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Upper Waikato Nutrient Efficiency Study – Drystock Update

Prepared for the

Waikato Regional Council

By

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1.0 EXECUTIVE SUMMARY

1.1 Reducing nitrogen losses in these farming systems remains highly linked to efficiency of stock production and the wide range of farming systems means there is no single fix.

1.2 The upgrade from Version 5 to Version 6 of Overseer resulted in an average increase in nitrogen leaching by 18%. This is typical of other analysis that has been completed on farms with similar parameters.

1.3 Three of the four farms in this study have direct links to the dairy sector, one each of dairy grazing, purchase of four day old bull calves and supply of dairy bulls.

1.4 Three of the four farms in the study showed cost to reducing nitrogen losses down to levels in line with the Integrated Catchment Management Pilot Project target. This cost ranged from $14.58 - $71.95 per kilogram of nitrogen.

1.5 Wintering off of dairy cows is a major factor for the upper Waikato catchment as this as a management tool only solves the problem for dairying if these cows move outside the catchment.

1.6 Dairy support requirements within the region are continuing to grow due to the profitability of this as a land use compared to sheep and beef. The secondary issue continues to be the expansion of dairying that is pushing traditional drystock farming on to harder classes of land.

1.7 This means that cattle (particularly dairy heifers) are being grazed on country and contour more traditionally farmed for sheep. This has the impact of increased nitrogen losses and, if the system is not well managed, a much higher risk of increased phosphate losses.

1.8 Three out of the four farms showed net cost to drop N leaching and the one that increased its profit per kg N was as a result of opportunities to improve per head performance.

1.9 There is a significant need to drive a greater understanding within the drystock sector as to how they can manage their operations to reduce nutrient losses. The suite of "*Menu*" booklets produced and developed by the Waikato Regional Council has been a fantastic start in this process.

1.10 Profitability remains a key motivator for the drystock sector given they have been through a challenging periods over the last five to seven years. More focus must be given to ensuring that there is a higher level of understanding within the sector. Their focus should be on factors that improve the efficiency and profitability of their operations and will by default reduce their nutrient footprint.

2.0 BACKGROUND

2.1 Project Outline

2.1.1 The report has been prepared for the Waikato Regional Council and is further to the initial study completed by AgFirst Waikato in September 2009

2.1.2 The initial Integrated Catchment Management pilot project for sheep and beef farms focused on the assessment of the impact of reducing drystock farming operations to a level of 12kg N leached. In addition to this the farm systems were also assessed on the basis of what could be determined as "*simple system changes*" to reduce Nitrogen (N) leaching

2.1.3 The project outline is as follows:

- Farm visit to update current situation
- Update the Overseer analysis to V6 including rerun of all mitigation scenarios
- Update current practices and changes since original study
- Update Farmax models and Overseer to 2013 system
- Provide farmers with a 1-2 page summary of the outcomes
- Provide the above reports plus a summary report to WRC

2.1.4 The initial project focused purely on nitrogen losses to the farming systems. The updated study has included analysis and reporting of Phosphate (P) losses from Version 6.

2.1.5 The focus for this update has been to update the previous analysis to the most recent version of Overseer and report on the changes in the outputs based on this. No further work has been undertaken to reduce nitrogen losses to the original targets (12kg N / ha). This is to ensure comparable analysis with the 2009 study.

2.1.6 It is also recognised that revising the selected farming operations down to a nitrogen leaching target of 12kg N / ha would have major negative impacts on the viability of the farms under Version 6/

2.2 Farm Summary

2.2.1 The farm systems used are best described as:

(N.B: - original farm codes have been used for direct comparability)

- SL1 – 281ha - low intensity sheep and dairy bull
- SL2 – 281ha - Medium intensity sheep and bull beef
- DMCSB1 – 158ha - High intensity deer and sheep
- DMCSB2 – 290ha - Medium intensity dairy support, sheep and beef operation

2.2.2 Each of these farm systems are operating in a relatively similar manner to 2009. There have been some minor changes that are noted in 4.0.

2.2.3 A summary of the key performance indicators for these businesses for the current year (2013) is as below:

N.B: All figures expressed on a per hectare basis unless otherwise stated.

