

Farm dairy effluent management regulation in the Waikato Region

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INTRODUCTION

In 1994 Environment Waikato introduced rules to regulate farm dairy effluent management in the Waikato Region through the *Dairy Shed Effluent Operative Plan* (Environment Waikato, 1994). This paper discusses the policy and implementation processes.

DISCUSSION

Policy

Terminology

It has been common practice among resource managers and research agencies in New Zealand to use the following terms related to farm dairy effluent management: *dairy shed effluent*, *dairy shed waste water*, *dairy shed*, *cow shed* and *effluent disposal*. From the dairy industry and sustainable resource management viewpoints these terms are inappropriate. Considering the international and national quality requirements imposed on milk, the high capital investment on dairy farming and the associated complex farm management practices, it is proposed that *dairy shed* or *cow shed* should be referred to as **farm dairy**. Consequently, the term *dairy shed effluent* should be referred to as **farm dairy effluent**. The use of terms such as *wastewater* should be discontinued because farm dairy effluent is a resource not 'waste'. It is suggested that when effluent is irrigated to grow plants, the activity must be referred to as **effluent irrigation** (or 'effluent application' or 'land treatment of effluent' or 'effluent spreading', or any other terms as long as the term *disposal* is avoided). However, the term 'disposal' is appropriate if treated or raw effluent is discharged into waterways.

Issues

Environmental

There are approximately 6000 dairy farms in the Waikato Region. Prior to the local government amalgamation in 1989, the Waikato Region comprised of the Waikato and Hauraki Catchment Boards. During this period more than 80% of the dairy farms were discharging farm dairy effluent to waterways. Assuming all farms were discharging untreated effluent to waterways with a lactation period of 240 days, an average herd size of 200 cows and farm dairy N output of 20 g N cow⁻¹ d⁻¹, approximately 5760 tonnes of N yr⁻¹ would have been discharged to waterways. With an effective grazing area of 70 ha per farm and the current average regional dairy pasture fertiliser-N use of 55 kg N ha⁻¹ yr⁻¹ the effluent-N loading would have been sufficient to supply 25% of the dairy farms fertiliser-N need in the Waikato Region. It could be argued that raw farm dairy effluent had not been discharged to waterways since the introduction of two pond and barrier ditches systems by MAF. Nevertheless, Hicky *et al.* (1989) estimated that treated effluent discharged from either two pond or barrier ditches systems would require > 2700 fold dilution for faecal coliforms (bathing criterion) and to prevent nuisance algal growth.

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These workers recommended that “the general design criteria applied to the pond treatment systems may be inadequate and that some revision is desirable”.

Cultural

A consistent message from Maori is that the purification of effluents through land is much more acceptable option than the direct discharge of effluents to waterways.

Administration

There were two sets of rules administered by the Waikato and Hauraki Catchment Boards in the Waikato Region: (a) discharges to land as effluent irrigation and discharges to waterways from pond systems did not require resource consents from Hauraki Catchment Board whilst (b) these activities required resource consents within the Waikato Catchment Board area. Following the amalgamation of these catchment boards under Waikato Regional Council, the administrative differences existed between the two catchments causing confusion among the dairy farmers.

Socio-economic considerations

Approximately 50% of the nation’s dairy farms are in the Waikato Region and hence the adverse environmental effects of these dairy farms are both regional and regional significance.

Rules

The rules are to (a) prohibit discharge of untreated farm dairy effluent to water, (b) permit discharge of effluent onto land provided certain conditions are met, and (c) allow discharge of treated effluent to surface water as a discretionary activity (i.e. an activity that requires a resource consent).

