameters and nomenclature

<table>
<tr><th>Soil type</th><th colspan="2">Slope class</th><th colspan="2">Rainfall band</th></tr>
<tr><td>Allophanic (Al)</td><td rowspan="4">Gentle (1)</td><td rowspan="4">Steep (2)</td><td colspan="2" rowspan="2">n/a</td></tr>
<tr><td>Recent (Re)</td></tr>
<tr><td>Podzol (Po)</td><td rowspan="2">Low (L)</td><td rowspan="2">High (H)</td></tr>
<tr><td>Pumice (Pu)</td></tr>
</table>

1.2 Baseline status quo models of representative dairy and dry stock farming operations were developed in Farmax and Overseer software, with the Farmax models based on actual farming enterprises within the catchment's geophysical zones. The profit forecasting functionality within Farmax was utilised to estimate the annual operating profit generated from each of these systems. Medium term pricing expectations for used for forecasting income, while operating expenses were based on representative industry averages, moderated for locality and system specific variance as necessary.

1.3 A cumulative stepwise N-loss mitigation protocol was then applied to each representative farm system, with a scenario run created for each mitigation that was deemed applicable to the system. The dairy and dry stock mitigation protocols had been previously developed by a group of industry professionals (including the author, DairyNZ & Beef+Lamb NZ) on the basis of how it was perceived farmers in the catchment might rationally apply sequential changes to their system to reduce N loss to water, in the context of both their likely commercial and emotional reality.

1.4 This simulated change process was constrained by an assumption that farm productivity was limited to the existing management capability represented by each modelled farm system. This constraint was captured in the step-wise modelling process by excluding system responses that would result from improved pasture management/utilisation. This was typically expressed as an inability to increase per head performance in response to the need to reduce stocking rate. The singular exception to this was where the potential to lamb ewe hoggets and reduce ewe numbers was deemed to be a viable mitigation, in which case the feed intake and productivity of the ewe hogget obviously increased. This assumed that the decision to mate or not mate ewe lambs was based on farmer preference, rather than any perception that lambing ewe hoggets required an increase in management ability.

1.5 Accordingly neither the baseline status quo nor mitigated farm models are "optimised" for profit or nutrient use efficiency.

1.6 The step-wise mitigation protocol for both the dairy and dry stock models are presented in Figure 1and Figure 2 below.

Dairy

1 Baseline

Contain production losses

2 Remove summer crop, replace with supplements
3 Reduce autumn N application (if any), replace with appropriate low(er) N feed
4 Cull early as feed demand allows (10% culls early Feb, 10% culls early March)
5 Replace high N feed (imported pasture, PKE) with low N feed (maize silage) as appropriate

Reduce supplement up to 20% reduction, targeting lower value feed and autumn feed first, reduce SR/production

6.1 20% autumn feed reduction
6.2 20% spring supplement reduction
6.3 Reduce spring fert to deliver annual N use to 100kg N/ha
6.4 Reduce winter supplement by 20%

7 Retire marginal land and decrease SR (assume 5% marginal)

Figure 1: Dairy step-wise mitigation protocol

1.7 This process resulted in series of paired Farmax and Overseer outputs that could be analysed for changes in N leaching to water and financial performance (as measured by operating profit).

1.8 This output could then be utilised to derive the quantitative relationship between the application of likely sequential mitigations on farm systems and farm operating profit.

Drystock

1 Baseline

2 Reduce N that supports capital livestock (i.e. primarily maintenance feed demand)
3 Reduce winter cropping providing it doesn't affect dairy support enteprise (if any)
4 Lamb hoggets and decrease ewe numbers
5 Decrease dairy young stock (R1, R2), replace with bulls or steers as appropriate. For sole dairy support system, remove calf grazing (R1) only.
6 Remove wintering dairy cows. Increase other stock numbers
7 Graze any dry hoggets off
8 Increase sheep: cattle ratio - limit of 70% sheep

Figure 2: Drystock step-wise mitigation protocol

1.9 A total of 7 representative dairy models and 36 representative dry stock models were developed to cover the sector spread within the geophysical zones in the catchment. Each model was then run through the entire step-wise mitigation protocol. This resulted in 54 dairy scenarios and 111 dry stock scenarios in addition to the baseline models. A total of paired 208 Farmax and Overseer files were created.

