

Reducing the Impacts of Agricultural Runoff on Water Quality

A Discussion of Policy Approaches

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TABLE OF CONTENTS

1. INTRODUCTION -----	1
1.1 Scope of the Discussion -----	1
1.2 Development of the Paper-----	2
1.3 Links with Other Government Initiatives-----	2
1.4 Structure of the Paper -----	3
2. RESOURCE MANAGEMENT ISSUES -----	4
2.1 Environmental Issues -----	4
2.2 Economic Issues -----	5
2.3 Imperfect Monitoring and Measurement -----	6
2.4 Attitudes and Behaviour -----	6
3. AGRICULTURAL PRACTICES THAT MINIMISE WATER QUALITY IMPACTS - 8	
3.1 Selecting the Most Appropriate Land Use-----	8
3.2 Increasing Efficiencies in the Application of Farming Inputs-----	9
3.2.1 Fertiliser and Pesticide Management -----	9
3.2.2 Cropping Systems Management -----	10
3.3 Increasing the Resistance of the Farming System to Losses-----	10
3.4 Making Use of Field and Landscape Buffer Zones-----	11
4. POLICY RESPONSES -----	12
4.1 Resource Management Responsibilities -----	12
4.2 The Range of Policy Instruments -----	13
4.3 Voluntary Change -----	14
4.3.1 Information and Education -----	16
4.3.2 Guidelines -----	18
4.3.3 Codes of Practice -----	19
4.3.4 Demonstration Farms -----	20
4.3.5 ISO Accreditation-----	20
4.3.6 Study Groups -----	21
4.3.7 Community Groups -----	21
4.3.8 Farm Plans -----	22
4.3.9 Non-Financial Incentives -----	24
4.4 Economic Methods -----	24
4.4.1 Financial Contributions -----	25
4.4.2 Charges -----	25
4.4.3 Subsidies -----	26

4.4.3.1 Discharge and Design Subsidies -----	26
4.4.3.2 Input and Output Subsidies -----	27
4.4.4 Performance Bonds -----	27
4.4.5 Other Economic Methods (Central Government)-----	27
4.5 Interests in Land -----	28
4.5.1 Land Purchase -----	29
4.5.2 Encumbrances over Land Titles -----	29
4.5.3 Other Methods-----	30
4.6 Regulatory Methods-----	30
4.6.1 Common Law and Liability for Damages-----	30
4.6.2 Regulatory Control Powers Under the Resource Management Act -----	30
4.6.2.1 Discharge Standards -----	31
4.6.2.2 Ambient Receiving Water Standards-----	31
4.6.2.3 Catchment Clubs-----	32
4.6.2.4 Design Standards -----	32
4.6.2.5 Input Standards -----	33
4.6.2.6 Output Standards -----	34
5. POLICY DEVELOPMENT -----	35
5.1 Approaches to Policy Development -----	35
5.2 Integrating District and Regional Council Responsibilities -----	36
5.3 Selecting the Most Appropriate Methods -----	37
5.3.1 Ability to Achieve Objectives -----	38
5.3.2 Compliance Costs-----	38
5.3.3 Ease of Monitoring and Enforcement -----	38
5.3.3.1 Monitoring-----	38
5.3.3.2 Enforcement-----	39
5.3.4 Administrative Costs -----	39
5.3.4.1 Search and Information Costs -----	39
5.3.4.2 Bargaining and Decision Costs-----	39
5.3.4.3 Policy Development Costs -----	40
5.3.5 Certainty-----	40
5.4 Suggested Policy Development Framework -----	40
5.4.1 Develop Infrastructure and Clarify Responsibilities -----	40
5.4.2 Identify problems -----	41
5.4.3 Identify Catchment Management Objectives and Priorities -----	41
5.4.4 Understand Farmer Perceptions -----	41
5.4.5 Inform Farmers about their Environmental Impacts and Alternative Management Practices -----	41
5.4.6 Provide Appropriate Incentives -----	42
5.4.7 Identify and Control Undesirable Practices -----	42
5.4.8 Strategic Purchase of Interests in Land-----	42
5.4.9 Monitoring and Feedback -----	43
5.5 Conclusion -----	43

Executive Summary

Urban and agricultural runoff is lowering the water quality and degrading aquatic ecosystems in New Zealand. A significant source of contamination in our streams, rivers, lakes, wetlands and coastal waters is runoff from agricultural land. This is a major impediment to achieving the sustainable management of water resources.

Agricultural runoff, however, is difficult to measure and control. Unlike point source discharges (those discharging through a single point, such as a stormwater or effluent pipe), non-point source discharges (pollution from wide areas such as runoff from pastures or hillsides) are relatively complex systems to measure and control. Most agricultural sources of contamination are from non-point discharges.

While regulatory methods such as water quality standards and discharge permits commonly have been used to manage point source pollution, these techniques are generally impracticable for managing non-point source pollution. Therefore, changes are required in the ways in which thousands of individual farmers manage their land without relying solely on regulatory methods

This paper provides local authorities and other interested parties with suggestions about how these changes may be encouraged, focusing on the available regulatory and non-regulatory options. The paper recognises that, although regulatory methods may be suitable in some instances, non-regulatory methods are likely to be both more successfully implemented and easier to administer. In particular, voluntary change has been identified as a key factor in the *Sustainable Land Management Strategy* and in policies directed at achieving that strategy. The paper contains information on the various methods which may be used to encourage voluntary change. Methods which support and build on the initiatives of local communities and encourage a collective approach among land users are often particularly successful.

Whichever type of approach is selected, it is critical that policies and methods are developed and implemented in close consultation with farmers and the local community. It is also important that the selected methods are communicated to farmers clearly and effectively. The sharing of information is a key point of the approach, and land users and local communities should be involved in the gathering of information relevant to their activities.

The paper does not recommend that any method be either categorically rejected or adopted. Each local authority should consider the costs and benefits of adopting any particular method in the context of the circumstances and environment of their region or district. To make this evaluation process easier, the paper proposes a process which councils can use to identify and implement the most suitable methods to improve water quality in their jurisdiction.

1. INTRODUCTION

New Zealanders take great pride in the clean waters of their rivers, lakes and streams. Scientific studies² confirm that, overall, the quality of the water is high compared to that of other countries. However, in areas where land has been developed, the water is often not pristine.

Agriculture is the dominant land use in New Zealand, and it is an activity which has significant impacts on water quality. Some of the effects of farming activities on water are direct (e.g. the discharge of agricultural effluent into waterways or the taking of water for irrigation), but many of the effects are indirect - that is, they are a side effect of land use activities. Some land use activities may result in contaminants leaching or seeping into ground water or surface water (e.g. seepage from offal pits, farm rubbish disposal sites or silage pits). Other farming activities, such as clearing vegetation, planting crops and adding fertiliser, can result in changes to the quantity and quality of runoff which may degrade the environment, especially the aquatic environment. It is these latter effects of land use activities (i.e. effects resulting from agricultural runoff) which this document is concerned with.

Degraded aquatic ecosystems and poor water quality in the middle and lower parts of catchments are issues facing nearly every part of the country, whether or not it is highly urbanised or intensively farmed. Water quality is both a regional and a district issue — while regional councils have prime responsibilities for water resources under the Resource Management Act 1991, city and district councils also have responsibilities for managing the adverse effects of land use, including agriculture. The main task for each of these authorities in minimising agricultural impacts on water quality is to encourage the farmer to modify his or her activities and adopt practices (such as fencing and planting) which will minimise the impacts.

1.1 Scope of the Discussion

This paper is intended for use primarily by local authority policy makers who are involved in preparing policy responses to water quality and riparian management in their area. The paper may also be of use to other organisations involved in the policy development process (e.g. people making submissions on regional or district plans) or organisations who wish to develop their own initiatives for reducing the impacts of agriculture on water quality (e.g. Landcare groups).

The main focus of the paper is to provide background information. It does this by identifying the range of methods available for addressing agricultural runoff, and by reviewing each method in terms of its advantages and disadvantages, with regard to effectiveness and cost-efficiency. This review is in general terms only, as detailed analysis would still be required by the local authority in formulating its policies.

² See, for example, *Towards Sustainable Agriculture: Freshwater Quality in New Zealand and the Influence of Agriculture*. Ministry of Agriculture and Fisheries Technical Paper 93/10. 1993.

The paper also contains case studies of initiatives currently being undertaken by local authorities in New Zealand. These studies are presented as ideas to spark further discussion and will not necessarily be applicable to all parts of the country.

Although the paper concentrates on water quality issues, many of the methods discussed may also be applied to protect and improve aquatic ecosystems. Similarly, although the purpose of the paper is to reduce the effects of agricultural runoff on surface water, the methods discussed may also be effective in addressing other agricultural sources of pollution (e.g. seepage from the disposal of agricultural wastes into groundwater and surface water).

1.2 Development of the Paper

This paper is part of a two-year process to improve the understanding of the causes of water quality degradation by agriculture and the means by which water quality may be improved. The process began in 1993 when the Ministry for the Environment and the Ministry of Agriculture and Fisheries jointly commissioned a study into the effects of agriculture on New Zealand's freshwater resources. This study was the first comprehensive analysis of the quality of surface waters, rivers, lakes and groundwater in relation to the use of land for agricultural purposes. The report outlining the findings of that study³ concluded that the quality of lowland rivers and lakes has been reduced by agricultural runoff.

In response to these findings, the Ministry for the Environment prepared an issues paper in August 1994 as a first step toward developing a strategy to address agricultural impacts on water quality. A summary of the submissions received on the issues paper was published by the Ministry in October 1994. Two workshops were conducted (in Hamilton and Dunedin) during that same month where the issues were addressed by the 130 participants. The Ministry, with the assistance of a specially convened technical group, developed a draft action plan to address these impacts. The outcomes of this study and consultation process form the basis of this paper.

The paper is not intended to provide a comprehensive examination of the issues nor an exhaustive analysis of alternative policy instruments. The information presented in the paper is a summary of the key points and an indication of possible directions in policy responses.

1.3 Links with Other Government Initiatives


The issues addressed in this paper are linked with a number of other Government initiatives. The Government's strategy on the environment, *Environment 2010*, sets out a number of priorities for environmental action which this paper helps to address. In particular, *Environment 2010* promotes integrated land and water management and a "landcare" approach to the management of non-point source discharges. *Environment 2010* gives priority, among other matters, to developing and implementing a sustainable land management strategy for New Zealand. The *Sustainable Land Management Strategy* (SLMS) was published in June 1996 and its purpose is to enable land users, and those who provide

³ *Towards Sustainable Agriculture: Freshwater Quality in New Zealand and the Influence of Agriculture*. Ministry of Agriculture and Fisheries Technical Paper 93/10. 1993.

support and services to land users, to work together more effectively to make land use practices more sustainable. The Strategy emphasises that the primary role in achieving sustainable land use lies with the individual land manager or owner, and that sustainable management requires an ethic of striving for the best management practices and continual improvement. The “continual improvement” concept is similar to Total Quality Management (e.g. ISO 9000) and Environmental Management Systems (e.g. ISO 14000). The approach adopted in this paper is consistent with the emphasis provided by the SLMS.