Permitted activity conditions – discharge of effluent onto land

- (a) There shall be measures in place to ensure that no discharges of effluent to water, that is not part of a treatment system, will occur as a result of pump breakdown or prolonged wet weather.*
- (b) Any effluent treatment or storage facilities (e.g. sumps or ponds) shall be sealed so as to prevent any contamination of water by seepage of effluent. This shall be done by ensuring that the permeability of the sealing layer does not exceed 10^{-9} metres sec^{-1} .*
- (c) Any effluent treatment shall be sited and operated so as to avoid odour and spray drift nuisances.*
- (d) The effluent loading shall be either:*
 - at a rate not exceeding $150 \text{ kg N ha}^{-1} \text{ yr}^{-1}$*
 - at a higher rate provided there is no elevation of ground water N concentrations such that existing or reasonably foreseeable uses of the receiving ground water or surface water would be compromised.*
- (e) The maximum loading rate of effluent onto any part of the irrigable land shall not exceed either:*
 - 25 mm depth per application*
 - a higher rate provided there is no elevation of ground water N concentrations such that existing or reasonably foreseeable uses of the receiving ground water or surface water would be compromised.*
- (f) Effluent application shall not be undertaken in circumstances such that effluent enters surface water that is not part of a treatment system, or results in ponding on the land surface for more than five hours.*

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(g) *The discharger shall provide information to show how the requirements of the rule (conditions (a) to (f) above) are met, if requested by Council.*

Discretionary activity conditions – discharge of treated effluent to surface water

(a) *Any effluent treatment or storage facilities (e.g. ponds) shall be sealed so as to prevent any contamination of water such that existing or reasonably foreseeable uses would not be compromised by seepage of effluent.*

(b) *Any effluent treatment or disposal systems shall be sited and operated so as to avoid odour and spray drift nuisances.*

(c) *The effluent shall be treated in either:*

- *a two pond or barrier ditch system; or*
- *a system which can be demonstrated by the applicant to the satisfaction of Environment Waikato to be consistently capable of achieving a discharge effluent quality of not more than 100 g m⁻³ of BOD and 100 g m⁻³ suspended solids.*

The council will accept as compliance with this standard a pond or barrier ditch system designed in accordance with the criteria specified in the document “Farm dairy effluent treatment systems – a guide to the design, installation and operation” (Environment Waikato, 1993).

(d) *The system shall be operated and maintained in accordance with good practice and, in particular, the discharger shall desludge any system upon request by the council to do so.*

When the rules were proposed in 1993 many submissions were received in opposition to and in support of the rules (the rules stated above are the current rules following the hearing of submissions). The N loading rate for the *proposed* permitted activity rule is worth mentioning here. The proposed N loading rate was 100 kg N ha⁻¹ yr⁻¹ based on a detailed N modelling by Selvarajah (1994) presented as a technical report to the Council. A major portion of this technical report was also presented at the Fertiliser and Lime Research Centre, Massey University (Selvarajah, 1996a). Due to the overwhelming response from the dairy farming community and to encourage land based system as a preferred treatment option the Hearing Committee increased the N loading rate from 100 to 150 kg N ha⁻¹ yr⁻¹. Most regional councils in New Zealand currently use a loading rate of 200 kg N ha⁻¹ yr⁻¹ with little or no scientific basis.

Rules implementation methods

(a) *Establishment of rules*

- *permit minor or desirable activities subject to meeting appropriate environmental standards*
- *regulate other acceptable activities subject to meeting appropriate environmental standards, and*
- *prohibit unsustainable activities*

(b) *Encouragement of land treatment*

“Environment Waikato will encourage the re-use of farm dairy effluent through land treatment systems”.

The methods will be implemented through:

- *the rules hierarchy which defines appropriate land treatment practices as permitted activities*
- *financial incentives (i.e. no administration or consent charges) for permitted activities*
- *encouragement and advice via field staff to farmers*

(c) Encouraging research

“Environment Waikato will encourage and support research into effluent management practices and new technologies for managing farm dairy effluent”.

The method will be implemented through:

- *support of research into effluent minimisation practices*
- *support of research into determining sustainable effluent loading rates for land treatment systems*
- *support of research into, and testing of new technologies. This includes the co-ordination and support of wetland treatment system trials*
- *and evaluation of a selection of existing pond, barrier ditch and land treatment systems including:*
 - *the quality of the treated effluent*
 - *environmental effects*
 - *the range of variables affecting the performance of the treatment system.*

(d) Information

“Environment Waikato will prepare and circulate to farm dairy effluent dischargers, information addressing appropriate effluent management practices and means of compliance with regional rules”.