2. Establishment of baseline models

2.1 Dairy systems

2.1.1 Dairy farm activity was identified via BOPRC data to have the potential to occur within 7 geophysical zones – 6 zones where dairying currently or recently occurred and one zone where future land use change to dairy was considered viable

2.1.2 Analysis of the "current areas" of milking platform (including effluent and any contiguous cropping areas to support dry or milking dairy cows) of Rotorua dairy farms was undertaken to establish an appropriate average size for the seven dairy farm models developed. Utilising the most accurate data available to the author, the average size of milking platform in the Rotorua area comprised 219ha (range 48ha to 633ha). As discussed with DairyNZ, this average milking platform was to be used as the basis for the baseline Farmax models generated for the seven representative dairy systems modelled.

2.1.3 Real farms that DairyNZ and the author agreed as being the most representative of all farms in each identified geo-physical zone were then modelled in Farmax as they currently exist. This was possible for five of the geo-physical zones, being Al1, Pu1H, Po1H, Po2H and Pu2. Where replacement yearling heifers were grazed on contiguous land owned by the farm that wasn't milked off, heifers were treated as being grazed off farm for the purposes of modelling, given dairy heifer grazing is captured in the drystock systems modelling. Land area was then increased up to or down to 219ha (with associated activities like silage making and cropping pro-rated accordingly) utilising the "scale" function in Farmax. Stock numbers and pasture management were then scaled up or down, again utilising the "scale" functionality in Farmax, to deliver identical level of feasibility. Systems were then reviewed to ensure stocking rates and per cow production were consistent with the original farm systems.

2.1.4 Hypothetical farms were then created for the Re1 and Pu1L zones. For the Re1 zone, where there had previously been dairying activity up until 2007, a model was created based on real historical farm performance to derive pasture growth parameters. The farm system was then adjusted to reflect reasonable changes that were likely to have occurred with the production system in the intervening 7 years.

2.1.5 For the Pu1L zone, where no singular dairying enterprise exists but such future activity was deemed feasible, pasture growth parameters were derived based on an average between the Re1 and Pu1H models, subsequently adjusted to ensure relativity with the Pu2 pasture growth model and altitude differences with Re1. This pasture growth curve was then applied to the Re1 model (given the physical characteristics would be similar) and the production system adjusted to reflect the higher summer pasture growth.

2.1.6 Note that average slope for Pu2, is >13°, based on the actual data from what is recognised as the steepest farm in the catchment.

2.1.7 Cost and revenue assumptions used for forecasting the financial performance of these systems in Farmax were primarily based off the 2012/13 Central Plateau Owner-Operator benchmark from DairyBase data. Where necessary, these were moderated to reflect justifiable deviations from the benchmark average within specific farm models, predominantly the Pu2 geophysical zone. This essentially resulted in two sets of broad financial assumptions; one specific to the dairy activity in the Pu2 zone (which supports a more extensive and lower production dairy system) and one for the remainder of the dairy farm systems, which were considered more homogeneous in nature.

2.1.8 These operating cost structures were used to create two "Farmax expense plans" which were then applied consistently across the models based on their underlying system parameters.

2.1.9 A milk price of $6/kg MS was used for determining dairy farm milk revenue, while an appropriate medium term price expectation for manufacturing beef was applied to the normal seasonal schedule distributions in Farmax. The milk price used reflected both the nominal average Fonterra milk price ($6.07/kg MS)[1] for the period 2006/07 through 2014/15 and the fact that the real (CPI adjusted) NZ milk price since 1975 is just under $6/kg MS[2].

2.1.10 All of the financial assumptions are summarised in Appendix 1 below.

2.1.11 These baseline farm systems were then modelled in Overseer™6.1.3, utilising geophysical data representative of the midpoint of the rainfall bands of the geophysical zones to assign appropriate climate data to the models. Soil orders, rather than individual soil types, were utilised to allocate soil characteristics in Overseer, with the exception of anion storage

[1] Source: interest.co.nz and Fonterra Cooperative Group Ltd
[2] LIC, BERL 2015

capacity ("ASC"), which was manually input to reflect local conditions specific to each farm model.

2.2 Drystock systems

2.2.1 Given the significant number of possible combinations of operating system and geo-physical zone within the Rotorua catchment, a simplified process was undertaken to derive representative models for each combination.