The SLMS identifies three priorities for action, one being agricultural impacts on aquatic ecosystems. Two of the initiatives set out in the Strategy are the establishment of a Landcare Trust (see Section 4.6.7) and the preparation of best management practice guidelines to encourage land users to adopt sustainable land management practices. The best management practice guidelines are still in preparation. They will cover environmental management problems similar to those addressed in this paper, but will be aimed at land users rather than policy makers.

1.4 Structure of the Paper

- Section Two examines the nature of agricultural impacts on water quality and other factors which influence agricultural land management decision-making.
 - Section Three describes some agricultural practices which minimise water quality impacts.
 - Section Four looks at policy options or methods which councils could use to encourage farmers to adopt sustainable management practices.
 - Section Five draws conclusions about the policy options and methods, and proposes a process and policy development framework which councils could use to identify and implement the most suitable methods.
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2. RESOURCE MANAGEMENT ISSUES

Agriculture is the dominant land use in New Zealand and a major force in our economy. However, New Zealand's agricultural productivity has been achieved at some cost to the environment.

The resource management issues addressed in this paper include the adverse effects of agricultural runoff on water quality and the consequent effects on ecosystems, the economic impacts of these effects, the importance of attitudes and behaviour in effecting change, and the difficulties of monitoring and measurement.

2.1 Environmental Issues

Water quality is one indicator of environmental health. The water quality of a stream reflects, and is a measure of, the health of the catchment. However, there is no single measure of water quality; "good" or "poor" water quality depends on the uses and values of the water. Water is subject to many potentially incompatible uses, and degraded water quality can increase the level of conflicts among water users.

Farming, like any business, involves applying a variety of inputs to existing resources to produce a variety of outputs. Some of these outputs are the desired products of the production process and allow the farm to be economically and socially sustainable. However, the production process for farming typically results in water runoff that is contaminated by nutrients and chemicals from the farm. In sufficient concentrations, these may degrade the environment.

A report⁴ released by the Ministers of Agriculture and Environment concluded that intensively farmed parts of New Zealand were characterised by poor water quality. The report highlighted the following concerns.

- Intensive dairying areas were found to be typified by rivers and streams in "poor" condition. The most common problems are excessive nutrient concentrations, high suspended sediment levels and widespread faecal contamination.
- The quality of many rivers declines progressively on moving down river.
- Nutrient concentrations (particularly dissolved inorganic nitrogen and/or dissolved reactive phosphorus) are often excessive in lowland river reaches in agriculturally developed catchments and, in reaches where other environmental factors are favourable, profuse aquatic plant growths occur occasionally or frequently.
- Baseflows in the lower parts of agricultural catchments are often turbid with high suspended sediment concentrations.

⁴ *Towards Sustainable Agriculture: Freshwater Quality in New Zealand and the Influence of Agriculture*. Ministry of Agriculture and Fisheries Technical Paper 93/10. 1993.

- The most widespread problem, however, is faecal contamination. Many lowland rivers, streams and creeks are often not suitable for contact recreation. In intensive dairying areas, streams receiving multiple dairy farm and/or piggery discharges may not be safe for stock watering.
- Eutrophication (enhanced phytoplankton growth in response to elevated nutrient levels) is the cause of a number of water quality problems in New Zealand lakes, including low levels of oxygen in the bottom waters during summer-autumn, poor water clarity, and scums and blooms of nuisance phytoplankton. A large number of small lakes, particularly in the North Island, experience some or all of these problems. Development of their catchments, primarily for agriculture, is almost certainly responsible, due to the substantially increased nutrient loads that result from land use.
- The most significant (and most frequent) kind of groundwater pollution from agriculture is the accumulation of nitrate-nitrogen, especially where concentrations equal or exceed 11.3 milligrams per litre, levels that may influence the health of bottle fed infants. Only shallow groundwaters (down to 60 m) show the effects of agricultural activity, but the phenomenon is common throughout rural New Zealand where stock densities or cropping intensity are high and groundwaters are vulnerable to contamination from surface drainage.

The water quality effects described above can contribute to ecosystem effects such as reduced biodiversity in aquatic ecosystems and increased weed growths in the middle and lower reaches of catchments. Poor water quality can also restrict the uses to which water may be put (e.g. contact recreation requires good water quality) and the aesthetic values of the water.

In addition to these issues, tangata whenua throughout the country have expressed concerns about the impacts of agricultural activities on water quality. As a general guide, the types of issues that Maori may be concerned about include:

- effects on the uses and values of water. To the tangata whenua, water has special spiritual and life sustaining properties which may be affected by the presence of agricultural contaminants;
- effects on the uses and values of special areas and resources, such as waahi tapu (“sacred places”), mahinga kai (food resources), and areas of cultural significance (e.g. marae); and
- effects on the role of tangata whenua as kaitiaki, or guardians, of their environment.

This list of potential concerns is indicative only; tangata whenua themselves are the only ones able to identify issues specific to their iwi, hapu or whanau.

2.2 Economic Issues

Not only does agricultural runoff have significant adverse impacts on aquatic systems, but the decline in farm resources (such as soil and nutrients) will render the farm less economically sustainable. Low water quality increases the costs of water supply for stock and for rural and urban residents. It may also result in animal health problems. Although New Zealand's

water quality is good compared to much of the world, there is no competitive advantage in being average if we are trying to sell our “clean, green image”.

Further difficulties may arise when others bear the costs associated with farming activities, such as the loss of agricultural, recreational, ecological, or cultural values. For example, a mussel farmer may not be able to export shellfish because bacterial concentrations in the growing waters are excessive — while it may be the pastoral farmer upstream who degrades the water, it is the mussel farmer who incurs the costs.

2.3 Imperfect Monitoring and Measurement

One of the characteristics of non-point source pollution problems such as agricultural runoff, is the uncertainty associated with relating a particular observed effect to a specific cause. It can be difficult to attribute any measured contamination to a particular discharge or activity, because of natural variability and the influence of neighbouring discharges. This makes non-point source discharge problems particularly difficult to identify. For example, does the observed effect (degraded water quality) result from natural processes (e.g. release of nutrients from sediments), point source discharges directly into a waterway, non-agricultural sources of pollution (e.g. septic tanks) or agricultural runoff?

Many elements of agricultural systems cannot readily be monitored or are monitored only occasionally. The problems associated with taking samples and the imprecision of measurement from extensive areas and catchments make monitoring a complex and costly task. Significant problems are also associated with the “invisibility” of the discharges and the “hidden” nature of many farming activities.

2.4 Attitudes and Behaviour

Another issue is the importance of attitudes and behaviour on influencing farming practices.

It is generally accepted among resource users that the resource user should take responsibility for reducing any adverse effects of the resource use on the environment. In the case of agricultural land use, failure to change to more environmentally sustainable farming systems can be a result of a lack of understanding of this responsibility among land users, or it can be a result of system failure (i.e. the imposition of a system which is inappropriate to the situation). In many cases, farmers may be willing to make changes to the way that they operate their farms but are unable to make significant changes immediately for economic reasons. It is therefore important to examine any potential impediments to change among land users.

A strong resistance to rules and an anti-bureaucracy feeling remain among farmers. The President of Waikato Federated Farmers described farmers as follows⁵:

⁵ Pinnell, G. (1994). *Farmer perspectives on sustainable farming*. Farm Progress (New Zealand Farmer) June 1994:38-39.

Farmers are fiercely independent by nature and by necessity, in that they have sole management responsibility over a unique and complex system. We resent rules unless they are necessary and there is no better option.

Two other important attitudinal considerations in the policy development process are the time required for change, and the “ownership” of problems and solutions. One model for increasing land user ownership of problems and solutions is the continual improvement model, whereby land users continually monitor and review their progress against environmental objectives that they themselves have set. Land users are not the only party with an interest in these issues, however. The interests of both agricultural land users and other parties with an interest in water quality should be represented in the policy process. Exposure to the needs of other water users can help raise awareness among land users of the “bigger picture” of the downstream effects of farming activities.

Policies have to recognise these factors, as the major aim of any policy instrument, or mix of instruments, is to change behaviour and practices. Therefore, whatever policies are developed, effective methods for influencing behaviour have to be formulated in conjunction with land users and other interested parties.

3. AGRICULTURAL PRACTICES THAT MINIMISE WATER QUALITY IMPACTS

The main task in minimising agricultural impacts on water quality is to encourage farmers to adopt practices that minimise contamination by agricultural runoff. The details of these practices are likely to be relatively site-specific, depending on the particular problems and opportunities of the farming situation. However, in general, techniques which farmers can carry out to minimise contamination by agricultural runoff include:

- *selecting the most appropriate land use for the site and circumstances* — this is likely to have the greatest bearing on the level of aquatic impacts;
- *increasing efficiencies in the application of farming inputs* — these responses avoid or reduce the quantity of potential contaminants, such as fertilisers and pesticides, making less available for loss to the environment;
- *increasing the resistance of farming systems to losses of nutrients and chemicals* — these responses address major pathways by which sediment, nutrients, pesticides and other contaminants reach water; and
- *making greater use of field and landscape buffer zones* — these responses intercept contaminants and reduce the erosive force of runoff water.

3.1 Selecting the Most Appropriate Land Use

Deciding on the most appropriate land use is the most fundamental decision to be made by the land user. Different land uses subject the land to different levels of erosion and runoff of contaminants. The type of land use selected should, therefore, be a function of the land's particular characteristics. The question to be answered is which crop, animal or combination of crops and animals, should be grown, if any? Which is more appropriate: trees (forestry), wool (pasture), dairy (pasture), crops from arable land, or horticulture? Where changes in existing land use practices are needed, land users have a range of options such as converting highly erodible land to forestry or other less erosive uses. In some cases it may be appropriate to have different land uses within a single farm.

Responsibility for selecting the appropriate land use rests in the first instance with the land owner. Regulatory intervention should be restricted to situations in which there is an issue of sustainable management of natural and physical resources, for example, in particularly sensitive catchments. As existing land uses controlled by territorial authorities are protected under the Resource Management Act so long as they were lawfully established and the effects of the use remain the same, it may not always be possible to intervene.

Although the land owner has primary responsibility, deciding the appropriate uses within a farm should not be undertaken in isolation from other farms and properties within the same catchment. Land use decisions will depend on short term as well as long term economic returns. Choices of land use should consider an overall catchment strategy, as improvements to water quality usually occur from the collective actions within a catchment. Collective action, such as under a management plan or a "landcare" approach (see Section 4), also provides individual property owners with more flexibility in determining the mix of land uses and land use practices. The "landcare" approach is well suited to dealing with diffuse runoff,

because collective action by a local group of land users may, in many cases, be the best way to address the problem (see section 4.6.7).