The method will be implemented through:

- *the continued production and circulation of the “Ground Cover” newsletter to the rural community*
- *the availability of copies of Environment Waikato’s guide to farm dairy effluent treatment systems to:*
 - *provide technical information pertaining to the design, construction, maintenance and operation of effluent treatment systems*
 - *specify Environment Waikato’s objectives, policies and directions pertaining to farm dairy effluent management*
 - *inform dischargers of the benefits of on-farm N management.*

Monitoring and review

(a) Compliance monitoring

All discharge systems will continue to be monitored at least once annually.

(b) Impact monitoring

Impact monitoring of individual systems will not normally be performed due to the high number of systems involved. Impact monitoring will be performed through an environmental monitoring programme to assess cumulative effects.

(c) Performance monitoring

The objective relating to improved administrative efficiency can be monitored by analysis of data from the consent process database. This will provide information such as total and average costs for processing and monitoring consents. Moreover, annual compliance monitoring reporting will be used to assess the trend of the extent of the use of land treatment systems.

Implementation process

There was no formal implementation programme or project initiated following the introduction of the farm dairy effluent rules. To date common sense has been used by council staff to implement the policies. Fortunately, most of the policies and implementation methods prescribed in the plan have already been implemented successfully. However, a formal implementation programme may have achieved more results.

(a) Establishment of rules

Permitted activity

Questionnaires and forms were sent to dairy farmers in the Waikato Region to apply for resource consents (if they have ponds or barrier ditches) and surrender resource consents (if they meet permitted activity conditions). Most farmers responded promptly, however, some were confused. To date Environment Waikato continues to hear from farmers that had land based systems but had been holding resource consent and paying administration charges (\$200 per annum). This must be due mainly to the fact that some farmers do not read council forms or letters properly or the contents are not clear enough for them to understand. Those farmers who claimed that they could meet all permitted activity conditions received a permitted activity sticker and cancellation of resource consent and administration charges from the council.

Farmers who have been using land based system have been using tankers, pot spreaders and travelling irrigators to spread effluent from a sump (raw effluent collection area) or holding pond (an ex pond/barrier ditch system). When effluent is irrigated from a holding pond, contractors have been employed to irrigate effluent. The key conditions for compliance monitoring are whether the farmer has sufficient land area for irrigation and that there is no visual sign of excess effluent application. Based on the effluent survey performed by AgResearch for Environment Waikato in 1995, for a 200 cow herd, about 7.4 ha is required for farm dairy effluent irrigation at $150 \text{ kg N ha}^{-1} \text{ yr}^{-1}$.

Discretionary activity

Despite the increasing use of land based systems in the Waikato Region, due to the large number of farms requiring resource consents annually (up to 800 farms per annum), the resource consents are processed as if they were controlled activities (controlled activities are activities for which consents are granted under certain standard conditions prescribed in the plan). Strictly speaking these consents are for discretionary activities and should have been processed on a case by case basis giving regard to adverse environmental effects of discharges on waterways. Since the consent processing is rapid, the cost of processing is generally less than \$250 per consent application. If proper Environmental Impact Assessment had been required with appropriate consultation and notification the cost would have been 10 to 100 fold greater. At the beginning of the policy implementation most consents were granted for a ten year period. For the past two years, however, farm dairy effluent consents have been granted for a 5 year term. Although not prescribed in the plan resource consents requiring discharges to lakes and other sensitive water bodies (e.g. streams in Reporoa area) have been discouraged with more shorter consent terms. Similarly farms with high herd size have also been advised to adopt land based systems.

Since the introduction of the farm dairy effluent plan there have been three prosecutions related to the non-compliance of pond treatment systems and associated poor quality discharges. Of the three prosecutions one was unsuccessful. Of the two successful prosecutions, one case was where a pond

system collapsed and released a substantial volume of effluent into a stream. In total the farmer was fined \$7500 (Table 1).