2.2.2 Three real farms were modelled in Farmax to derive both realistic pasture growth curves for areas of differing slope within the catchment and physical performance parameters for three base operating policies – sheep & beef cattle, sheep and dairy support and dairy support. These were then applied across all six geo-physical zones and two slope classes by way of a varying pasture growth curve for each slope and soil & rain interaction. The models were also adjusted on the basis of an assumption that the wintering of dairy cows only occurs where average slope is <16°, beef cows replace beef finishing as a policy above 16° and that the mowable area comprised no more than 15% of total farm area for properties with >16° average slope. This resulted in six different representative farm systems for the catchment.

Table 2: Livestock policies modelled for the representative farm models

	Sheep/Beef ("SB")	Sheep/Dairy ("SD")	Dairy Support ("DS")
Slope low (<16°) ("L")	Breeding ewes Beef cattle for finishing	Breeding ewes Dairy heifers Wintering dairy cows	Dairy heifers Wintering dairy cows
Slope high (>16°) ("H")	Breeding ewes Beef cows	Breeding ewes Dairy heifers	Dairy heifers

2.2.3 Beef+Lamb NZ data for Class 3, 4and 5 farms from the 2014/15 Beef + Lamb Economic Service Sheep & Beef Farm Survey was then used to set both the modal property size and to inform the operating expense parameters used in Farmax[3] for the low and high slope class non-dairy support sheep & cattle farm models for the Rotorua catchment, as presented in Table 3 below. For the dairy support properties, due to their small size and specialist activity, both sets of parameters were adapted from Class 5 Beef+Lamb NZ survey data and then moderated where applicable using actual farm data from the catchment used as the basis of the models. The operating cost structures were used to create four "Farmax expense plans" which were then applied consistently across the models based on their underlying system parameters.

[3] Farmax defaults, adjusted by the author for local market conditions were used for variable farm expenses determined by functionality in the Farmax model (such as crop costs, direct stock expenses etc)

Table 3: Source of representative model farm size and operating cost structure ("Farmax expense plans")

	Sheep/Beef ("SB")	Sheep/Dairy ("SD")	Dairy Support ("DS")
Slope low (<16°) ("L")	BLES Class 4 survey	BLES Class 5 survey	BLES Class 5 survey, Perrin Ag Consultants
Slope high (>16°) ("H")	BLES Class 3 survey	BLES Class 4 survey	

2.2.4 Medium term revenue expectations were applied to the normal seasonal schedule distributions in Farmax for sheep meat ($5.50/kg), beef ($4.20/kg base price) and wool ($3.40/kg). These are summarised, along with the operating expense parameters and how they were applied, in Appendix 2 to Appendix 6 below. Note that analysis was also completed for a second base beef price ($3.75/kg).

2.2.5 These baseline farm systems were then modelled in Overseer™6.1.3, utilising geophysical data representative of the midpoint of the rainfall bands of the geophysical zones. As with the dairy farm models, soil orders, rather than individual soil types, were utilised to allocate soil characteristics in Overseer, with the exception of anion storage capacity ("ASC"), which was manually input to reflect local conditions specific to each farm model.

2.2.6 We note that no deer farm systems were modelled. Deer were excluded from the project brief due to the small proportion of deer that are farmed in the catchment as a proportion of other drystock systems. We note, however, that the economic outcomes from lowering nitrate leaching from a deer farm system was modelled in the BOPRC funded 2014 NDA Impact Analysis Project.

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Appendix 1: Dairy operating expense assumptions

Expense item	Applied	All except PU2	Pu2
Wages	/cow	$ 256.00	$ 256.00
Management Wage	/cow	$ 105.00	$ 105.00
Electricity	/cow	$ 42.00	$ 42.00
Fertiliser (Excl. N)	/kg MS	$ 0.51	$ 0.64
Weed & Pest	/ha	$ 34.00	$ 34.00
Vehicles	/ha	$ 169.00	$ 40.00
Fuel	/ha	$ 73.00	$ 37.00
R&M Land & Buildings	/ha	$ 274.00	$ 147.00
R&M Plant & Equipment	/ha	$ 72.00	$ 46.00
Freight	/cow	$ 23.00	$ 23.00
Administration	/ha	$ 142.00	$ 142.00
Insurance	/ha	$ 62.00	$ 40.00
ACC	/ha	$ 21.00	$ 21.00
Rates	/ha	$ 107.00	$ 63.00
Depreciation	/ha	$ 317.00	$ 237.00