	CS1	CS2	CS3	CS4
Business – Profit				
Asset Value Total	$8,982	$9,032	$16,596	$10,496
Total Liabilities	$3,565	$3,904	$2,563	$1,207
Debt servicing at 8%	$285	$312	$205	$97
Any additional debt	$0	$0	$0	$0
Total Liabilities if changed in model	$3,565	$3,904	$2,563	$1,207
Debt servicing total debt (if changed)	$285	$312	$205	$97
Gross Farm Income (GFI)	$1,231	$1,097	$1,434	$1,182
Total operating Expenses (TOE)	$771	$792	$1,174	$937
Farm Working Expenses (FWE)	$593	$614	$857	$765
Total Operating Profit (EFS)	$460	$305	$260	$245
Operating Profit/Ha	$0	$0	$260	$0
ROA%	5.12%	3.38%	1.57%	2.33%
ROE %	3.23%	-0.14%	0.39%	1.60%
Physical and Efficiency Measures				
Tonnes (pasture) Grown (nett)	6.1	7.18	8.34	5.52
Kg c/c/ha	285	333.69	189	186
Kg LW wintered	790	694	907	1198
Kg DM/kg Product	22.5	21.92	46.86	33.6
$GM/kg Product	3.39	2.56	4.79	3.79
Risk				
Op Profit margin	37%	28%	18%	8%
FWE/ % GFI	48%	56%	60%	71%
Solvency				
Equity %	60%	57%	85%	89%
Environmental				
Kg of N leached/Ha	14	15	21	25
Kg of P Runoff/Ha	2.1	2.9	2.0	2.8

2.3 Analysis Methodology

2.3.1 The farming systems were analysed using standard industry tools of Farmax (V 6.5.0.03) and Overseer (V 6.0.3) as a basis for standard comparison

2.3.2 All Overseer files were updated to the new version to give comparability on nutrient losses

2.3.3 Market prices were used as standard across all analysis and updated to reflect current medium term market forecasts:

2.3.4 Product prices used have shifted moderately since 2009 to the current day bearing in mind the prices used were based on medium term outlook prices at that time. The comparison prices are shown as below:

	2009	2013	% shift
Lamb ($ / kg)	$5.25	$5.50	+5%
Wool ($/kg)	$2.20	$2.70	+23%
Bull beef ($ / kg)	$3.55	$3.75	+6%
Prime - steer ($/kg)	$3.65	$3.80	+4%
Deer ($/kg)	$8.25	$7.50	-10%
Dairy Calf Grazing ($/wk)	$5.00	$6.00	+20%
Dairy Heifer Grazing ($/wk)	$8.00	$8.00	0%
Winter Cows Grazing ($/wk)	$22.00	$22.00	0%

2.3.5 The price changes that have occurred over this time period have been relatively minor. The overall impact of the changes in the wool price and dairy calf grazing rates are minimal due to the small contribution they make to the overall Gross Farm Income (GFI). The negative shift in deer price (down 10%) only impacts on one of the farming operations.

2.3.6 The 2009 Base Model analysis for each farm has been updated to 2013 product prices as above to ensure comparability across all scenarios.

3.0 FARM ANALYSIS

3.1 Background

3.1.1 The comparative analysis for all farming operations has been presented in the format which shows the original analysis conducted in 2009 but updated for the nutrient losses via Overseer Version 6.

3.1.2 This is compared to the current day operation to gauge what has changed over the four years and the impact of this on profitability and nutrient losses.

3.2 Case Study One (SL1)

3.2.1 Background

- This farm is operating as a low intensity operation carrying 720 ewes and 140 replacements.
- The cattle policy is based around supplying bulls to the dairy industry which provides a highly profitable operation
- Current stocking rate is 11.6 SSU / ha with a 33:67 sheep to cattle ratio.
- Winter cropping is undertaken to support the bulls through the winter period. This is via direct drilling to crop and then full cultivation to grass.

- No nitrogen used as part of this farm's policy

3.2.2 Mitigation Scenarios Undertaken

- This farm was an anomaly in the original study as the base nitrogen leaching under Version 5 was 12kg N / ha i.e. no further reduction or modification was required.
- Further analysis was undertaken to assess the likely nutrient losses under a higher performing operation. This included increasing stocking rate and the use of nitrogen fertiliser. This was completed to gauge the issues should the operation intensify in the future.

3.2.3 Current System

- The current system has seen little change since the 2009 study. The main changes of note are:
  - Increase in bull calves reared from 207 to 220 head
  - Additional winter crop grown on hill country for the yearling bulls to improve performance
- This is shown as below:

Winter Numbers	2009	2013
Sheep		
MA Ewes	820	860
Rams	10	10
Total	**830**	**870**
Beef		
R1 Bulls	207	210
R2 Bulls	258	230
Total	**465**	**440**

- The focus remains on a relatively low intensity farming operation that is surrounded by dairy farms which gives an indication of the land class.

3.2.4 Mitigation outcomes Case Study 1

- The following summarises the operation analysis undertaken.

N.B: All figures expressed on a per hectare basis unless otherwise stated.