3.2 Increasing Efficiencies in the Application of Farming Inputs

More efficient application of farming inputs can be achieved by either:

- altering the application of fertilisers and pesticides to better match the needs of the farming system; or
- altering the cropping/grazing rotations to retain nutrient levels and, therefore, reduce fertiliser inputs.

3.2.1 Fertiliser and Pesticide Management

Artificial applications of nutrients (including the use of agricultural effluent as a fertiliser supplement) are significant aspects of intensive farming systems. The added nutrients themselves, and the additional production they make possible, each contribute to elevated nutrient levels in waterways and subsequent effects on environmental quality.

Farmers can alter the application of nutrients to minimise environmental impacts by:

- setting realistic crop yield goals and applying fertiliser at the times of maximum plant intake;
- accounting for all sources of nutrients, synchronising fertiliser applications with pasture and crop requirements, and applying nutrients in correct proportions;
- applying fertiliser at a rate that ensures maximum plant uptake and, equally importantly, that the fertiliser remains in the area in which it was applied; and
- ensuring that fertiliser and effluent spreading equipment are certified for efficiency. Many farmers are using calibrated equipment which reduces fertiliser wastage and contamination of waterways.

Applying agricultural effluent to land, rather than discharging it directly into water, can help reduce the impacts of agriculture on water quality, as well as retaining nutrients on the farm. However, care must be taken that the effluent is applied over sufficient area and at a rate which does not allow runoff or seepage into water systems.

The addition of water to farm systems can have greater adverse effects on water quality than the taking of water for irrigation. This is because additional water input such as irrigation of grazed dairy pasture accentuates nitrate leaching by increasing annual hydrological recharge. Careful assessment of the need for and potential impacts of irrigation can therefore help reduce adverse effects on water quality.

Pesticide losses can be reduced by improving pesticide management practices, such as selecting appropriate pesticides for the conditions, applying at rates which minimise the potential for runoff, and reducing off-target spray drift onto water. Integrated pest

management, combining organic and conventional farming principles, also reduces the quantities of applied pesticides.

3.2.2 Cropping Systems Management

Optimal crop management can substantially reduce impacts. The selection of appropriate cover crops can reduce erosion, surface runoff and leaching of nitrates, and can improve soil quality. Crop rotations have been employed for centuries to restore soil fertility and structure. However, crop rotations are generally not a feasible option for hill country pastoral farmers as bare land may increase sediment losses⁶. Instead, appropriate pasture management will increase productivity and reduce environmental impacts. Examples of existing practices that do this include:

- the separation of land types by the use of suitable paddock sizes, so as to enable controlled grazing to protect vulnerable areas; and
- the establishment and maintenance of resilient and productive botanical compositions of pasture, along with appropriate applications of fertiliser (e.g. the use of deep-rooted grass species and clover-based pasture minimises additional nitrogen input in dairying systems).

3.3 Increasing the Resistance of the Farming System to Losses

Losses of contaminants from farming systems may be reduced by addressing the major pathways by which sediment, nutrients, pesticides and other contaminants reach surface water.

Maintaining soil structure and its associated increase in soil micro-organisms reduces the loss of sediments and nutrients, reduces the mobility of agricultural chemicals, and increases chemical degradation. Soils with good structure have better water holding capacity, thereby reducing runoff. Research in New Zealand and overseas indicates that organic carbon levels in cultivated soils have declined substantially. Market gardening farmers who rely on intensive cultivation systems should consider the use of organic manures such as composts, effluent sludges and farm effluent to improve soil structure and water holding capacity of the soil. Another practical way of improving organic matter level is to use a cover crop over the fallow period and ploughing in.

Stream banks and channels also need protection from the physical energy of runoff and from the trampling of stock. Suitable practices include riparian planting, fencing to exclude stock, and careful siting of stream crossings and construction of bridges. Many of these techniques will also enhance the ability of riparian areas to buffer impacts on streams and other waterways.

⁶ This problem can be reduced through direct drilling of crop seed.

Farmers may also reduce losses of contaminants from their land by:

- identifying and retiring from grazing land types too vulnerable for grazing;
- directing runoff from farm tracks onto less steep soakage areas to reduce sediment flows to waterways;
- identifying periods when the farming system is at greatest risk, so as to allow a targeted management response; and
- reducing grazing intensity on highly erodible or highly permeable soils.

3.4 Making Use of Field and Landscape Buffer Zones

Buffer zones intercept contaminants and reduce the erosive force of runoff water. Riparian buffer strips (i.e. areas of land immediately adjacent to lakes and rivers) have substantial environmental benefits while still allowing some productive use of the land (e.g. as a source of timber). Riparian zones can filter sediment and associated contaminants in overland flow and remove nitrate in shallow groundwater prior to entry to streams. By excluding stock, riparian buffers (including fencing) can also prevent the trampling of stream banks and the direct input of excreta into streams. In addition, riparian margins strongly influence life in streams and rivers by providing shade and food, and are often unique habitats in their own right.

General approaches to managing riparian zones include protecting remnant vegetation, planting trees, shrubs, and flaxes, maintaining a vegetated ground cover, protecting wetlands and controlling stock access to water⁷. Riparian management should be targeted at specific objectives (e.g. improving light and temperature parameters for aquatic ecosystems, or intercepting contaminants) and management techniques selected accordingly.

⁷ Further information on using riparian buffer zones can be found in *Managing Riparian Zones: A Contribution to Protecting New Zealand's Rivers and Streams*. NIWA, Department of Conservation, 1995.

4. POLICY RESPONSES

This section examines the responses that local authorities could consider adopting when formulating policies to reduce the impacts of agriculture on water quality. It firstly examines the responsibilities and principles of the Resource Management Act, and then outlines and reviews, in general terms only, the range of methods that could be used by local authorities to encourage sustainable land management practices.

4.1 Resource Management Responsibilities

The Resource Management Act focuses on the effects of activities. Its purpose is to “promote the sustainable management of natural and physical resources”, which includes land and water resources. Principles are specified in sections 6 (Matters of national importance) and 7 (Other matters). Section 8 requires those exercising functions under this Act to take into account the principles of the Treaty of Waitangi.

An important feature of the Act is the devolution of functions to the communities of interest. This means that the prime responsibility for resource management initiatives rests with local authorities. For example, while prime responsibility for water management remains with regional councils⁸, managing the effects of land use is also the responsibility of territorial local authorities.

Integrated management is another important feature of the Resource Management Act. Regional councils are explicitly empowered to control the use of land to maintain and enhance water quality and to maintain water quantity (section 30(1)(c)), as well as to control discharges. One of the purposes of regional policy statements is to provide for the integrated management of natural and physical resources (section 59). Integrated management is further facilitated by the catchment basis of regional council boundaries. Ideally, objectives, policies and methods to address agricultural impacts on water quality should be developed through regional and district plans, consistent with an overall framework established by the appropriate regional policy statement.

The critical element to the process of formulating any policy on water quality issues will be the instruments, or methods, used to implement the policy. Possible methods range from regulatory powers to command and control, to a wide spectrum of non-regulatory techniques. Regulatory controls under the Act are likely to be required to *set* water quality standards. However, regulatory controls may not be the most effective way to *achieve* the standards. The most effective solutions are likely to be worked out and applied from within the farming community and other affected parties and not necessarily imposed from the outside.

If farmers are to change their land use practices, they need information about alternative techniques and incentives to change. While techniques have been developed to address many of the problems, information is not always available to those who can apply it most effectively.

⁸ Territorial authorities are responsible for the control of activities on the surface of waterbodies, but this is not an issue in relation to agricultural land use.

4.2 The Range of Policy Instruments

There are many methods which potentially can be employed to encourage farmers to adopt sustainable land management practices. These can be categorised into three broad headings—voluntary, economic, and regulatory methods—as follows.

Voluntary Change

- Farmers are shown that the *voluntary adoption of particular practices* is in their self-interest (technical assistance) or in the interests of others (moral suasion).

Not all of these methods are able to be, or likely to be, used by local authorities. Those methods which may be used by local authorities are evaluated below in terms of their practicability and usefulness. Examples of methods that have been used by local authorities are given. Those methods which are not currently likely or able to be used by local authorities are discussed only briefly.

Economic Methods

- *Taxes or levies* increase the private costs of farming to reflect the social and environmental costs of the activity. Taxes can be imposed on discharge quality, farm production inputs, etc.
- *Subsidies* are payments to encourage behaviour that advances some public policy goal. For example, subsidies can be paid in relation to discharge quality or for farm management practices.
- *Transferable discharge permits* enable discharge permit holders to transfer all or part of the permit to another discharger.
- *Performance bonds* are paid in expectation of compliance with specified conditions, and are refunded when compliance is achieved.

The Acquisition of Interests in Land

- Through the *purchase of interests in land* (such as easements or the title to the land), the farmer is compensated for the loss of the ability to use land.

Regulatory Methods

- *Common law* proceedings may be used to seek restoration, damages or compensation.
- *Rules and regulations* prepared under the Resource Management Act may be used to allocate rights to use water, discharge contaminants, or control land uses, subject to certain conditions. Conditions can, at least in theory, be imposed on:
 - discharge quality;
 - ambient (receiving water) quality;

- farm management practices;
 - production inputs; or
 - production outputs.
- *Enforcement and abatement procedures* under the Resource Management Act can be used to enforce compliance with regulations or to remedy or cease adverse effects on the environment.
 - *Statutory powers under other legislation* (such as the Soil Conservation and Rivers Control Act 1941 and Biosecurity Act 1993) can be used to control the actions of land users.

4.3 Voluntary Change

Voluntary change is a key factor in the *Sustainable Land Management Strategy*. Promoting voluntary change should be a cornerstone of any policy development. Voluntary change occurs because land users come to recognise (e.g. through the provision of information or technical assistance by a council) that the adoption of certain practices is in their self-interest. Alternatively, voluntary change may work by moral suasion, whereby land users recognise that certain agricultural activities have detrimental effects on others and that this is unacceptable or inappropriate.

Voluntary change appears to be effective in encouraging the adoption of appropriate land management practices, provided that:

- impacts are conspicuous or sufficient information is available on the nature of current impacts;
- sufficient information is available on options to minimise these impacts;
- costs incurred by the land user are not substantial and are within the land user's discretionary income; and
- the land user is motivated to protect the environment through a positive environmental ethic or through a perceived net benefit to the land user.

Voluntary change methods may also be more effective where the environmental improvement is obvious and occurs, or at least commences, in the medium term. However, land users may often not see or perceive the benefits of their voluntary actions on water quality, and changes that result from alterations of farm practices may be subtle (e.g. a change in bacterial numbers) and therefore not visible. Changes can also occur further downstream, away from the area where the voluntary action is being taken. If this is the case, land users need to be made aware that environmental changes may not be immediately obvious, least they feel that their actions are having no effect at all. A key point for all voluntary change methods is the need to monitor the effectiveness of the method and ensure that information, incentives and advice are acted upon.