Source 1: DairyBase 2012/13 Central Plateau Owner Operator Survey

Animal Health Costs

Stock Class	$ / hd / yr
Heifer Calf	35.00
1-Year Heifer	35.00
2-Year Heifer	67.50
Cow	67.50
Bull Calf	18.00
1-Year Bull	8.00
2-Year Bull	7.00
Bull	20.00

Source 2: Farmax 2014

Breeding Costs

AI	25.00	$/submission
ET	250.00	$/submission
Sexed Semen	50.00	$/submission

Source: Farmax 2014

Nitrogen Fertiliser

Nitrogen Cost	1.80	$/kg N
	828	$/t Urea

Source: Perrin Ag Consultants 2014

Regrassing

Regrassing cost ($/ha) 600

OK Cancel

Source: Perrin Ag Consultants 2014

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Dairy feed assumptions

Name	Class	Units	Unit Size	Dry Matter	Energy	Default Yield	Cash Price	Production Cost	
			kg/unit	%	MJME/kgDM	units/ha	$	$/ha	$/unit
Pasture Silage	Conserved	tonnes DM	1,000	100	10.0	2.0	210.00	450.00	
Maize Silage	Harvested Crop	tonnes DM	1,000	100	10.8	22.0	320.00	3,600.00	
Annual ryegrass	Grazed Crop	tonnes DM	1,000	100	12.5			1,200.00	
Kale	Grazed Crop	tonnes	1,000	100	11.5	13.0		1,259.00	
Swedes	Grazed Crop	tonnes DM	1,000	100	12.8	15.0		1,259.00	
Turnips	Grazed Crop	tonnes DM	1,000	100	12.0	12.0		1,259.00	
Maize Silage bought	Bought	tonnes DM	1,000	100	10.8	22.0	320.00	2,700.00	60.00
Palm Kernel	Bought	tonnes	1,000	90	11.0		250.00		
Pasture Silage bought	Bought	tonnes DM	1,000	100	10.0	2.0	340.00		110.00
PKE with Canola	Bought	tonnes DM	1,000	90	12.0		380.00		
Calf Meal	Calf Feed	tonnes	1,000	89	13.0		650.00		
Colostrum/Milk	Calf Feed	litres	1	100	3.2				
Milk Replacer	Calf Feed	litres	1	100	3.2		0.40		

Source: Farmax 2014, Perrin Ag Consultants 2014

Appendix 2: Sheep revenue assumptions for a $5.50/kg base schedule

Sheep Prices Prices / kg for Rotorua

Prices / kg												
Works ($/kg Cwt)	O	N	D	J	F	M	A	M	J	J	A	S
17 kg PM Lamb	6.16	6.00	5.50	5.12	5.01	4.95	5.01	5.22	5.45	5.61	5.89	6.11
24 kg Sheep	2.96	2.76	2.53	2.35	2.25	2.33	2.50	2.46	2.72	2.80	2.94	3.11
Store ($/kg Lwt)	O	N	D	J	F	M	A	M	J	J	A	S
Ewe Lamb	2.59	2.52	2.25	2.15	2.15	2.13	2.15	2.25	2.29	2.41	2.59	2.75
Ewe Hogget	2.83	2.82	2.64	2.46	2.20	1.98	1.90	1.83	1.96	2.24	2.71	2.81
MA Ewe	2.22	2.22	2.04	1.43	1.40	1.39	1.40	1.46	1.58	1.68	2.06	2.14
Ram Lamb	2.77	2.64	2.37	2.30	2.25	2.23	2.25	2.35	2.40	2.52	2.77	2.87
Ram Hogget	4.25	4.38	4.29	2.51	2.50	2.57	2.85	3.03	3.21	3.37	3.65	3.85
MA Ram	7.45	7.25	7.59	8.34	8.51	8.61	8.91	8.36	8.17	7.80	7.77	7.57
Wether Lamb	2.71	2.58	2.37	2.25	2.20	2.18	2.20	2.30	2.34	2.47	2.71	2.81
Wether Hogget	2.34	2.22	2.04	1.94	2.05	2.03	2.00	2.19	2.34	2.52	2.59	2.44
MA Wether	1.97	2.04	1.76	1.59	1.80	1.83	1.85	1.67	1.74	1.80	1.82	1.71