Farm Name ID: SAL1	2009 - Base Model	2013 - Current	Scenario 1
Business – Profit			
Asset Value Total	$9,032	$8,982	$9,172
Total Liabilities	$3,584	$3,565	$3,584
Debt servicing at 8%	$287	$285	$287
Gross Farm Income (GFI)	$1,344	$1,231	$1,583
Total operating Expenses (TOE)	$775	$771	$832
Farm Working Expenses (FWE)	$554	$593	$611
Total Operating Profit (EFS)	$569	$460	$752
ROA%	6.30%	5.12%	8.20%
ROE %	5.18%	3.23%	8.32%
Physical and Efficiency Measures			
Tonnes (pasture) Grown (nett)	6.17	6.1	7.44
Kg c/c/ha	270	285	336
Kg LW wintered	833	790	947
Kg DM/kg Product	23.62	22.5	22.71
$GM/kg Product	3.95	3.39	3.64
Risk			
Op Profit margin	42%	37%	47%
FWE/ % GFI	41%	48%	39%
Solvency			
Equity %	60%	60%	61%
Environmental			
Kg of N leached/Ha	14	14	17
Change in Kg of N leached.	0	0	-3
$ change in Op Profit/change in Kg of N leached	0	0	-60.83
Kg of P Runoff/Ha	2.1	2.1	2.0

3.2.5 Summary

- The profitability of the system is strong mainly due to the supply of dairy bulls. This does come at a cost to the N leaching due to the high number of cattle carried.
- For this operation the operating profit increased under the more intensive operation however N leaching also increased by 3kg N / ha resulting in a negative return.
- The above result is not unexpected however given the scale of the operation there is little viable opportunity to reduce overall profitability.
- There is little change in Phosphate losses across the scenarios although given Overseer operates on the assumption of *"best practice*" farm management this is to be expected.

3.3 Case Study Two (SL2)

3.3.1 Background

- This farm is operating as a medium intensity operation carrying 1,200 ewes and 360 replacement ewe lambs.
- The cattle policy is based around the purchase of four day old calves which are taken through and primarily finished to 20 months. Approximately 30% are taken through a second winter and finished in the spring.
- Current stocking rate is 13.3 SSU / ha with a 48:52 sheep to cattle ratio.
- No cropping is undertaken and has not been done since 2007.
- Nitrogen is now only used on a limited basis to fill feed gaps where deemed economic.

3.3.2 Mitigation Scenarios Undertaken

- The original mitigation options undertaken were focused on improving the performance of the breeding ewe flock, reduction in steer numbers and improved performance in the bull operation.
- Nitrogen applications were also phased out.
- Scenario two options focused on further reductions in bull numbers

3.3.3 Current System

- The following changes since 2009 are:
    - Decrease in sheep and increase in cattle to effectively reverse the sheep: cattle ratio since 2009
    - Reduced all nitrogen applications – previously two applications of 27kg N / ha over the whole farm.
    - Increase in bull numbers reared and traded.
    - Removal of in steer trading due to slim margins.
    - Still a heavy focus on improving sheep performance.

- Conscious management practices such as younger bulls following older bulls on hill country.
- Increase in silage made to increase the level of buffer in the system

- Stock numbers are as follows:

Winter Numbers	2009	2013
Sheep		
MA Ewes	1265	1200
Ewe Hoggets	330	360
Wthr Hoggets	325	140
Rams	22	22
Total	**1942**	**1722**
Beef		
R1 Bulls	200	270
R2 Bulls	76	70
R2 Steers	20	
Total	**296**	**340**

3.3.4 Mitigation Outcomes Case Study 2

The following summarises the operation analysis undertaken.

N.B: All figures expressed on a per hectare basis unless otherwise stated.

Farm Name ID: SAL2	2009 - Base Model	2013 - Current	Scenario 1	Scenario 2
Business – Profit				
Asset Value Total	$9,032	$9,032	$9,081	$9,035
Total Liabilities	$3,904	$3,904	$3,904	$3,904
Debt servicing at 8%	$312	$312	$312	$312
Gross Farm Income (GFI)	$918	$1,097	$1,111	$1,071
Total operating Expenses (TOE)	$770	$792	$766	$764
Farm Working Expenses (FWE)	$549	$614	$545	$543
Total Operating Profit (EFS)	$148	$305	$346	$307
ROA%	1.64%	3.38%	3.81%	3.40%
ROE %	-3.20%	-0.14%	0.64%	-0.10%
Physical and Efficiency Measures				
Tonnes (pasture) Grown (nett)	6.57	7.18	7.13	6.88
Kg c/c/ha	273	333.69	321	306
Kg LW wintered	652	694	703	678
Kg DM/kg Product	24.18	21.92	22.92	23.13
$GM/kg Product	1.63	2.56	2.44	2.45
Risk				
Op Profit margin	16%	28%	31%	29%
FWE/ % GFI	60%	56%	49%	51%
Solvency				
Equity %	57%	57%	57%	57%
Environmental				
Kg of N leached/Ha	16	15	15	14
Change in Kg of N leached.	0	0	1	2
$ change in Op Profit/change in Kg of N leached	0	0	$197.25	$79.38
Kg of P Runoff/Ha	2.9	2.9	2.9	2.9