Voluntary change methods have the potential to result in higher environmental quality than regulatory methods operating alone. While regulatory approaches are suitable for raising the performance of poor performers to a minimum level of acceptability, for complex resource

management issues such as agricultural runoff, regulation alone may also result in good water quality managers reducing their performance back to the minimum level. Voluntary methods encourage all players to raise their level of performance.

However, voluntary change will not influence all farmers and implementation may take time. Voluntary change as a method must also be developed with and have the support of the wider community as well as the agricultural sector.

The main methods for promoting voluntary change are discussed below.

Case Study: Riparian Retirement in Taranaki

The Taranaki Regional Council produces riparian plans, at no cost, for those landowners who are interested in protecting watercourses on their property. Reasons for fencing off water courses may include improved farm management, improved water quality, intrinsic values, wildlife habitat or cultural significance. A plan includes information on the advantages of riparian management and sustainable land use practices such as stock management and fertiliser application, a detailed management plan, an inventory of species to plant, a weed control programme and a maintenance programme.

The Taranaki Tree Trust is a regional initiative administered by the Taranaki Regional Council. The Trust operates by promoting the appreciation and protection of Taranaki's distinctive natural heritage, which includes surveying, purchasing, retiring and/or planting riparian margins. The Trust is registered as a charitable trust and approves approximately nine projects per year. Projects are selected using criteria which evaluate their representativeness, rarity, regional importance, diversity, aesthetics, the availability of funds and general benefit to the region. Projects are suggested to the Trust by the community, the Regional Council and environmental organisations. The Regional Council services the Trust's work. The Trust also obtains funding for its projects from the Regional Council and from company donations and sponsorship, which are tax deductible.

An example of the Trust's work is a project undertaken in the Wairau/Waimoku Catchment. This project involved riparian planting proposals to increase the water quality of the catchment. This is a small catchment which drains into the sea at Oakura beach, to the southwest of New Plymouth. The beach is regionally significant and popular for surfing and swimming, while the Oakura river estuary is a popular recreational area for families. The bacteriological quality of the water flowing onto the beach from the Wairau/Waimoku catchment is poor and the Regional Council identified that the water was being polluted from non-point sources. However, the cost of fencing and planting the riparian margins for the landowners in the catchment would be very high. The catchment was chosen as a project appropriate for the Taranaki Tree Trust because it is considered to be of regional importance and the results would be of benefit to the entire community.

After the identification of the project, the Trust visited individual land owners (10 landowners were affected by the project) and explained the project to them, along with the benefits of riparian management. Taranaki Regional Council staff assisted the process by preparing riparian management plans for four properties free of charge, all in the Waimoku catchment. Some landowners completed the work shown in the plan themselves, while others hired staff to complete the work, or a combination of the two. All work on this project was fully refundable by the Trust. In order to cut costs, the Trust approached Project Arborgro to grow the plants for the project. Project Arborgro is a non-profit making, community funded nursery at the New Plymouth Prison. Project Arborgro propagates native trees and shrubs for worthy and approved tree planting schemes which benefit the community.

4.3.1 Information and Education

Provision of information and educational material and opportunities about the effects of activities and methods of mitigating such effects may substantially influence land users' behaviour.

Local authorities are required by section 35 of the Resource Management Act to monitor the state of the environment, including the effects of activities. The information gathered by local authorities can be used to provide land users with information about the state of their environment, including the effects of activities on water quality. It can also be used to demonstrate the environmental benefits of different management practices, such as comparing the environmental qualities of different catchments. Information may be more demand driven and have increased ownership if collected by the community.

Example:

Stream Health Monitoring and Assessment Kit (SHMAK)

The Stream Health Monitoring and Assessment Kit (SHMAK) has been developed by Federated Farmers and NIWA (the National Institute of Water and Atmospheric Research) with help from farmers and funding from the Sustainable Management Fund of the Ministry for the Environment. The kit is designed for farmers and community groups to monitor water quality and other aspects of the health of streams and small rivers. The idea behind the kit is to allow farmers to become proactive in monitoring water quality on their properties, so as to learn more about the sustainability of their farming operation. The kit allows for different levels of monitoring, ranging from basic to more complex. The parameters which can be measured include stream flow and volume, water clarity, conductivity (an indicator of nutrient levels), pH, stream invertebrates, deposition of silt on the stream bed, and plant and algal cover. The kit can also be used by community groups, and Canterbury Regional Council has undertaken to introduce the kit to two schools this year.

Information gathering and dissemination may be more targeted if it is a specific part of policies for addressing water quality issues within a region or district. There are many methods of providing the necessary information, and this can be done in a creative and innovative manner.

Example:

“Farming with Pictures”

“Farming with Pictures”, a Hamilton-based company, produce videos which are used as regular “newsletters” for dairy farmers throughout New Zealand. The video is produced quarterly and is distributed free-of-charge to all dairy farmers. The New Zealand Dairy Board provides approximately

half of the funding for the video, with commercial sponsors (who can either pay to have their products used in a feature article or who can buy time on the video for their own clip) paying the remainder of the cost. The wide distribution of the video makes it especially attractive to commercial sponsors.

As a consequence of the significant Dairy Board contribution, the video always contains an industry report, covering marketing and product development, and a section on husbandry, covering aspects of farm management ranging from pasture maintenance to stock management. In addition, the videos contain feature articles on topics of interest to farmers, such as Occupational Safety and Health, animal health, business matters, and livestock improvements.

An editorial committee has been established to edit the videos. This committee comprises consultants, scientists, farmers and representatives of the major sponsors. Many people sit on the committee on a voluntary basis, and are provided with petrol vouchers for their effort.

The Accident Compensation Corporation (ACC) bought space on "Farming with Pictures" and made its own clip about safety on farms, to be included on the video. A survey of video recipients has shown that 49% of farmers who watched the ACC clip have done something about safety on their farm!

Example:

“Environment Topics”

The Hawke's Bay Regional Council makes available, free of charge, a series of *Environment Topics* targeted at providing information on critical farm management issues affecting the environment. These leaflets are used by staff during farm visits to provide easily read technical information, and are provided to the public at field days on request. A typical example is the problem of gullying of infilled valleys in coastal mudstone areas. Gullies not only destroy farm access but also stream quality both on and off the farm. An Environment Topic provides photographic examples of the type of damage and examples of prevention and control measures as well as describing how to undertake a range of control measures. The availability of free folders to regular clients ensures this information becomes readily available reference material for land managers.

Other methods for providing information include the establishment of advisory services. Advisory services often dovetail with existing staff resources and tasks.

Example:

Advisory Services in Taranaki

The Taranaki Regional Council offers technical advisory services that give farmers free advice on riparian management and sustainable land use practices to avoid unnecessary discharges into water - the *Riparian Management Advisory Service*, which covers the flat, fertile ring plain area where the predominant land use is dairy farming, and the *Sustainable Land Use Advisory Service*, which covers areas of steep hill country within the region.

These programmes provide several services, ranging from general and technical advice to developing management plans for specific farms (either whole farm plans, forestry plans, riparian management plans or conservation plans). The whole farm plans are the most popular component of the services.

When a plan has been requested by a farmer, Council staff consult with the land owner during an initial field visit to the property. From that visit, staff are able to establish what type of plan will accommodate the environmental issues and objectives the farmer has. If the farmer only wants to explore a forestry venture, then an evaluation of the areas identified is run using the *Agroforestry Estate Model* in a forestry plan. Where the farmer is interested in looking at sustainable options on the entire property, the property is mapped using land use capability classification. Then staff, in close consultation with the land owner, explore various management options such as fertiliser application rates, pole planting, production forestry, subdivision, drainage and so on. Farm plans are the most comprehensive of the management plans prepared by the Council. Conservation plans deal with isolated issues on a property such as sandblow, farm shelter or erosion control.

After completing 70 riparian management and sustainable land use plans, the Council has become well known amongst farmers for its advisory services, and in particular the preparation of management plans.

Farmers are motivated to use the advisory services and implement the management plans for many reasons. Often farmers enquiring about the services are already interested in environmental issues and are looking at ways to address them on their property. Other farmers, particularly on marginal hill country farms, are motivated because they recognise the economic advantages, such as those gained by retiring and planting areas of land, or by fencing steeply banked rivers to avoid stock losses.

Farmers have little time to spend in structured learning situations such as off-farm training and so training programmes must be carefully targeted. Farmers generally prefer small group learning/training environments in which they can question, discuss and debate, to a university style lecture setting. Formal educational methods can be very effective, but are relatively costly, unless they are linked with other organisations or targeted at small groups. On the other hand, small scale regular meetings between authorities, farmers and industry groups can act both as a forum for information sharing and technology transfer and as a means of strengthening the relationship between authorities and land users.

4.3.2 Guidelines

The preparation and use of guidelines by local authorities can be part of a wider information/education programme. The purpose of guidelines is to provide information to assist resource users to make informed decisions about the environmental consequences of their actions. Guidelines usually specify the environmental outcomes being sought and provide advice as to the means by which outcomes can be achieved.

Guidelines can be useful means to explain the objectives of the local authority in readily understandable terms, and to suggest practical solutions for implementation on a day-to-day basis. They can thus support more formal policy and regulatory approaches. They may be more effective if prepared by or in conjunction with other organisations, such as sector representative bodies or those with technical authority (scientific, industrial or research agencies).

4.3.3 Codes of Practice

Codes of Practice provide specific directions on preferred methods, techniques and uses that avoid or reduce the environmental impacts of activities. Typically, Codes are industry-driven in that they are produced by the organisation representing some sector of industry to promote environmentally responsible resource use by its members.

Farmers in the Waikato and Hawke's Bay are developing Pastoral Codes of Practice that seek to reduce the adverse effects of pastoral farming on water quality. The New Zealand Fertiliser Manufacturers' Research Association is currently preparing a Code of Practice for the use and handling of fertiliser. Codes can be officially recognised through Standards New Zealand, as with *the Agrichemical Users' Code of Practice*⁹. Other codes include the *Pig Farming Code of Practice*¹⁰ and the *New Zealand Forest Code of Practice*¹¹.

Codes are important methods of promoting collective responsibility by and from within sectors of resource users. Being self-produced, codes are usually better targeted methods of encouraging self-change in management practices.

However, care should be exercised if codes become mandatory through incorporation in plans prepared under the Resource Management Act (e.g. a rule in a plan may specify that a certain farming activity is permitted on the condition that it complies with a specified code). Codes are not generally drafted in the same manner as rules - provisions in codes are often imprecise and difficult to enforce. To ensure certainty, the plan must specify the version of the code to which it refers, but this means that should the code change, the plan will require adherence to an obsolete version of the code unless the plan is amended. It is also important that the code is made freely available during the plan preparation process so that it can be scrutinised by submitters together with the other provisions of the plan.

⁹ NZS 8409:1995 *Agrichemical Users' Code of Practice*. New Zealand Agrichemical Education Trust, Standards New Zealand, 1995.