Sheep Prices Charges for Rotorua

Charges				
	Transport $/head	**Commission** % of gross	**Headage** $/head	**Killing** $/head
Purchases	1.50			
Store Sales		5.50		
Works Sales				2.00

Sheep Prices Relativities for Rotorua

Relativities												
Works (/kg Cwt)	O	N	D	J	F	M	A	M	J	J	A	S
17 kg PM Lamb	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24 kg Sheep	0.48	0.46	0.46	0.46	0.45	0.47	0.50	0.47	0.50	0.50	0.50	0.51
Store (/kg Lwt)	O	N	D	J	F	M	A	M	J	J	A	S
Ewe Lamb	0.42	0.42	0.41	0.42	0.43	0.43	0.43	0.43	0.42	0.43	0.44	0.45
Ewe Hogget	0.46	0.47	0.48	0.48	0.44	0.40	0.38	0.35	0.36	0.40	0.46	0.46
MA Ewe	0.36	0.37	0.37	0.28	0.28	0.28	0.28	0.28	0.29	0.30	0.35	0.35
Ram Lamb	0.45	0.44	0.43	0.45	0.45	0.45	0.45	0.45	0.44	0.45	0.47	0.47
Ram Hogget	0.69	0.73	0.78	0.49	0.50	0.52	0.57	0.58	0.59	0.60	0.62	0.63
MA Ram	1.21	1.21	1.38	1.63	1.70	1.74	1.78	1.60	1.50	1.39	1.32	1.24
Wether Lamb	0.44	0.43	0.43	0.44	0.44	0.44	0.44	0.44	0.43	0.44	0.46	0.46
Wether Hogget	0.38	0.37	0.37	0.38	0.41	0.41	0.40	0.42	0.43	0.45	0.44	0.40
MA Wether	0.32	0.34	0.32	0.31	0.36	0.37	0.37	0.32	0.32	0.32	0.31	0.28

Source: Farmax 2014, Perrin Ag Consultants 2014

Appendix 3: Bull beef revenue assumptions for a $4.20/kg base beef schedule

Bull Beef Prices Prices / kg for Rotorua

Prices / kg												
Works ($/kg Cwt)	O	N	D	J	F	M	A	M	J	J	A	S
295 kg M Bull	4.54	4.37	4.16	4.03	3.95	3.95	3.95	4.03	4.16	4.28	4.45	4.54
Store ($/kg Lwt)	O	N	D	J	F	M	A	M	J	J	A	S
R1 Bull	4.81	4.32	3.91	3.75	3.55	2.92	2.57	2.46	2.45	2.61	2.76	2.68
R2 Bull	2.54	2.36	2.29	2.14	2.05	2.01	2.01	1.98	2.00	2.23	2.45	2.45
MA Bull	2.54	2.40	2.29	2.14	2.05	2.01	2.01	1.98	2.00	2.23	2.49	2.45

Bull Beef Prices Charges for Rotorua

	Charges			
	Transport $/head	**Commission** % of gross	**Headage** $/head	**Killing** $/head
Purchases	12.00			
Store Sales		5.50		
Works Sales				32.35

Bull Beef Prices Relativities for Rotorua

Relativities												
Works (/kg Cwt)	O	N	D	J	F	M	A	M	J	J	A	S
295 kg M Bull	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Store (/kg Lwt)	O	N	D	J	F	M	A	M	J	J	A	S
R1 Bull	1.06	0.99	0.94	0.93	0.90	0.74	0.65	0.61	0.59	0.61	0.62	0.59
R2 Bull	0.56	0.54	0.55	0.53	0.52	0.51	0.51	0.49	0.48	0.52	0.55	0.54
MA Bull	0.56	0.55	0.55	0.53	0.52	0.51	0.51	0.49	0.48	0.52	0.56	0.54