3.3.5 Summary

- The opportunities to reduce N leaching in the original study showed strong levels of improved profitability. This was largely on the back of opportunities that existed to improve the current per head performance of the existing operation
- The reduction in nitrogen applications due largely to economics also aided the ability to reduce surplus N in the system. This is a major benefit of feed budgeting and ensuring applications only occur where they are required.
- The operating profit margin of this farm is still relatively slim indicating little opportunity to reduce income to meet nitrogen targets.
- Phosphate losses remain unchanged across the scenarios although at 2.9kg / ha these are considered comparably high. This is primarily due to high phosphate levels (Olsen P-52) on the steeper hill country and the high potential for loss. Olsen P levels on this property could be reduced resulting in lower P loss risk with little negative impact on pasture production.

3.4 Case Study Three (DMCSB1)

3.4.1 Background

- This farm is operating as a high intensity operation carrying primarily deer with only a small mob of sheep for ragwort control and cattle to control surplus pasture where required.
- Current stocking rate is 16.1 SSU / ha with a 3:12:84 sheep:beef:deer ratio.
- Winter cropping is undertaken to support the deer through the winter period.
- Silage is fed through a self feeding silage pit.
- Nitrogen is used during spring and autumn where required.

3.4.2 Mitigation Scenarios Undertaken

- Scenario one focused on reducing cattle numbers from the system, particularly breeding cows, reducing the winter crop area
- The target reduction to 12kg N / ha involved large scale reductions in the overall stocking rate coupled with significant silage sales (2,000 bales).

3.4.3 Current System

- The current system has seen minor change since 2009. Key changes include:
    - Removed female cattle from the system – at the time of visit there was still a small mob (40) on farm however these will likely be changed with velveting stags this year.
    - Crop area has been reduced from 10ha to 7ha. This also varies depending on paddock chosen.

- There has been a conscious effort to improve stock weights and efficiency of production which has been successful with the increase in average sale weight of weaner deer by 2-3 kgs.

- Stock Numbers are summarised as below:

Winter Numbers	2009	2013
Sheep		
MA Ewes	100	50
Ewe Hoggets		25
Rams	5	3
Total	**105**	**78**
Beef		
R2 Heifers	40	45
R1 Heifers	13	
Total	**53**	**45**
Deer		
MA Hinds	560	560
R2 Hinds	70	70
R1 hinds	272	267
R1 Stags	272	267
Breeding Stags	36	40
Total	**1210**	**1204**

3.4.4 Mitigation outcomes Case Study 3

- The following summarises the operation analysis undertaken.

N.B: All figures expressed on a per hectare basis unless otherwise stated.

Farm Name ID: DMCSB1	2009 -Base Model	2013 - Current	Scenario 1	Scenario 2
Business – Profit				
Asset Value Total	$16,631	$16,596	$16,631	$16,631
Total Liabilities	$2,563	$2,563	$2,563	$2,563
Debt servicing at 8%	$205	$205	$205	$205
Gross Farm Income (GFI)	$1,554	$1,434	$1,394	$1,799
Total operating Expenses (TOE)	$1,225	$1,174	$1,157	$1,706
Farm Working Expenses (FWE)	$845	$857	$777	$1,326
Total Operating Profit (EFS)	$329	$260	$237	$93
ROA%	1.98%	1.57%	1.42%	0.56%
ROE %	0.88%	0.39%	0.23%	-0.80%
Physical and Efficiency Measures				
Tonnes (pasture) Grown (nett)	8.68	8.34	7.83	7.1
Kg c/c/ha	219	189	186	135
Kg LW wintered	920	907	770	562
Kg DM/kg Product	41.55	46.86	44.02	43.31
$GM/kg Product	4.91	4.79	5.47	7.91
Risk				
Op Profit margin	21%	18%	17%	5%
FWE/ % GFI	54%	60%	56%	74%
Solvency				
Equity %	85%	85%	85%	85%
Environmental				
Kg of N leached/Ha	21	21	18	16
Change in Kg of N leached.	0	0	3	2
$ change in Op Profit/change in Kg of N leached	0	0	-$30.84	-$71.95
Kg of P Runoff/Ha	2.0	2.0	2.0	1.8

N.B: This system is primarily deer. The feed conversion efficiency figures, while high, are extracted from Farmax are based on historical work conducted in the late 1980's for deer farming systems. Work is underway to update this and ensure these figures are accurate.

3.4.5 Summary

- The significant drop in overall profitability through the mitigation options. The cost of $92 / kg N under the 12kg N target also comes with significant risk and the significant sales of silage would result in a largely impractical system.
- Of note is that the ICM pilot project target of 12kg N / ha under Scenario two has lifted to 16kg N under V6.
- This case study shows the impacts on a largely deer farming operation. While deer are traditionally are viewed as being higher returning / kg N leached, this is a clear example that this is less applicable at higher stocking rates.
- There has been a minimal reduction in phosphate losses except for scenario 2 which was a result of the export of large amounts of silage.