¹⁰ *Code of Practice - Pig Farming*. New Zealand Pork Industry Board, August 1993.

¹¹ *New Zealand Forest Code of Practice*. Logging Industry Research Association, Rotorua. 1993.

4.3.4 Demonstration Farms

One of the best ways to provide farmers with information on sustainable management practices is to demonstrate the application of these practices in a real world situation, such as through “demonstration farms” or “focus farms”.

Case Study:

Demonstration Farms in Tasman and Taranaki

Agriculture New Zealand and the Tasman District Council have facilitated the development of a Monitor Farm to demonstrate environmentally sustainable methods of pastoral farming. The owners of the farm work with a management committee involving farming community representatives, a veterinary surgeon and representatives of the sponsoring organisations. In addition, a community committee has been established for other interested farmers who wish to be involved in the project. A specific objective of the monitor farm project is the development of practical indicators for sustainable farming systems. The project also includes an extension programme to encourage pastoral farmers to take up sustainable management practices.

The Taranaki Hill Country Sustainable Farming Group (with assistance from Agriculture New Zealand and the Taranaki Regional Council) has set up six focus farms. The aim of the project is for the six farms to identify areas which cannot be farmed in a sustainable way and to begin a forestry planting or retirement programme. The farms also aim to increase their net income from pastoral production by \$10,000 or 10%, whichever is greater. Information from the focus farms is to be transferred to other farmers in the area to raise awareness of sustainable management issues. Each focus farm has the goal of influencing 10 neighbouring farms to adopt more sustainable farming practices.

4.3.5 ISO Accreditation

ISO 9000 and ISO 14000 standards provide quality assurance programmes for business. The ISO 14000 series of standards for environmental management is currently being developed by the International Standards Organisation. Unlike the ISO 9000 standards, which specify product quality (e.g. car seat specifications), the ISO 14000 standards specify a system of environmental management which is designed to enable organisations to improve their environmental performance. Performance under the ISO 14000 standards is able to be audited, and a company can receive formal certification, either from the International Standards Organisation, or from Telarc NZ.

The Taranaki Regional Council is currently investigating the application of ISO 14000 standards for environmental management systems to dairy farms. Hawke’s Bay Federated Farmers has initiated an on-farm quality assurance programme involving twenty farmers. The objective of the programme is “insurance for the day when non-tariff barriers are imposed on New Zealand by our overseas customers”. Participation in the programme does not guarantee extra income for the farmers at present, but accreditation may provide access to niche markets and differentiation in prices for products from accredited and non-accredited farms.

4.3.6 Study Groups

Study groups are a means of tapping into technical information and assisting in practical farm problem solving. The key is to involve like-minded individuals with a focus on achieving common goals. Even if goals are not met, these groups create greater interest and awareness of water quality issues, whereas previously water quality may have been seen as unimportant by many farmers attending the group.

4.3.7 Community Groups

Community groups refer to groups of people from particular communities or areas of interest that are formed voluntarily to identify common issues and seek to implement agreed actions on a collective basis. For example, Landcare groups in Australia work together to identify problems on the land and then deal with those problems. The key feature is action by the community, rather than by individuals, and “ownership” of these groups is retained by the community.

In New Zealand, the Ministries of Agriculture and Forestry have facilitation programmes to promote sustainable land management and many regional councils also have facilitation programmes. For example, Hawke’s Bay Regional Council has been working with community groups since 1992 and currently has nine Landcare groups in its region. Additional focus and resources have been provided to Landcare groups through the launch, in July 1996, of the New Zealand Landcare Trust. Federated farmers played a key part in establishing the Landcare Trust. The Trust will provide information about sustainable land management practices and help people set up landcare groups. A network of facilitators trained by the Trust will assist Landcare groups to get started and to find the resources they need to plan and implement successful programmes. Further assistance in establishing Landcare groups is provided in guidelines such as *The Landcare Action Guide*, prepared by the Women’s Division of Federated Farmers¹².

Local authorities can help to promote the formation of Landcare groups by acting as a catalyst rather than the principal agent. Facilitation is the key to successful group schemes, especially in increasing interest, involvement and controlling conflicting views. Using council staff as facilitators is not always a good idea as they may be perceived as having a particular viewpoint, and may not be able to empathise with farmers. In addition, farmers are often suspicious of bureaucracy. Instead, if needed, councils should seek appropriate people from the community who have been trained in facilitation.

¹² *The Landcare Action Guide, Te Whakaipo Whenua. A Kit for Setting up and Maintaining an Landcare Group.* Women’s Division Federated Farmers, 1995.

Case Study:

Landcare in Southland

The implementation of a trial catchment study on the Oteramika Catchment by the Southland Regional Council prompted the formation of a Landcare group for this catchment. The catchment study was initiated as a result of the Council's concern about the environmental and other effects brought about by the conversion of a number of large scale sheep farms into dairy farms within the region.

A working party was established to look at the implications of this change on the district. The working party included farmers and representatives from various organisations, including AgResearch, Landcare Research, dairy co-operatives, iwi, Ministry of Agriculture and Fisheries, district councils, Department of Conservation, Southland Health, Fish and Game Council and NIWA. This working party decided to commission a report, entitled *Southland Dairy Farming Expansion - Environmental Impact Assessment*, which addressed the effects of increased dairying and various dairying practices on water quality. The report recommended that a trial catchment approach be taken, and recommend the use of the Oteramika catchment .

When the report was released, a number of farmers within the Oteramika catchment were concerned about the Council's motives for suggesting such a study for the catchment. These people met, and formed a Landcare group. The group includes representatives from farms within the catchment and a representative of the local community board.

The Regional Council offers various services to the Landcare group, such as facilitation skills and technical assistance. It also has project grants available, subject to conditions, for approved projects. A land use questionnaire was written and funded by the Regional Council, with the Oteramika Catchment Landcare Group co-ordinating the responses and supplying the completed forms to the Council. As an incentive to get the completed questionnaires back, the Council provided a free faecal coliform well sample for each property. This information will be used by the Council in its assessment of the catchment, but was also useful for the Landcare Group to decide what action was necessary to improve the water quality in the catchment. The Landcare Group has taken initiatives with riparian management and is in the process of trialing different vegetation species and monitoring changes in water quality.

The Regional Council is continuing in its advisory role to the Landcare group by attending and demonstrating riparian management techniques at field days which are organised by the group at members' farms. The control of the group lies with the land owners.

4.3.8 Farm Plans

Farm plans refer to plans prepared by farmers to manage their properties on an environmentally sustainable basis (they are also known as 'Environmental Plans'). Farm plans are statements of intent prepared by farmers, developed around the farmers' goals with the objective of adopting sustainable land management practices. They usually include statements about the environmental issues facing the particular farm, and set out a programme for dealing with those issues. When preparing a farm plan, the farmer is supported by others, such as the regional and district council, and the Department of Conservation.

It is important that farm plans are prepared by and for the land users - they are intended to be the landowners' vision for their property, and the responsibility for implementing the environmental programme is also the farmers'.

There are six steps in the formulation of these plans.

- (i) Prepare property inventory to indicate the state of on-farm resources, including water quality.
- (ii) Identify personal goals and goals for the farm.
- (iii) Identify problems - what is holding the farmer back from reaching these goals?
- (iv) Identify options - such as better resource use.
- (v) Prepare implementation schedule.
- (vi) Formulate a means to evaluate and monitor effectiveness.

Voluntary change is encouraged through farm plans as they require farmers to identify the important relationship between goals and resources. This increased awareness gives farmers the motivation to change.

Farm plans may take time before they are given support and are successfully implemented by farmers. The adoption of plans could be encouraged through:

- providing rates relief for a farm plan;
- providing a consultant to help prepare the plan;
- recognising implemented farm plans in the farm valuation process (presently valuations do not take account of the state of the environment);
- providing subsidies for on-farm work that benefits the community, based on the findings of the farm plan; and
- making exempt from the consent process, activities approved in the farm plan.

Upon successful implementation of a farm plan, a farm could become a demonstration or 'focus' farm, to demonstrate the value and benefits of improved practices for sustainable land management.

Case Study:

Environmental Plans in the Bay of Plenty

The concept of environmental plans was first proposed in 1993 by Federated Farmers (Rotorua/ Taupo Province) in submissions to the Draft Rotorua District Plan. In response to the proposal, a working group was established to develop the Environmental Plan concept further, comprising representatives from Federated Farmers, Rotorua District Council, Environment BOP, Environment Waikato and the Department of Conservation. After holding workshops and field inspections, the group developed a framework for the preparation and implementation of environmental plans.

The first step in the preparation of an environmental plan is the identification of environmental resources and issues on the property, such as farm dump site(s) and ofal holes, effluent disposal, streamside protection, protection of springs and wetland areas, natural water supplies, farm runoff, weeds and pests, landscape/aesthetics, water quality, the use of chemicals, erosion, protection of forest remnants and other natural features, and tree planting. The next step is to identify what needs to be done to address any issues, setting objectives and formulating a programme for achieving those objectives. A typical environmental plan includes a description of environmental concerns, a programme of works or actions, estimated costs and a timetable, a map of the property showing the programme, and a statement of responsibilities. Plans are seen as a living document that may have features that are changed over time according to changing circumstances.

The key people in the preparation of environmental plans are the land owners. The plan represents the landowners' visions for their properties. They prepare the plan, draft and implement the environmental programme, contribute a minimum of 50% of the cost of works, and are responsible for long-term maintenance.

However, such plans only work with the support of outside agencies. In this case, the Regional Council staff provide active support, including resources (aerial photos, maps, plans), administration support (typing, drafting services) and professional advice on erosion control, tree planting, riparian management, and effluent disposal. Soil conservation staff assist in organising the environmental programme, and the Council provides financial assistance for works with off-farm benefits. In addition, Environment BOP is responsible for maintaining an on-going monitoring programme. District councils are able to assist in providing other specialist advice (such as on landscape issues), as well as providing financial assistance for specific works with off-farm/district benefits. The Department of Conservation can provide specialist advice on significant natural features, habitat and wildlife values, as well as possible financial assistance to protect such features. Where public money has been spent on financial assistance, covenants may be placed on the title to ensure that the protection is secured.

4.3.9 Non-Financial Incentives

Incentives to adopt particular practices need not be financial. Alternatives include conservation awards, and authorities giving priority of service (such as advice) to those practising sustainable management. It may also include the provision of services which indirectly encourage voluntary changes in management practices. Such methods are already in use in some parts of the country, and are seen as supplementary to a broader policy of promoting voluntary change and self-regulation.

Example: Incentives and Services

Many councils around the country already operate a range of incentives and services to encourage sustainable management practices.

For example, as an incentive to implement sustainable practices, Environment Waikato offers an environmental award for those persons who have furthered the philosophy of the Resource Management Act. The Council advertises for nominations for the award. These nominations often come from Council staff who, in their work, have come across someone who they believe deserves recognition for their effort over and above that required by the law. A panel of managers decides who will win the award.