Source: Farmax 2014, Perrin Ag Consultants 2014

Appendix 4: Prime beef revenue assumptions for a $4.20/kg base beef schedule

Prime Beef Prices Prices / kg for Rotorua

Prices / kg												
Works ($/kg Cwt)	O	N	D	J	F	M	A	M	J	J	A	S
295 kg M Steer	4.74	4.52	4.35	4.18	4.13	4.09	4.05	4.13	4.26	4.39	4.61	4.74
220 kg LT Heifer	4.69	4.43	4.22	4.13	4.05	4.01	3.96	4.09	4.09	4.26	4.66	4.74
230 kg M Cow	3.70	3.57	3.39	3.26	3.22	3.19	3.12	3.14	3.37	3.51	3.73	3.75
Store ($/kg Lwt)	O	N	D	J	F	M	A	M	J	J	A	S
R1 Heifer	2.75	2.62	2.52	2.42	2.40	2.41	2.27	2.23	2.26	2.37	2.54	2.56
R2 Heifer	2.56	2.53	2.48	2.34	2.23	2.13	2.02	1.98	2.05	2.15	2.26	2.32
MA Cow	1.90	1.95	1.83	1.67	1.78	1.68	1.86	1.82	1.88	1.89	1.84	1.85
R1 Steer	3.32	3.17	3.04	2.92	2.89	2.86	2.71	2.64	2.64	2.77	2.95	2.94
R2 Steer	2.80	2.58	2.52	2.38	2.36	2.29	2.23	2.15	2.17	2.28	2.49	2.56
MA Steer	2.70	2.49	2.39	2.30	2.27	2.25	2.18	2.15	2.17	2.28	2.49	2.56

Prime Beef Prices Charges for Rotorua

Charges				
	Transport $/head	**Commission** % of gross	**Headage** $/head	**Killing** $/head
Purchases	12.00			
Store Sales		5.50		
Works Sales				32.35

Prime Beef Prices Relativities for Rotorua

Relativities												
Works (/kg Cwt)	O	N	D	J	F	M	A	M	J	J	A	S
295 kg M Steer	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
220 kg LT Heifer	0.99	0.98	0.97	0.99	0.98	0.98	0.98	0.99	0.96	0.97	1.01	1.00
230 kg M Cow	0.78	0.79	0.78	0.78	0.78	0.78	0.77	0.76	0.79	0.80	0.81	0.79
Store (/kg Lwt)	O	N	D	J	F	M	A	M	J	J	A	S
R1 Heifer	0.58	0.58	0.58	0.58	0.58	0.59	0.56	0.54	0.53	0.54	0.55	0.54
R2 Heifer	0.54	0.56	0.57	0.56	0.54	0.52	0.50	0.48	0.48	0.49	0.49	0.49
MA Cow	0.40	0.43	0.42	0.40	0.43	0.41	0.46	0.44	0.44	0.43	0.40	0.39
R1 Steer	0.70	0.70	0.70	0.70	0.70	0.70	0.67	0.64	0.62	0.63	0.64	0.62
R2 Steer	0.59	0.57	0.58	0.57	0.57	0.56	0.55	0.52	0.51	0.52	0.54	0.54
MA Steer	0.57	0.55	0.55	0.55	0.55	0.55	0.54	0.52	0.51	0.52	0.54	0.54

Source: Farmax 2014, Perrin Ag Consultants 2014

Appendix 5: Other drystock revenue assumptions used

FARMAX Dairy grazing contract			
Age (months)	Grazing Fee ($/hd/week)	Age (months)	Grazing Fee ($/hd/week)
0 - 4	6.50	15	8.50
5	6.50	16	8.50
6	6.50	17	8.50
7	6.50	18	8.50
8	6.50	19	8.50
9	6.50	20	8.50
10	8.50	21	8.50
11	8.50	22	28.00
12	8.50	23	28.00
13	8.50	24 +	28.00
14	8.50		

Source: Perrin Ag Consultants 2014

FARMAX Wool and Velvet Prices		
Wool Prices		
Crossbred Lamb	3.50	$ / kg Greasy
Crossbred Hogget	3.60	$ / kg Greasy
Crossbred Adult	3.40	$ / kg Greasy
Superfine Lamb	9.40	$ / kg Greasy
Superfine Hogget	9.40	$ / kg Greasy
Superfine Adult	8.45	$ / kg Greasy
Ultrafine Lamb	11.16	$ / kg Greasy
Ultrafine Hogget	11.16	$ / kg Greasy
Ultrafine Adult	9.55	$ / kg Greasy
Velvet Prices		
Spiker	40.00	$ / kg
2-year	45.00	$ / kg
Adult	50.00	$ / kg