3.5 Case Study Four (DMCSB2)

3.5.1 Background

- This farm is operating as a medium intensity dairy support operation intensity operation carrying 300 ewes and 140 replacement ewe lambs to run on the steeper hill country.
- The cattle policy is primarily based around the grazing of dairy heifer and winter cows as well as operating a small beef breeding herd for pasture control.
- Current stocking rate is 11.4 SSU / ha with a 16:84 sheep to cattle ratio.
- Winter cropping is undertaken to support the dairy cows through the winter period for an average of 8-9 weeks.
- Nitrogen is used on the easy and more intensively farmed land up to 30kg N / ha.
- Maize (9ha) and lucerne (10ha) crops are grown for supply to the dairy unit located near by

3.5.2 Mitigation Scenarios Undertaken

- The strategies employed were based around reductions in nitrogen used and overall stocking rate for the first scenario.
- To hit the 12kg N / ha target required the removal of the maize, lucerne and winter cropping as well as removing all of the breeding cows (130 from the farm.

3.5.3 Current System

- The current system has undergone the following changes since the 2009 study
  - Increased dairy heifer grazers by 30 head (25%).
  - Added in carryover cows (50 head) for eight months of the year.
  - Increased winter dairy cows from 180 to 250 head.
  - All trade cattle will be sold store at weaning.

- Reduce sheep numbers to reduce workload and sales policy for lambs now based on selling the lambs as soon as the work load needs to ease.
- Nitrogen applications are now focused on the more intensive areas only.

- Stock Numbers are summarised as below:

Winter Numbers	2009	2013
Sheep		
MA Ewes	640	300
Ewe Hoggets	240	140
Total	**880**	**440**
Beef		
MA Cows	110	100
R2 Heifers	51	25
R1 Heifers	51	25
Breeding Bulls	4	4
Total	**216**	**154**
Dairy Grazers		
R1 Heifers	120	150
R2 Heifers	120	150
MA Cows	180	250
Carryover Cows		50
Total	**420**	**600**

- This has led to the operation now fully focused on operating as a true support unit for the dairy farm which is the primary focus.

3.5.4 Mitigation outcomes Case Study 4

- The following summarises the operation analysis undertaken.

N.B: All figures expressed on a per hectare basis unless otherwise stated.

Farm Name ID: DMCSB2	2009 -Base Model	2013 - Current	Scenario 1	Scenario 2
Business – Profit				
Asset Value Total	$10,496	$10,496	$10,190	$9,836
Total Liabilities	$1,207	$1,207	$901	$547
Debt servicing at 8%	$97	$97	$72	$44
Gross Farm Income (GFI)	$1,176	$1,182	$1,121	$1,104
Total operating Expenses (TOE)	$979	$937	$921	$1,021
Farm Working Expenses (FWE)	$765	$765	$707	$779
Total Operating Profit (EFS)	$197	$245	$200	$83
ROA%	1.87%	2.33%	1.96%	0.85%
ROE %	1.08%	1.60%	1.38%	0.43%
Physical and Efficiency Measures				
Tonnes (pasture) Grown (nett)	6.7	5.52	5.6	4.2
Kg c/c/ha	215	186	182	151
Kg LW wintered	1098	1198	921	731
Kg DM/kg Product	32.4	33.6	30.91	27.91
$GM/kg Product	3.15	3.79	4.03	4.87
Risk				
Op Profit margin	17%	8%	18%	8%
FWE/ % GFI	65%	71%	63%	71%
Solvency				
Equity %	89%	89%	91%	94%
Environmental				
Kg of N leached/Ha	25	25	21	13
Change in Kg of N leached.	0		4	8
$ change in Op Profit/change in Kg of N leached	0		$0.83	-$14.58
Kg of P Runoff/Ha	2.8	2.8	2.8	2.9

3.5.5 Summary

- The reductions required to achieve the initial 12kg N/ ha target (now 13kg N / ha) were deemed uneconomic and impractical for the primary purpose for this operation.
- If these changes were required this farm would be uneconomic in its present form as a dairy support unit.

3.6 Case Study Summary

3.6.1 Nitrogen losses

- One method to lower nitrogen losses is to focus on higher per head performance and efficiency. Another requires reductions in stocking rate.
- To ensure that these operations can remain viable also means achieving higher levels of return for the product produced. This strategy has also been adopted with the "*Taupo beef*" enterprise that is operating in Taupo.
- Nitrogen fertiliser use on drystock farms is relatively low and its use is only on a sporadic and strategic basis due to the underlying economics of the cost of pasture grown.
- The simple option of minimising or removing cropping on drystock farms reduces one of the high N leaching areas. However, given the development status of large tracts of drystock land in the catchment, this is a crucial tool in improving land productivity as this enables operations to derive higher per head performance.