Prohibited activity

Since the introduction of the rules there have been few reported cases of raw effluent deliberately discharged into waterways. Since 1993 there have been five prosecutions related to raw effluent discharge into water bodies (Table 1). Most cases were related to poorly managed land based systems with raw effluent run-off to waterways due mainly to no effluent pumping. These prosecutions had a 100% success rate with a range of fines being from \$2000 to \$25000. It must be noted that dairy farmers have been prosecuted prior to the introduction of the farm dairy effluent rules. According to the records 9 farmers were prosecuted between 1989 and 1992. One case worth noting was where a farmer was prosecuted for a poorly managed land based system and fined \$25000 by the Planning Tribunal in 1991. It must also be noted that approximately 40 abatement notices have also been served on dairy farmers on effluent issues.

Table 1. Prosecutions related to farm dairy effluent discharges in the Waikato Region

Name	Year	Incident	Fine
McCosh	1989	Discharge of effluent to water	\$1500
Duguid	1989	Discharge of effluent to water, unsatisfactory oxidation ponds.	?
Lindsay	1989	Discharge of effluent to water, unsatisfactory oxidation ponds.	\$250
Sutton	1989	Two farms, no system in place, discharge of effluent to water.	\$5000 and \$2000
The sharemilkers on Sutton's two farms	1989	Both sharemilkers fined \$100 each. This was an action against Sutton, the share-Milkers were caught up in the process.	\$100
Entwisle	1990	The case was dismissed.	
Singh	1991	Poorly managed land treatment system, effluent discharged to water.	\$25000
Russo	1991	Land base treatment, inoperative pump, and discharge of effluent to water.	\$1000
Bassi	1993	Discharge of effluent from oxidation pond. Charges laid against contractor and Bassi. Case dismissed against contractor, Bassi fined.	\$1000
Pollack	1995	Inoperative spray system, discharge of effluent to water.	\$20000
Wheeler	1995	No system, discharge of effluent onto land and to water.	\$4500
Swap	1996	Release of effluent from oxidation pond. Case lost.	
Spence	1997	Discharge of effluent to land and water	\$2000 plus appeal costs \$1500
Withers	1997	Discharge of effluent to water from storm-	\$3000

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		water by-pass system and also for discharge of effluent from collapsed pond.	\$4500
Mockford	1997	Sharemilker for Withers, discharge of effluent to water from storm-water by-pass	\$2000
Ofsoske	1997	Two farms, discharge of effluent to water.	\$16000

(b) Encouragement of land treatment

This policy has been fully implemented. There are no charges for permitted activities and there has been a substantial amount of advice given to farmers by field staff about the benefits of land based systems. Displays have also been used at Field Days and Dairy Expo's to illustrate the benefits of land treatment systems.

(c) Encouraging research

The majority of this policy has been implemented. However, effluent minimisation research has yet to be conducted. For the first time in an attempt to promote farm dairy effluent research and to avoid duplication of research conducted on farm dairy effluent management until 1995 was compiled as an article to NZ Soil News (Selvarajah, 1995).

The following research has been either fully or partially funded by Environment Waikato:

1. Evaluation of pond/barrier ditch systems performance – fully funded and conducted by Environment Waikato (Selvarajah, 1996).
2. Raw farm dairy effluent characterisation – fully funded and conducted by Environment Waikato (Selvarajah, 1996).
3. Seepage of farm dairy effluent treatment ponds – fully funded by Environment Waikato and conducted by Lincoln Environmental (ongoing) (Ray *et al.*, 1995 and 1997).
4. Constructed wetland systems – partially funded by Environment Waikato and conducted by NIWA (Tanner and Kloosterman, 1997).
5. Mineralisation of effluent organic-N – partially funded by Environment Waikato and conducted by Lincoln Environmental (to be completed – contact Greg Barkle).
6. Nitrogen removal through denitrification from land application of effluent – partially funded by Environment Waikato and conducted by Lincoln Environmental in collaboration with AgResearch (to be completed – contact Greg Barkle).
7. Land treatment of farm dairy effluent using short rotation tree crops – partially funded by Environment Waikato and conducted by Massey University (contact Ralph Sims).
8. Nutrient removal from farm dairy effluent using recyclable material – partially funded by Environment Waikato and conducted by Massey University (contact Nanthi Bolan).
9. Sustainability of irrigation of farm dairy effluent in relation to soil and water qualities – partially funded by Environment Waikato and conducted by Massey University (contact Nanthi Bolan).

