

# **Nitrogen and Phosphorus Losses from "Average" Waikato Farms to Waterways as affected by Best or Potential Management Practices**

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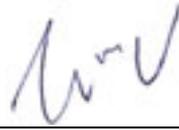
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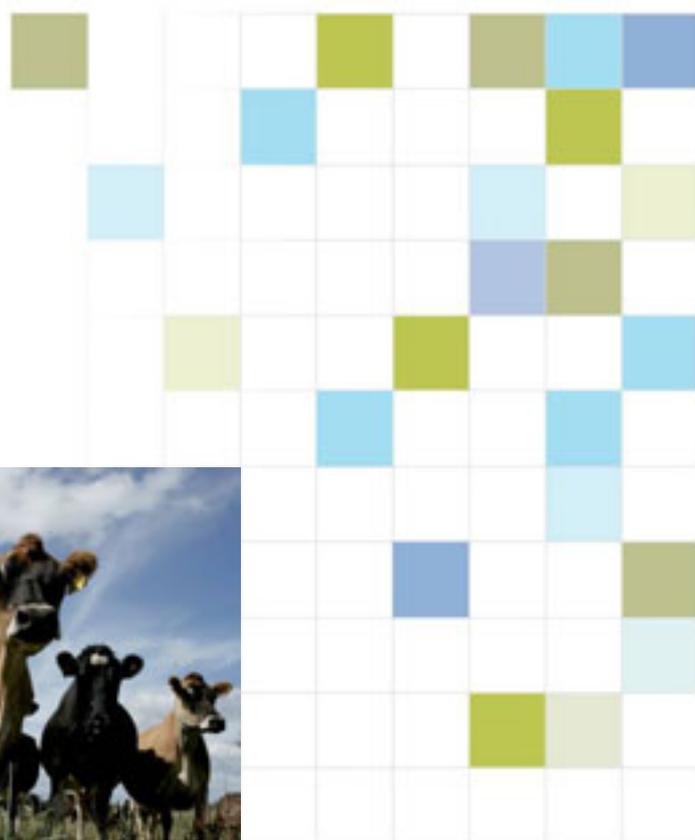
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Stewart Ledgard and Ian Power

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## **1. Introduction**

As part of a broad scoping exercise on the potential for reducing nutrient loads in the catchments of the shallow lakes within the Waikato Region, Environment Waikato required estimates of nitrogen (N) leaching and phosphorus (P) runoff (kg/ha/yr) from typical dairy and sheep & beef farms within the region. These estimates were made using the OVERSEER<sup>®</sup> nutrient budget program with particular emphasis on the Waikato River floodplain where many of the small lakes are located. Yields of N and P were estimated for the current “average” system, best management practice and potential mitigation practices for the two farm types. The OVERSEER<sup>®</sup> nutrient budget program (version 5.2.4.0) was used for these calculations.

## **2. OVERSEER<sup>®</sup> nutrient budget program**

The OVERSEER<sup>®</sup> nutrient budget program is a decision support model designed to help users develop nutrient budgets and evaluate implications of alternative management practices.

The OVERSEER<sup>®</sup> nutrient budget program is an empirical, annual time-step model. It provides estimates of the fate of nutrients in kg/ha/yr, ignoring year-to-year variability due to weather. The model contains a number of databases for nutrient concentrations of fertiliser, animals and products. These are used for estimating the nutrient inputs or outputs on a per-hectare basis.

### **3. Farm category information**

The “average” dairy farm was primarily based on data for Waikato dairy farms from the LIC database while the average sheep and beef farm was based primarily on statistics from the MAF sheep and beef farm monitoring report (see appendices 1 and 2).

The best management farm practice scenario was based on assumptions relating to farm practices which are beneficial environmentally but which have minimal net cost or may potentially increase farm profitability (e.g. no N fertiliser in winter, land application of farm dairy effluent, optimum soil P status).

The potential scenario included practices which can significantly reduce N and P losses but which may represent a significant cost on farm (e.g. winter feed pad systems, nitrification inhibitors, full riparian management).