Source: Farmax 2014

Appendix 6: Drystock operating expense assumptions

Expense item	Applied	Class 3	Class 4	Class 5	Dairy support
Wages	/SU	$ 19.00	$ 19.00	$ 19.00	$ 19.00
Fertiliser (Excl. N & Lime)	/SU	$ 11.00	$ 13.47	$ 12.50	$ 13.00
Nitrogen					
Lime	/SU	$ 0.40	$ 1.00	$ 1.30	$ 1.30
Weed & Pest Control	/SU	$ 0.75	$ 1.17	$ 1.17	$ 1.17
Vehicle Expenses	/ha	$ 14.00	$ 29.30	$ 37.00	$ 37.00
Fuel	/ha	$ 16.00	$ 25.00	$ 38.00	$ 38.00
Repairs & Maintenance	/ha	$ 48.00	$ 64.21	$ 75.00	$ 75.00
Freight & Cartage	/SU	$ 0.70	$ 1.67	$ 1.60	$ 1.60
Electricity	/SU	$ 0.86	$ 0.86	$ 1.05	$ 1.05
Other Expenses	/SU	$ 0.60	$ 0.60	$ 0.60	$ 0.60
Administration Expenses	/ha	$ 17.00	$ 29.19	$ 34.00	$ 34.00
Insurance	/ha	$ 13.97	$ 13.97	$ 18.00	$ 18.00
ACC Levies	/SU	$ 0.46	$ 0.46	$ 0.87	$ 0.87
Rates	/SU	$ 2.00	$ 2.00	$ 4.00	$ 4.00
Depreciation	/ha	$ 26.81	$ 52.62	$ 70.00	$ 70.00

Source: Beef+Lamb Economic Service Survey 2014, Perrin Ag Consultants Ltd

Animal Health Costs (excl. Velveting)

Sheep	$ / hd / yr	Beef	$ / hd / yr	Deer	$ / hd / yr
Ewe Lamb	2.40	Heifer Calf	12.00	Hind Fawn	5.00
Ewe Hogget	2.40	1-Year Heifer	8.00	1-Year Hind	7.00
Ewe	3.65	2-Year Heifer	7.00	2-Year Hind	5.00
Ram Lamb	2.40	Cow	12.00	Hind	4.00
Ram Hogget	2.40	Bull Calf	18.00	Stag Fawn	5.00
Ram	5.00	1-Year Bull	108.00	1-Year Stag	7.00
Wether Lamb	2.40	2-Year Bull	7.00	2-Year Stag	5.00
Wether Hogget	2.40	Bull	20.00	3-Year Stag	5.00
Wether	2.00	Steer Calf	7.00	Stag	5.00
		1-Year Steer	8.00		
		2-Year Steer	7.00		
		Steer	7.00		

Source: Farmax 2014

Shearing Costs

Shearing	$ / head	Crutching	$ / head
Lambs	3.25	Lambs	1.15
Hoggets	3.55	Hoggets	1.50
Adults	3.55	Adults	1.50

Source: Farmax 2014

Nitrogen Fertiliser

Nitrogen Cost	1.81	$/kg N
	833	$/t Urea

Source: Farmax 2014, Perrin Ag Consultants 2014

Drystock feed assumptions

Name	Class	Units	Unit Size	Dry Matter	Energy	Default Yield	Cash Price	Production Cost	
			kg/unit	%	MJME/kgDM	units/ha	$	$/ha	$/unit
Baleage	Conserved	big bales	525	38	10.0	15.0	95.00		42.00
Pasture Silage	Conserved	tonnes DM	1,000	100	10.0	3.0	210.00	450.00	
Kale	Forage Crop	tonnes DM	1,000	100	11.0	12.0		1,259.00	
Plantain	Forage Crop	tonnes DM	1,000	100	12.5	14.0		260.00	
Swedes	Forage Crop	tonnes DM	1,000	100	12.8	10.5		1,259.00	
Calf meal	Bought	tonnes	1,000		13.0		665.00		

Source: Farmax 2014, Perrin Ag Consultants 2014