The Auckland Regional Council and Environment Waikato each provide a service to the community where unwanted chemicals are collected and disposed of free-of-charge. Survey forms are distributed to ascertain what chemicals people have for disposal and in what quantities. The collections are then advertised through regional and local authorities, newspaper articles and letter drops. Waste disposal companies, where possible, recycle or reuse the chemicals, or dispose of those which cannot be recycled.

4.4 Economic Methods

The main economic methods for addressing non-point source pollution from agriculture are taxes, charges and subsidies. Taxes increase the private costs of farming to reflect the true

value (monetary and non-monetary) of resources to the community, including the costs of pollution on the environment (the “social costs” of the resources). The terms “taxes” and “charges” are often used interchangeably; however “tax” refers to the economic incentive, while “charge” is a payment for a service. Subsidies are payments to encourage behaviour that advances some public policy goal. They may be paid by an authority on behalf of the general public, or by the beneficiary of the activity.

Some economic methods are not currently available for local authority use, either because they are only available for use by central government (e.g., taxation and certain powers under the Resource Management Act), or because they may be available in theory but are not currently used in practice (for example, methods for which legislative change is required). These methods are listed in section 4.4.5. Economic methods which are currently available to local authorities are discussed below.

4.4.1 Financial Contributions

Section 108(1) of the Resource Management Act provides for the setting of financial contributions, which are a form of environmental compensation to offset adverse effects on the environment. Financial contributions are broadly defined, and may include cash or services, but may only be used for the purposes specified in a plan.

4.4.2 Charges

The primary purpose of charges is not that of an economic incentive, although they may have this effect. Administration charges have a prime objective to recover administrative costs, such as compliance and environmental impact monitoring. Section 36 of the Resource Management Act provides regional and district councils with the ability to recover costs incurred while carrying out their statutory responsibilities. The Act limits charges to cost recovery and requires councils, in setting the charges, to have regard to the benefits gained by individuals in relation to the activity carried out by the council. As these charges relate to reasonable monitoring and administration costs, they are unlikely to be a significant incentive to encourage farmers to adopt alternative, often expensive, land management practices if they are not otherwise so inclined.

4.4.3 Subsidies

Councils have powers to make grants under the Local Government Act 1974 and the Rating Powers Act 1988. The Resource Management Act does not specifically provide for the granting of subsidies at a regional or local level. Councils could potentially waive section 36 charges or rates, where a farmer's actions benefited the community, but the limited sums involved would not provide much incentive.

Subsidies suffer many of the problems associated with taxes (see section 4.4.5), run contrary to the principle of polluter pays, and may be inconsistent with the General Agreement on Tariffs and Trade. However, while subsidies should not be used to reward resource users for achieving an environmental bottom line or simply complying with legislation, they can be used to achieve positive environmental results over and above minimum acceptable standards. Subsidies are more likely to be appropriate where the benefits of land management practices occur largely "off-site" and to the wider community, while the costs fall largely on the land owner or resource user. It should also be noted that the "polluter-pays" approach may lose favour in some circumstances if the community perceives that the approach is failing to protect a highly valued resource. Two types of subsidies are discussed below.

4.4.3.1 Discharge and Design Subsidies

Reductions in pollution loadings or ambient contaminant concentrations could be rewarded through subsidies. The adoption of certain practices, such as those which reduce soil erosion, can be encouraged through subsidies. In the past, soil conservation practices in New Zealand have been subsidised by the Crown through catchment boards. Farmers could also be assisted in adopting non-point source control practices through funding by the local beneficiaries of improved water quality. Aside from the issues of obtaining and allocating the funding for subsidies (such as who should be paying for the funding), the principal difficulty of discharge subsidies relates to accurately correlating their costs with the benefits derived from them.

Case Study:

Hawke's Bay Regional Landcare Incentive Scheme

The Hawke's Bay Regional Council administers a voluntary grant scheme to assist land users to undertake land management practices which will reduce soil erosion or adverse effects on water quality. The scheme was introduced in 1994 and currently involves about \$300,000 per year being made available for up to a 50% grant for works. Projects must have one of the following: a beneficial effect on water quality, an identifiable environmental education component, erosion control works or an identifiable soil conservation component. Priority is given to Landcare groups over individual land owners. Following the signing of a contract the work becomes the responsibility of the land owner(s), with staff giving assistance only if asked and checking to ensure the final work is up to standard.

In 1996, 101 applications were approved with \$311,000 of grants allocated. The most common type of application was to stabilise slopes to minimise sediment generation. Stream, gully and gorge retirement was also common and Queen Elizabeth II Trust Covenant requirements were often included for larger projects. The introduction of the scheme has seen a resurgence of protection planting and waterway protection in the Region.

4.4.3.2 Input and Output Subsidies

Input/output subsidies can be provided to lower the costs of certain farming inputs. This encourages changes in the use of inputs and thereby affects the rate and levels of outputs. For example, lowering the cost of fertilisers with lower levels of contaminants (such as cadmium) can encourage application of these fertilisers in farming.

In the past, Government policies of subsidising fertilisers have resulted in the application of greater, rather than more judicious, inputs of fertiliser. Land development and drainage schemes were also subsidised, often with negative environmental consequences. There are overseas examples of subsidies being used at a national level to promote policies on agricultural discharges. For example, subsidies for the reduction of agricultural production outputs are used extensively in the United States, primarily for supply control and income enhancement, rather than pollution control. In the Republic of Ireland, the Rural Environmental Protection Scheme (REPS) offers subsidies to farmers who comply with eleven measures designed to encourage environmentally friendly farming practices. REPS was set up in 1994 and is focused on nutrient management planning, maintenance and improvement of biodiversity, and landscape protection and enhancement.

An example of a locally applied subsidy is the supply by a council of soil conservation or riparian management materials at cost.

Again, the principal difficulty of input subsidies relates to accurately correlating their costs with the benefits derived from them. For example, a council supplying soil conservation materials would need to monitor the scheme to ensure that the subsidised inputs were meeting the policy objective, and that the costs of supplying the materials accurately reflected the benefits.

4.4.4 Performance Bonds

Performance bonds are paid in expectation of compliance with specified conditions, and are refunded when compliance is achieved. The bond is equivalent to a tax equal to the amount of potential damage incurred by poor or no performance. It is usually determined by estimating the costs of mitigating any adverse effects or restoring the environment if damage occurs. The simplest case is a deposit-refund scheme for pesticide containers. More complex bonds are paid in relation to site restoration after mining has been completed.

Farming is not an extractive activity like mining which occurs over a finite time frame. More importantly, performance bonds for environmental restoration can only be imposed as a condition of a resource consent. It is therefore impossible to apply performance bonds to overall farming activities, unless the entire farming activity requires a resource consent. There may be some scope for bonds to be applied to particular activities, such as the purchase of pesticide containers and the clearance of vegetation, with repayment being subject to certain conditions.

4.4.5 Other Economic Methods (Central Government)

Economic methods not currently available to local government include:

- the setting and collection of *resource rentals*. Section 360(1)(c) of the Resource Management Act allows the Minister for the Environment to set royalties for the use of geothermal water and sand, but the Act does not allow for resource rentals to be charged for freshwater;
- the application of *input or output taxes* to commodities and processes. For example, input taxes could be applied to processes closely associated with the production of agricultural contaminants. Output taxes could be applied to products whose production or consumption pollutes the environment;
- the application of *ambient-based taxes*. This type of tax is specified as a tax per unit of the observed difference between measured and desired levels of environmental quality (for example, water quality);
- the use of section 26 of the Resource Management Act, which provides the Minister for the Environment with the power to make *grants and loans* (although local government does have these powers under other legislation - see Section 4.4.3); and
- the use of *transferable discharge permits*, whereby a total discharge load is specified and dischargers must each have a discharge permit, but are able to transfer all or part of the permit to another discharger. The Resource Management Act does not provide for transferable discharge permits.

Taxes are not currently used as a method to improve water quality. An effective taxation system requires full information on marginal damages and abatement costs, and requires these costs to be consistent across the industry. These conditions do not exist in the area of non-point source pollution from agriculture.

4.5 Interests in Land

The purchase of interests in land is an expensive option for local authorities as land in intensively farmed areas is very expensive. This approach is contrary to polluter pays and may undermine other authorities' policies controlling land use. It may, however, be a pragmatic response to the need for high levels of protection for particular areas of land (for example, critical areas of land in upper catchment areas which contribute high sediment and nutrient loads). The three main types of third party interests in land are direct land purchase, acquiring encumbrances over land title and contractual agreements, as described below.

4.5.1 Land Purchase

The title to wetlands and land along stream, lake, and coastal margins can be purchased by territorial authorities (e.g. for amenity purposes and environmental reasons) and by regional councils (e.g. for flood control works). The Department of Conservation purchases land for reserves and parks, and non-governmental organisations such as Ducks Unlimited, the New Zealand Native Forest Restoration Trust, and Fish and Game Councils purchase land to provide for conservation values.

Where land alongside a river is subdivided under certain conditions, section 231 of the Resource Management Act provides for the creation of esplanade reserves which are vested in the district council or, less commonly, with other authorities. Under the Act, compensation to the land owner is required if the subdivision is of four hectares or larger. In the Matamata-Piako District, for example, esplanade reserves are currently in place along eight kilometres of rivers. However, the costs entailed with land purchase, as well as associated matters such as surveying and consent costs, generally limit the practicality of this method for addressing non-point contamination to circumstances in which purchase is the only option. Other types of interests in land, whereby farmers retain land ownership, can achieve similar results at less cost.

4.5.2 Encumbrances over Land Titles

Encumbrances involve obtaining, often by purchasing, selective use rights from land owners, which are recorded on the title to the land. Encumbrances can be used to prevent those uses of land in which degradation of water or soil quality occurs, rather than preventing the use of the land entirely. Encumbrances can also be used to provide other rights to third parties to achieve an environmental outcome, such as protecting riverside vegetation or providing access onto property for water quality management purposes.

The specific set of rights acquired depends on the environmental problem to be addressed. For example, rights to grow certain crops may be restricted but other uses allowed, or there may be restrictive controls on uses of wetlands.

Encumbrances include access and/or use easements, covenants (such as covenants under the Queen Elizabeth The Second National Trust Act 1977), and esplanade strips (which can be created under the Resource Management Act). Restrictions on the use of land are registered on the title, although title remains with the landowner.

Encumbrances have many advantages, such as relatively low costs (compared with regulatory controls and land acquisition) and retention of land ownership for farmers. They can also be important in providing voluntary resolutions to particular environmental problems, negotiated between landowners and local authorities.

In terms of addressing non-point sources of pollution from agriculture, the principal uses of encumbrances are to protect the margins of rivers and water bodies and to provide buffer strips to reduce the levels of contaminants entering those water bodies. Encumbrances are of little use in addressing sources of contamination themselves.