3.6.2 Phosphate losses

- Overseer does not model P loss well and may well underestimate it given the assumption of best practice.
- Overall phosphate losses show little change across the systems analysed, however there is a need for education for farmers on what drives this and also understanding of why Overseer is poor at accounting for this.
- Overseer remains the *"tool"* to estimate these losses however the danger is that with a lack of model understanding many farmers may believe that they can do little to change P losses from their farm.

3.6.3 Summary – Current Operations

- The current operations are summarised as below:

	CS 1	CS 2	CS 3	CS 4
Operating Profit ($ / ha)	$460	$305	$260	$245
N leached	14	15	21	25
$ OP / kg N leached	$32.80	$20.33	$12.30	$9.80

- While CS 4 shows the lowest overall profitability and lowest operating profit per kg of N leached it is important to remember this operation is

primarily in place to support the dairy operation. This is typical of runoff operations.

- The most efficient of the systems, based on $OP / kg N leached, is the low intensity bull breeding operation. This is primarily driven by the high levels or per head performance (high growth rates) and high return per kilogram of product produced, the latter due to the dairy bull supply enterprise.

3.6.4 Summary – Financial

- A key outcome of this study was to assess the impact of the change in farm profitability through investigating strategies to reduce nitrogen leaching.
- The following table shows the change in operating profit per kilogram of nitrogen leached for each of the scenarios:

	CS 1	CS 2	CS 3	CS 4
Scenario One	-60.83	197.25	-30.84	0.83
Scenario Two		79.38	-71.95	-14.58

- Three out of the four farms analysed showed a negative return (i.e. a cost) to reducing nitrogen losses. The only farm to shows a positive return from the reduction was the operation with a moderate base performance to begin with.
- Assuming a normal level of base profitability for case study two in the base year it would have been expected that the result would be on par with the other three farms.

3.6.5 SWOT Analysis

- The SWOT analysis tables as conducted in the original report remain true for each of the farms and analysis as appended to this report.

4.0 OVERSEER® VERSION CHANGE IMPLICATIONS

4.1 Given the recent change Overseer® version 6 a key component of this study was to obtain an accurate assessment of the impact that the change in version had on nitrogen leaching compared to the initial study.

4.2 The following shows the difference in N leaching (kg N/ ha) across the scenarios modeled for each farm between V5 (2009) and V6 (2013):

Farm	SL1		SL2			DMCSB1			DMCS2		
Scenario	Base	S1	Base	S1	S2	Base	S1	S2	Base	S1	S2
V5	12	14	15	13	12	18	15	12	20	18	12
V6	14	17	16	15	14	21	18	16	25	21	13
Change	2	3	1	2	2	3	3	4	5	3	1
%	17%	21%	7%	15%	17%	17%	20%	33%	25%	17%	8%

4.3 This shows an average lift in N leached of 18% due to the changes made between the models.

4.4 Interestingly it is the intensive deer operation that relied on heavy exports of silage to meet the 12kg N target shows the greatest discrepancy in N leached.

4.5 The continual development of Overseer does present challenges to undertaking such analysis however we must view this on-going improvement as a positive as we strive to gain a greater understanding of our farming systems and their impact on the environment.

4.6 As long as all users and stakeholders recognise the value in this improvement then there will be acceptance that the outputs will change, but long term this will be for the better.

5.0 DAIRY SUPPORT ROLE IN THE UPPER WAIKATO CATCHMENT

5.1 Background

The dairy support industry within the Waikato has grown significantly in recent year and will continue to grow in the future

Key factors influencing this growth are:

- **Growing dairy industry** – there is an increasing demand for quality grazing as growth of dairying in the Central Plateau continues. The economics of land use also mean that operations that traditionally "kept stock at home" are looking at options to graze off and increase milking herd sizes. Potential nitrogen limits on dairy farms would make it advantageous for dairy farmers to winter cows off.
- **Reduced profitability of sheep and beef farming** – dairy grazing revenue (particularly dairy heifers) provides a higher comparable return per kilogram of dry matter to traditional sheep and beef farming. The system also provides a more consistent income and less volatility than sheep and beef markets.
- **Opportunity to release capital** – selling the capital stock on farm and taking on dairy grazers results in capital released from the operation with no reduction in overall profitability (in fact this is an increased based on the above). A typical 300 hectare sheep and beef farm could have approximately $400,000 tied up on stock on farm at today's prices so this is a significant factor.
- **Aging farming sector** – those that are running drystock farming enterprises at the smaller to medium end of the scale (typical of the upper Waikato catchment) continue to do so without significant outside assistance. This is due primarily to scale and economics. By default therefore the ever increasing age means those managing these farms are looking for easier options that sheep and deer. This leads to an increase in cattle and primarily dairy grazers.
- **Cartage costs** – the rising cost of stock cartage means there is incentive for farmers to keep their grazing "*closer to home*". This means grazing stock that used to travel as far as the Hawkes Bay, for example, are now being grazed in the Waikato.