(d) Information

This policy has been fully implemented. Following the introduction of the farm dairy effluent rules the Dairy Liaison Group was formed to address the implications of these rules. Currently, the group is referred to as the Waikato Dairy Liaison Group. This group has more than 25 members including dairy farmers, dairy industry representatives and CRI scientists. More recently the Environment Waikato Councillors have also been invited to attend the meetings. The group members meet at

Environment Waikato on a quarterly basis and use the meetings as a technology transfer forum where scientific research and policy matters are discussed.

The Council has discontinued the circulation of 'Ground Cover' newsletter. However, a new newsletter called 'Envirocare' is in circulation, which targets both rural and urban community. A technical report (Environment Waikato, 1995) has been produced to act as a guideline document to design, install and operate effluent management systems. More recently another technical report (Environment Waikato, 1997) has been produced as a guideline for the land application of farm dairy effluent and sludge. A bulletin will also be produced shortly on farm dairy effluent irrigation. As for the on-farm N management, many Farmers Discussion Group meetings have been attended by staff and a nitrogen fertiliser use bulletin has also been produced and circulated in 1996. The fertiliser bulletin was produced with collaborative effort from Petrochem, Waikato Federated Farmers, AgResearch and Dairying and Environment Committee.

Monitoring and review

(a) Compliance monitoring

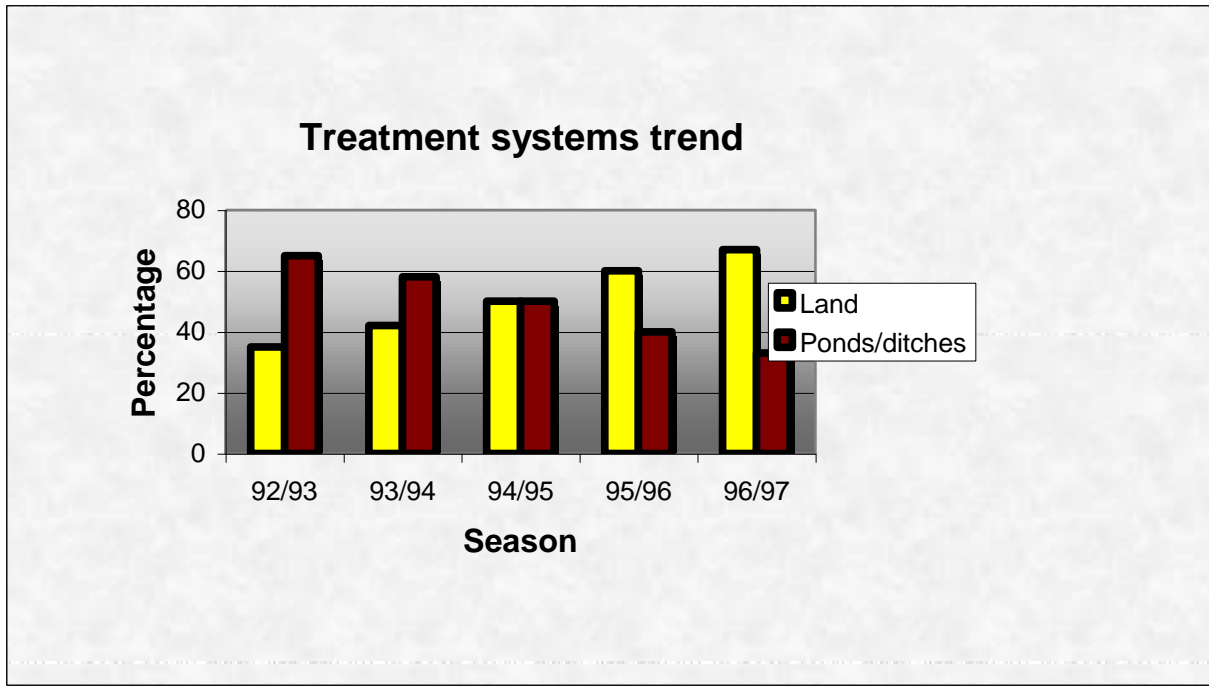
This policy has been fully implemented. All farm dairy effluent systems are monitored annually for compliance. MAFQual has been contracted to perform initial inspection and reporting using an Environment Waikato effluent survey form. The farms are ranked into four groups: Good (all good land treatment systems), Satisfactory (good ponds/barrier ditches), Marginal (both land and ponds) and Unsatisfactory (both land and ponds). Each inspection costs \$25 with the total annual contract costing \$150000. All 'Unsatisfactory' systems will be followed up by the Environment Waikato Resource Officers for compliance, advice or enforcement.