4.5.3 Other Methods

Other methods of obtaining third-party interests in the use of land primarily depend on obtaining forms of binding agreements. Examples include land improvement agreements, maintenance agreements and long-term contracts with landowners that seek to ensure that certain practices are followed or avoided or that other means of promoting water quality protection are implemented (e.g. agreements not to use areas of land adjoining streams for intensive grazing). The agreements could be achieved in exchange for some benefit to the landowner, such as through a financial incentive.

These methods have the benefit of being flexible and avoid some of the costs involved with more formal methods of encumbrances. However, they do still entail costs, as well as legal difficulties, and therefore may not be as useful as promoting non-contractual voluntary changes in management practices or land use.

4.6 Regulatory Methods

4.6.1 Common Law and Liability for Damages

Under common law, private property landholders have the right to use and enjoy their land to the exclusion of others. Duties under common law are limited to the obligations to neighbouring land owners and extend only to negative obligations such as not trespassing or committing a nuisance. Common law has no legal basis to deal with the effects of the actions of an individual land owner on the environment where other individuals are not directly affected and suffer damage which can be calculated in monetary terms.

4.6.2 Regulatory Control Powers Under the Resource Management Act

The Resource Management Act provides local authorities with certain powers to command and control the actions of land users to achieve the purpose of the Act, primarily through the use of rules in plans. In addition, regulations can be promulgated under the Act to establish, at a national level, standards and other controls.

Regulatory control methods can be difficult and expensive to monitor and enforce, particularly for matters such as non-point source pollution. Defining meaningful standards can also be difficult or arbitrary.

Regulatory controls are more effective in managing either readily measurable/controllable sources of pollution (such as discharges from dairy shed effluent ponds) or specific activities which can be related back to the actions of individual farmers (such as the misapplication of pesticides or stock access to waterways).

Farmers are more likely to adopt desired practices when they perceive that the community objectives are being achieved and they perceive that other land users have also adopted these practices. However, not all farmers will adopt sustainable land management practices voluntarily, even if provided with sufficient information. Rules can encourage the adoption

of these practices, but only if land users have been closely involved in determining which practices are to be regulated. Particular types of regulatory controls, most of which are available under the Resource Management Act, are reviewed below.

4.6.2.1 Discharge Standards

Discharge standards restrict the quality and/or quantity of contaminants lost from the farm. Point source discharges have long been controlled in this manner, with the choice of treatment system to achieve the standards left largely up to the discharger. The Resource Management Act continues this approach, allowing discharges of contaminants to be controlled through discharge standards.

Discharge standards have a number of advantages. For example, they provide clear limits which have to be met but they don't specify the manner in which the standards must be met. This provides polluters with considerable flexibility in the manner in which they can meet the standards. Discharge standards also provide measurable criteria, against which compliance can readily be determined. Another advantage is that discharge standards have a reasonably close relationship with the environmental outcomes that are being sought in that the cumulative effect of discharges which meet the set standards, will be to meet the desired quality objectives for the receiving waters.

One significant problem with discharge standards is that they are not useful for addressing non-point sources of pollution, as it is practically impossible to monitor the quantity of contaminants entering streams from non-point sources. Discharge standards are therefore difficult to enforce and are generally inappropriate for the direct control of non-point source pollution.

However, non-point source pollution of waterways may be reduced in an indirect manner by using discharge standards to control point source discharges to land (e.g. agricultural effluent, fertilisers, pesticides and irrigation water).

4.6.2.2 Ambient Receiving Water Standards

Ambient standards may be numeric (e.g., specifying maximum contaminant concentrations in receiving waters) or narrative (defining the intent of the policy in words, e.g. "there shall be no undesirable biological growths as a result of any discharge of a contaminant into water"). Water classification standards were widely used under the former Water and Soil Conservation Act 1967, and were implemented indirectly through discharge standards imposed on point source discharges. This provision has been carried through to the Third Schedule of the Resource Management Act, although it has not been widely used because of debates over enforcement.

Ambient standards can be implemented by issuing permits which allow land users to discharge contaminants up to the point where receiving water concentrations reach, but do not exceed, the ambient standards.

Ambient standards have similar advantages to discharge standards, especially in terms of linking performance criteria with environmental outcomes. In addition, compared with discharge controls, the specification of ambient levels simplifies significantly the monitoring

process (and reduces costs). Numeric standards are more easily applied in a uniform manner and monitored than narrative standards. However, even where standards can be monitored effectively, enforcement against individuals is still problematic in that it is often very difficult to identify sources of pollution, particularly infrequent or one-off pollution incidents.

4.6.2.3 Catchment Clubs

Groups of farmers and other land users within a catchment could be held collectively responsible for compliance with standards specified for the receiving waters. “Catchment clubs” could be formed, consisting of land users and others discharging contaminants to water. These clubs would be responsible for achieving regulatory established water quality standards, with the clubs being liable for violating their permit(s).

An advantage of this approach is that the monitoring difficulties for the authority would be reduced when ambient permits are issued to catchment clubs, although this transfers the enforcement problem from the authority to the club. Ultimately, however, the authority remains responsible for monitoring.

The Resource Management Act does not specifically provide for catchment clubs. Theoretically, however, a resource consent could be granted to a legal entity (e.g., an incorporated society) representing all landowners in a catchment or subcatchment. This entity would then be legally responsible for complying with the discharge permit requirements. For example, in Canterbury resource consents have been issued to irrigation companies comprising individual irrigators in a defined area. Catchment clubs could be formed voluntarily, but to succeed effectively, “club membership” would have to include all dischargers (actual or potential) within the catchment. Otherwise, legislative amendment would be required to force landowners to become members of a club. Compulsory membership is the major disadvantage of this method, and amending the statute to force club membership would be unpopular and unlikely to occur.

A further disadvantage of the catchment club model is that it has yet to be tested or implemented. It is therefore unclear whether the catchment club approach would have a positive effect on water quality in comparison with other methods. As a tool for reducing the impacts of agriculture on water quality, this approach needs further investigation.

4.6.2.4 Design Standards

In the “design standards” approach, rules specify actions which must or must not be taken by land owners. Design standards targeted towards reducing the effects of agricultural runoff tend to focus on land use activities, such as the use of contour ploughing or conservation tillage, or the prohibition of certain land uses on erosive lands. The approach is similar to the best management practice approach set out in the *Sustainable Land Management Strategy*, but best management practice refers to the voluntary adoption of such practices, whereas adherence to design standards is enforced through rules in plans.

There are a number of examples that illustrate the range of techniques that can be used to impose the adoption of design standards. Many dairy farmers throughout New Zealand have been required by water rights under the Water and Soil Conservation Act to treat effluent in Ministry of Agriculture specification oxidation pond systems prior to discharge. Some

regional councils have design standards relating to vegetation clearance and land disturbance activities. These have been developed to prevent soil erosion and associated effects. The standards require actions such as contour ploughing, revegetation, instalment of culverts and stormwater controls. Overseas, protection zones in the Netherlands and Germany restrict the use of pesticides within defined distances from bores into unconfined aquifers, while in Sweden aerial spraying of pesticides has been banned.

Design standards can be used to address sources of agricultural runoff, especially soil erosion. Some advantages of regulating land use by way of design standards are that it provides certainty to resource users, applies equally to all resource users and sets useful bottom lines. However, to be effective, design standards must be prescribed precisely (with adequate supporting data), be cost effective, and be able to be monitored and enforced. The latter problem is critical, as design standards remove the farmer's discretion to choose alternative or new management practices in response to changing circumstances (e.g., technological changes). This can be overcome, to an extent, by developing procedures which allow the design standard to be revised rapidly in response to the availability of improved technology. Resistance to the use of inappropriate design standards is likely to generate high information, administration and enforcement costs.

The use of this method is probably most effective in regard to specifying design standards in well-defined areas or circumstances, so that monitoring is confined to a known area, and land users can be targeted more readily. For example, design standards could be used within a catchment with specific water quality issues, such as a public water supply catchment or an area with high pollution problems. Whether design standards should be imposed or encouraged voluntarily, as in the case of best management practice, is a moot point.

4.6.2.5 Input Standards


Input standards specify the quantity and/or quality of inputs used in the production process. The distinction between input controls and design standards can be blurred. However, input controls tend to refer to inputs of consumables, such as fertilisers and pesticides, whereas design standards usually refer to actions which should or should not be taken such as contour ploughing and aerial spraying of pesticides. An example applicable to New Zealand is the imposition of controls on the amount of nitrogen which may be applied to pasture.

Input standards may be applied under the Resource Management Act, provided they can be justified on the basis of adverse effects. Input standards are limited in their usefulness for addressing non-point source pollution because often the method of application of the input is more important in determining environmental impacts than total quantity applied. Input standards are also difficult to monitor and enforce and to link scientifically with the adverse effects to be addressed.

4.6.2.6 Output Standards

Output standards specify limits on the quantity or quality of products or by-products that may be created through agricultural activity. The purpose of output standards is to reduce the quantity of contaminants lost to the environment, which often increases as productivity increases. For example, standards could limit the quantity of pesticide residues in crops, thereby encouraging low-input farming.

Output standards on products are not able to be set under the Resource Management Act. Internationally, they are not widely used to address non-point source pollution, presumably because of the difficulty in establishing their relationship with water quality and the high monitoring and enforcement costs.



5. POLICY DEVELOPMENT

5.1 Approaches to Policy Development

A range of methods, both regulatory and non-regulatory, were discussed in Section 4 for encouraging farmers to minimise agricultural impacts on water quality. These methods may be included in a policy statement or plan prepared under the Resource Management Act, or they may be part of council policy articulated in an annual plan or other council document. Plans prepared under the Resource Management Act need not contain rules (regulatory methods) and may simply contain other (non-regulatory) methods, if non-regulatory methods are better able to meet the objectives set out in the plan.

Whichever methods are implemented, and whichever documents they are set out in, the focus should be on finding ways to encourage the adoption of sustainable management practices. In some cases this may simply involve the modification of existing practices. For example, keeping stock away from particular waterways may be all that is needed, rather than changes to general livestock management. Changes to entire systems of farm management will often only be needed where the land use is having severe environmental impacts such as gross and widespread erosion, or where receiving waters are particularly sensitive.

Although regulatory methods may be needed in some instances, voluntary change has been identified as the key factor in the *Sustainable Land Management Strategy*. Non-regulatory methods are likely to be both more successfully implemented in the medium to long-term and easier to administer. Costs of regulatory methods to the enforcement agency are likely to be higher than costs of voluntary methods, and many regulations would be difficult to enforce. However, voluntary initiatives must be based on good information on the physical and biological characteristics of the land and surrounding environment. The major emphasis of the *Sustainable Land Management Strategy* is on providing information and support in a form that will encourage land users to change unsustainable land use practices.