- **Monitoring ability** – the challenging droughts of 2008 and 2013 have reinforced the need for dairy farmers to keep a close eye on the quality of the grazing they are paying for to ensure both value for money and also that their expectations are being met. Again this drives the ability to source grazing closer to home.

5.2 Support Type

There are a number of different options for dairy and understanding the system and implications of each of these is critical. These include:

5.2.1 Heifer Grazing – this involves taking on dairy replacement stock usually either from four months of age (December) or nine months (May) and taking these through to 21 months (following May). A down side of this policy is that the timeframes are largely fixed and there is little flexibility in tough seasons.

Economics – due to the ability to release capital and reduce costs this system remains one of the more profitable farming enterprises – typically returns around 16 cents / kg of DM. Also a key consideration is the monthly cashflow that this operation generates – far more attractive than waiting 2.5 years for a return on a steer.

Nitrogen Losses – Nitrogen losses typically increase compared to traditional policies due to the increase in female cattle. High growth rates and therefore higher feed intakes are required. The double up of stock in autumn means nitrogen use is high in these systems to meet the autumn feed demand.

Phosphate runoff – very system dependant but the resultant impact of cattle on hillsides will mean the potential for sediment losses on hillsides is higher. Higher growth rates are required and therefore higher quality pastures mean a general need for higher soil fertility and increased risk associated with increased soil phosphate levels.

5.2.2 Winter Cow Grazing – typically involves cows on farm for anything from 6-10 weeks over the critical winter period of high potential N losses. These losses are often exaggerated by the fact many of these cows are wintered on swede and kale crops.

Economics – highly dependent on the grazing system and grazing rate charged but short term returns are in the order of 25 – 32 cents / kg DM. The hidden cost here is the time take to set the feed up for these systems and the time to recover once the cows leave. This also detracts from the ability to set up profitable policies around this without the winter feed supply that is allocated to the dairy cows.

Nitrogen Losses – these are high given the stock type, timing and typical grazing management practices that are put in place.

Phosphate runoff – system dependent but with high portions of cows run on winter crops the risk factor is high when considered in line with sediment runoff.

5.2.3 Supplement Supply – this is traditionally in the form of grass silage and most notably baleage but increasing focus on best land use is meaning more areas producing maize silage. The latter is also being driven by increases in technology

Economics – supply of grass silage is only marginally profitable when all nutrients are considered in the economic analysis. The typical return of 15 – 20 cents / kg DM reduces to a nett return of 8-10 cents when compared on a true gross margin basis. Maize silage can typically return three to four times the typical gross margin of sheep and beef operations making this attractive for those that have dairy operations in the vicinity.

Nitrogen Losses – for grass silage this is no major issue given the net export of nutrients that takes place. For specialty crops such as maize silage the risk factor is high given the cultivation practices required and the nitrogen inputs applied.

Phosphate runoff – low risk for grass silage but has the potential to be high for specialty crops.

5.2.4 Dairy Bull Supply – this has become a growing sector within drystock farming enterprises where bulls are supplied to the dairy industry for herd mating. These are typically farmed through until two year age (26 months) and sold or leased to dairy farmers at this point.

Economics – typically strong given the ability to sell bulls at a $300 - $500 / head premium to works value. Countering this is the need to take all bulls through the second winter.

Nitrogen Losses – these are deemed moderate and are only increased by the need to take the large bulls through a second winter.

Phosphate runoff – very system dependant but there is a high risk of higher P losses through sediment due to large bulls being wintered (particularly if this is on hill country) and also increases significantly if winter crops are used to maintain feed supply.

5.3 Summary

The impact of the dairy support sector requires key consideration in the catchment in the future. It has high potential for increases in both N and P loss. The rapid ease with which this system change can occur is another factor to be considered.

Changes to existing traditional sheep, beef and deer policies which could potentially increase and P losses occur over time. Farmers who will be looking to increase stocking rate will do so in line with a farm development programme (fertiliser, regrassing etc) and the resultant increase will be gradual.

Winter dairy cow grazing or selling trade cattle and replacing with dairy heifers are decisions that can be made relatively easily and implemented quickly provided the right drivers are in place.

Appendix 1 SWOT ANALYSIS

SWOT Analysis for SAL1 - Base model v's high nutrient leaching 14kg N/ha/yr

Strengths

- The low leaching (12kg N leached) does not rely on nitrogen input for the system to work.
- Has lower N leaching.
- Reduced GHG emissions.
- Less supplement is required for this system – time and labour in feeding out.
- Cattle policy is simple and easy to manage.
- Access to niche market through historic networks and in part location.
- Reduced winter liveweight being carried.