## 4. Summary

**Nitrogen and phosphorus losses (kg/ha/year) from “average” Waikato farms to waterways as affected by best or potential management practices, estimated using the OVERSEER® nutrient budget model**

	Dairy		Sheep & beef	
	N	P	N	P
Average	36	0.5	13	0.3
Best practices	33	0.3	12	0.3
Potential practices	20	0.2	8	0.2

### Information sources and assumptions:

1. Average dairy farm. This was based on average Waikato farm data from LIC statistics, and average fertiliser data from Dexcel ProfitWatch database (114 kg N/ha/yr and 49 kg P/ha/year). It was assumed that 20% of N fertiliser was applied in winter (relatively high uncertainty for this assumption). Estimates were based on an average for two farm systems, one with dairy effluent going to ponds and the other to land application in a ratio of 1:3 according to the current average for the Waikato.
2. Best practice dairy farm. This assumed that all farm dairy effluent was land applied and that no N fertiliser was applied in winter (but that the annual total was unchanged). The effluent block was assumed to receive no N fertiliser and reduced P fertiliser according to maintenance requirements.
3. Potential dairy farm. This was based on further assumptions that the farm using winter management practices including a winter feed/stand off pad and nitrification inhibitors. It was also assumed that riparian management was used and reduced P losses by c. 20%.
4. Average sheep and beef farm. This was based on data from the MAF intensive monitor farm for the Waikato/Bay of Plenty region. Fertiliser use (20 kg N/ha/yr and 24 kg P/ha/year) was based on data from farms in the Monitor farm system and it was assumed that 50% of the N was applied in winter (high uncertainty in the latter estimate).

5. Best practice sheep and beef farm. This assumed that no N fertiliser was applied in winter (but that the annual total was unchanged).
6. Potential sheep and beef farm. This was based on further assumptions of the farm changing cattle to an all male cattle policy, and winter management practices such as the use of nitrification inhibitors. It was also assumed that riparian management was used and reduced P losses by one-third.

**NB: There is a wide variation in biophysical properties and management practices used on individual farms. Consequently the N and P losses from individual farms will show a wide variation around the “average” farm presented above. Similarly, the most appropriate practices to reduce N and P losses from farms to waterways will vary with individual farms. Economic and social factors will also affect likelihood of uptake of improved practices.**

## 5. Appendices

### 5.1 Appendix 1: Table of assumptions

Table of assumptions used in the OVERSEER<sup>®</sup> nutrient budget model to estimate Nitrogen and phosphorus losses (kg/ha/year) from “average” Waikato farms to waterways

	Dairy	Sheep and Beef
Stocking rate	3.0 cows/ha	Sheep 7.4 SU/ha Cattle 5.5 SU/ha (40% male)
Production	920 kg MS/ha/yr	25 kg wool/ha/yr
Effluent block area	15% of farm	
Contour	Flat	Rolling
Rainfall	1200 mm/yr	1200mm/yr
Soil type	Volcanic (ash)	Volcanic (ash)
Olsen P	43	16
Fertiliser	114 kg N/ha/yr 49 kg P/ha/yr	20 kg N/ha/yr 24 kg P/ha/yr

## 5.2 Appendix 2: Sources of Information

Ministry of Agriculture and Forestry. Sheep and Beef Monitoring report-July 2005.

<http://www.maf.govt.nz/mafnet/rural-nz/statistics-and-forecasts/farm-monitoring/2005/sheep-and-beef-2005.pdf>

Nitrogen and phosphorus fertiliser inputs for sheep and beef farms within the Waikato region was obtained from Ballance field representative's sales records.

The effectiveness of riparian zones on removing P in runoff was obtained from discussions with Dr Ross Monahan, AgResearch.

The effectiveness of nitrification inhibitors in reducing N leaching was obtained from published and unpublished studies.

Data on the number of dairy farms using a two pond anaerobic effluent disposal system was obtained from Environmental Waikato.

Dairy farm input data was obtained from LIC statistics, and average fertiliser data from the Dexcel ProfitWatch database

Amanda Judge and Stewart Ledgard (2004): Nutrient Budget for Waikato dairy and sheep and beef farms for 1997/98 and 2002/03 Client report prepared for Waikato Regional Council. June 2004. 34 pp