(b) Impact monitoring

Environment Waikato is in the process of producing a State of the Environment Reporting by the end of 1998. The extent of the cumulative effects monitoring will be fully known following the reporting.

(c) Performance monitoring

The majority of this policy has been implemented. Currently the council has a computer data base that is used to monitor consent processes (referred to as RUAMS or Resource Use Authorisation Management System). This will help track the time taken to process consents. There is also a computer 'Bring-up' system that helps monitor unsatisfactory/marginal farm dairy effluent systems. More recently a 'Complaint data base' system has been installed. This system helps identify the type of pollution complaints received and action required and taken by the council.



It is acknowledged that although the land application of effluent is now a permitted activity, oxidation ponds are still used as treatment systems by many dairy farmers to discharge effluent into waterways due mainly to practical problems associated with land based systems in certain regions. For example, despite the rapid conversion from farm dairy effluent treatment ponds to irrigation systems in the Waikato region (3000 farms within the last three years) about 30% of dairy farmers (approximately 1800 farms) are still using ponds/barrier ditches as treatment systems. Operational inconvenience, poor technological transfer and high capital cost related to effluent irrigation management and unsuitable soil or climatic conditions explain the reliance on dairy farm pond systems.

Whilst it is difficult to estimate in dollars the cumulative surface water quality enhancement resulting from minimising discharges to waterways, it is clear that allowing farm dairy effluent irrigation as a permitted activity has resulted in a loss of at least \$600000 as administration charge revenue (\$200 per farm for 3000 farms for the past 3 years). Although the consents have been surrendered by farmers who have adopted land based systems, the files are still retained by the Council for monitoring purposes. Since the success of any effluent treatment is dependent mainly on operator efficiency, a current 'good' system may not always be good due to the farm being sold to a poor operator. If they require regular monitoring, coupled with high rate of non-compliance, permitted activities could be a burden on Council's resources.

Future directions

The Council is currently developing a Regional Plan for the Waikato Region. Using this opportunity, farm dairy effluent discharge rules are being reviewed. Staff from the Resource Use Group have made the following recommendations:

- (a) Retain the current permitted activity conditions
- (b) Introduce a controlled activity rule to irrigate effluent $> 150 \text{ kg N ha}^{-1} \text{ yr}^{-1}$ loading rate (e.g. cut and carry system)

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- (c) Amend the existing discretionary activity substantially by removing (i) < 100 g m⁻³ BOD and SS discharge quality limits and (ii) requiring pond/barrier ditch systems as treatment systems. Consent should be granted on a case by case basis. Pond/barrier ditch systems may well be the best practicable options in most cases. In some cases pond mechanical aeration or a tertiary treatment system (e.g. wetland) may be required.
- (d) Retain the existing prohibited activity.
- (e) Introduce a charging policy to charge non-complying permitted activity holders.

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