Weaknesses

- Less alignment between the supply and demand curves.
- Has a lower Gross Farm Income and a lower Operating Profit.
- Both ROA and ROE is reduced in this model.

Opportunities

- Opportunity to improve sheep efficiency through reduced ewe size and improved litter size and weaning weight.
- Better integration between cattle system and sheep system for animal health benefits.

Threats

- That an environmental event such as drought may require the application of N to maintain the system.
- A drought or severe winter may also reduce the current stocking rate, dropping leaching but also reducing the profitability further.
- Failure of winter turnip crop through pest or environmental.
- Dairy farmers choose not to buy bulls or lease them.
- The personnel skill to manage the system.

SWOT Analysis for SAL2 – Base vs Low leaching 12kg N / ha / yr

Strengths

- This model has a shows a closer alignment between the supply and demand curves.
- This model does not rely on nitrogen input for the system to work.
- Has lower N leaching.
- Reduced GHG emissions.
- Has a higher Gross Farm Income and marginally lower Farm Working Expenses, giving an overall higher Operating Profit.
- Less supplement is required for this system – time and labour in feeding out.
- Focus is on a higher performing ewe flock at similar numbers.
- Cattle policy is simplified and focuses on a higher proportion of smaller animals.
- Both ROA and ROE is improved in this model.
- Fairly flat farm cover with improved pasture quality.
- 50:50 sheep:beef ratio giving balanced risk.

Weaknesses

- Higher winter liveweight being carried.
- Store bulls – risk of finding a market at this time.
- Buying steers on a grass market.

Opportunities

- The stock buying and selling policy is simplified and does provide flexibility in buying and selling depending on feed, price and availability.
- Opportunity to increase the profitability of the system whilst reducing the impact on the environment
- Improving the efficiency of the ewe flock will provide further opportunities in reducing leaching from maintaining ewe numbers but providing additional stock in the form of lambs.

Threats

- That an environmental event such as drought may require the application of N to maintain the system.
- A drought or severe winter may also reduce the current stocking rate, dropping leaching but also reducing the profitability.
- The inability to make or acquire supplements.
- Volatile product prices.
- The personnel skill to manage the system.

SWOT Analysis for DMCSB1 - Base vs Low nutrient leaching 12kg N / ha / yr

Strengths

- Lower N leaching
- Higher GFI
- Lower GHG overall due to reduced stocking rate
- System can be undertaken without significant capital expenditure

Weaknesses

- Lower profitability
- Negative ROE given current debt loading
- Extremely high reliance on exporting silage bales from system. Very high risk system in terms of the ability to be able consistently sell these bales
- High level of nutrient exported from the system
- Higher reliance on fertiliser to replace nutrients
- Higher GHG / kg product – only due to reduce product out the gate (excludes silage sales)
- Stock policy now primarily deer (no cattle, few sheep) – high risk if deer returns reduce
- High FWE % (risky)

Opportunities

- If economics improve there could be further opportunity to reduce SR and reduce N Leaching however economic viability is driving the need for high stocking rate

Threats.

- Inability to sell surplus silage
- Increases in fertiliser costs increasing the cost of the system
- Dairy industry not purchasing extra feed

SWOT Analysis for DMCSB2 – Base vs Low nutrient leaching 12kg N

Strengths

- Lower N leaching
- Higher GFI
- Lower GHG overall due to reduced stocking rate
- Reduced debt

Weaknesses

- Lower profitability
- Very poor ROE (0.03%)
- Extremely high reliance on exporting silage bales from system. Very high risk system in terms of the ability to be able consistently sell these bales
- High level of nutrient exported from the system in the above
- Higher reliance on fertiliser to replace nutrients
- Complete removal of one enterprise – less diversification and more risk
- No crops in system presents a high risk wintering operation of pasture growth rates are not sufficient to supply required winter feed
- More potential pugging with cows being wintered on grass – hill side damage as well
- Significant problems with pasture cover "blow out" in summer – peaking over 3,000kg DM / ha. Significant issues controlling brown top on hills and need to use dairy heifers for clean up – i.e lower weight gain
- Utilising maximum "mowable area" limits options in a good season – what to do with the surplus
- No weight gain opportunity on winter cows if the full 300 are to be wintered
- High FWE % (risky)

Opportunities

- Create a lower labour input system with low sheep numbers and primarily dairy grazing – contract out the winter grazing to the dairy farm and significantly reduce workload.

Threats.

- Dairy farm looking to lower input system and having to sell feed on the open market
- Poor winters and the issues this brings
- Inability to sell surplus silage
- Increases in fertiliser costs increasing the cost of the system
- Lower sheep returns would mean full reliance on dairy grazing income