A paper to the 1995 New Zealand Planning Institute Conference¹³ suggested that,

*The role of planners, which may have tended historically to rest on a regulatory approach to resource management issues, is now historical and passed. The future role of planners, and indeed those of us in policy positions, will increasingly be one of **change agents** using all the techniques and tools available to us to facilitate such change. The regulatory instruments will continue to play an important part in the mix of tools we have available to us. Increasingly, however, innovative economic instruments and particularly the use of community based participative processes that better enable land users to understand the issues affecting them and motivate them toward positive behavioural change will be critical.*

Whatever approach is adopted, the manner in which it is communicated to farmers will be critically important. Farmers themselves do not want to lose soil and nutrient resources or to pollute waters. As with public opinion, farmers' attitudes are changing as their awareness of

¹³ *Planning to Enable Sustainable Agriculture: The Challenges of the 90s*, delivered by Stuart Morriss from the Ministry of Agriculture and Fisheries.

environmental issues increases. Often a more environmentally sustainable farming system can be achieved through better management and only minor changes to current farming systems, rather than through radical and sudden change. The imposition of sudden change, except where this can be explicitly demonstrated to be necessary, is therefore not constructive as it can alienate support and potentially negate progress.

Farmers need to be made more aware of wastage and other unsustainable farming practices in order to become more efficient and effective. Central to this approach is education, underpinned and enforced by regulation and economic incentives. The approach requires more time to be spent on explanation and allowances to be made for a reduction in efficiency during the learning phases.

It is not appropriate for this paper to recommend that any particular method be categorically rejected or adopted. Each council will need to consider all of the benefits and costs of adopting any particular method in the context of the circumstances and environment of their jurisdiction, including the council's priorities, resources and particular water quality issues. This is, in any case, required for any statutory plan under the Resource Management Act (section 32).

In this section of the paper, an evaluation process is suggested for councils to identify and implement the most suitable methods to improve water quality for their jurisdiction. Section 5.2 explains how regional and district councils can select the most appropriate planning document and clarify their respective roles and responsibilities. Section 5.3 discusses how a council may select the most appropriate methods. Finally, in Section 5.4, a policy framework is suggested.

5.2 Integrating District and Regional Council Responsibilities

There is a strong relationship between activities which occur on land and water quality management. Effective management of the impacts of agriculture on water quality requires an integrated approach between district and regional councils, both at the policy development stage, and at the implementation stage.

In developing resource management policies and plans, local authorities have to develop an overall policy framework to provide a strategic basis for the management of water quality. For district councils, the district plan is the key planning document. For regional councils, regional plans are the key planning document for addressing water quality issues. Both types of plan derive overall strategic direction from regional policy statements, and are linked with strategic and annual planning processes.

The Resource Management Act specifies that regional councils are responsible for controlling the use of land for the purpose of maintaining and enhancing water quality (section 30(1)(c)). It is likely that all regional councils will prepare regional plans to manage water resources within their jurisdiction. It is particularly important that plans dealing with water quality are prepared in an integrated manner, as deterioration of water quality can occur from a complex set of factors, including soil erosion, the abstraction of water, and discharges of contaminants into land, as well as discharges directly into water. Integrated management should be addressed through the regional policy statement. Regional councils are exploring a range of

different policy frameworks for addressing water resource management, ranging from the concept of a single, integrated plan addressing all resource management issues in a region, through “media-based” plans (water, air etc) to more specific plans which address single issues such as floodplain management for some rivers. The use of catchment management plans for addressing water resources is also being pursued by some councils, particularly for catchments with significant or particular water quality issues.

The Resource Management Act also provides for further integration between regional and district council planning roles. The transfer of powers under section 33 allows one local authority to transfer some of its resource management powers and functions to another. For example, the management of a catchment could be undertaken on almost a “unitary basis”, with either a district council or regional council having substantial administrative control. Another opportunity is provided by section 80, which allows for combined plans to be prepared by two or more local authorities. For example, a regional and district council could prepare a joint plan to manage a particular catchment (or part of it). To date, there appears to have been little serious exploration of such opportunities, but hopefully such avenues will be used to advantage in the future.

At the implementation stage also, there is a need for greater integration and clarification of the roles of regional and district councils. District and regional councils in each area need to determine and co-ordinate who is to be responsible for educational and enforcement activities which help meet water quality objectives.

While regional councils have the primary responsibility for managing water resources under the Resource Management Act, district councils also have an important role in promoting sustainable land use. Both authorities can act as catalysts in promoting change to more sustainable practices in a complementary fashion. In terms of enforcement, regional councils have a statutory responsibility for establishing water quality standards to promote sustainable management. Part of this responsibility is to censure those who greatly misuse water resources.

Although the Act provides the framework, much of the success of an integrated approach depends on developing a spirit of cooperation through regular liaison, discussion and information sharing.

5.3 Selecting the Most Appropriate Methods

When contemplating adopting any particular method, a council should consider:

- the ability of the method to achieve a particular objective (whether that objective is set out in a plan prepared under the Resource Management Act, or in other council policy);
- compliance costs;
- the ease of monitoring and enforcement;
- administrative costs; and
- the level of certainty provided by the method.

These are discussed, in turn, below.

5.3.1 Ability to Achieve Objectives

Clearly, the effectiveness of a method in its ability to achieve the objectives set out in a plan or in other council policy is an important criterion. If the objective is the adoption of land management practices which minimise impacts on water quality, then methods which control variables most closely correlated with water quality will be preferred to those whose impacts are less direct. For example, methods which directly control the discharge of contaminants from the farm into a stream may be preferred. In some situations, though, it may be more practicable to focus on those aspects of farm management that indirectly affect water quality.

The ability of the method to encourage farmers to adopt the desired practices should also be considered. A method directly linked to water quality will not be effective if it is not readily accepted by farmers.

5.3.2 Compliance Costs

The implementation of regulatory methods involves compliance costs for farmers in meeting the prescriptions of the method (e.g. a rule in a plan). If farmers have a broad set of options to comply with a regulatory regime, the flexibility will allow them to select the most cost effective alternative for their particular circumstances. Compliance costs of a given method will be lower in the long run than in the short run as the farmer is able to make adjustments. Therefore, costs will be lower when the method takes effect if sufficient advance notice is given. This is particularly important when fewer options are available.

5.3.3 Ease of Monitoring and Enforcement

5.3.3.1 Monitoring

One of the main difficulties in controlling non-point source pollution is the measurement of each discharger's sources of the pollution and their abatement efforts. Particular problems are associated with the invisibility of discharges and many farming activities, the difficulty in taking samples, the imprecision of measurement, and the need to detect a true violation, avoiding false positives and negatives. The authority may be left in a position where, although the outcome of the combined efforts of all dischargers can be monitored (such as ambient pollution concentration measured at monitoring points), the effects of the activities of individuals cannot be measured.

There are currently very few tools available for farmers to monitor what is happening on their own farms. Thus, new easy-to-use monitoring methods are urgently needed for both individual landowners and catchment management authorities, for measuring the progress of both voluntary and regulatory mechanisms to improve water quality.

Care should be taken in measuring the progress of voluntary change against a set standard. If farmers are incurring costs in making changes, they would like to see this reflected in improved environmental quality. Environmental response, however, is usually subject to

time lags and the absence of an immediate environmental response may not mean that efforts have been wasted. The more progress a farmer feels is being made, the more motivation there will be to continue changing. Ideally, any monitoring programme will be based on help and guidance from the local authority and will involve community input. The programme would also have a procedure for farmers to record and report their monitoring results.

Over-reliance on monitoring can encourage reactionary, rather than anticipatory, planning. In particular, where there are long time lags and cumulative environmental effects, a reliance on monitoring results may encourage unsustainable land uses or may make sustainable land uses difficult to achieve. Monitoring results should therefore be considered simply as one input in reviewing and developing policies and plans.

5.3.3.2 Enforcement

Regulatory methods such as the use of rules or resource consents often have substantial enforcement costs associated with their implementation for the regulatory authority. For example, the regulatory authority may need to monitor whether conditions on a consent are being complied with. Costly enforcement action, whether this is informal (e.g., warnings) or formal (abatement notices, enforcement orders, prosecution) may need to be taken if conditions are not complied with. The costs of monitoring compliance with conditions on a consent may be recovered from the consent holder, provided that this is set out in the consent conditions. Some costs of prosecution may be recoverable through the awarding of court costs and payment of fines by a polluter.

5.3.4 Administrative Costs

5.3.4.1 Search and Information Costs

Some methods have high costs, for both regulatory authorities and land users, associated with finding and distributing appropriate information. For example, if a method encourages land users to adopt alternative land management practices, but information on alternative practices is not readily available, or is in a form that is not applicable, then land users must spend time and money obtaining and digesting the information. Alternatively, the authority may have costs associated with compiling information in an appropriate form and making it available to land users. Information brokers may reduce costs by providing relevant information, but increase direct costs through their brokerage fees. Local authorities are able to recover costs under the Resource Management Act for the provision of information, but this may be counterproductive as it would not encourage land users to make use of available information.

5.3.4.2 Bargaining and Decision Costs

Different methods have different costs associated with decision-making processes. For example, agreements between parties, including local authorities, iwi and neighbours, require negotiation, which involves some costs to all parties involved. Regulatory methods, such as requiring resource consents for certain practices, involve costs for the applicant in preparing documentation and applying for a consent. The regulatory authority's costs in making decisions on consent applications may be recovered, at least in part, from the applicant.

However, where negotiation takes place outside a statutory process, cost recovery from the parties is usually unlikely.

5.3.4.3 Policy Development Costs

Methods which require a lot of information collection, consultation and staff time for their development (for example, methods which are a radical change from the status quo, or potentially controversial) will have higher costs for authorities than methods which are relatively straight forward to develop and implement. Consideration needs to be given to whether the local authority has the necessary staffing expertise to develop and implement the method. Land users and other stakeholders also incur costs through their involvement in policy development processes (e.g. attending meetings, writing submissions).

5.3.5 **Certainty**

Methods should provide certainty to the authority and to the land user. Uncertainty can affect the adoption of appropriate land management practices in relation to future profitability. Economic and climatic uncertainty can encourage land users to adopt practices which detrimentally affect the environment. For example, farmers may increase applications of inputs, such as fertilisers, as insurance against unforeseen events.

Uncertainty may also lead to over or under-investment in abatement technology. The adoption of appropriate land management practices often requires capital investment. This investment is only likely to occur when the farmer can expect a return on this investment. Where marginal returns are low, some period of policy stability is needed. On the other hand, if the farmer is unduly concerned about potential punitive enforcement measures, excessive investment in abatement technology may result. This will reduce the farmer's ability to invest in alternative technologies and may unnecessarily reduce the farm's profitability. However, certainty is not a free good, it will often have to be traded off against other issues such as flexibility in the face of environmental change and increasing knowledge.

5.4 ***Suggested Policy Development Framework***

No single method discussed in Section 4 of this paper can be expected to encourage a diverse group of agricultural land users on many different types of land to reduce their multiple impacts on water resources. Therefore, it is clear that a mix of methods will be needed to encourage the adoption of sustainable land management practices.

A suggested policy development framework is presented below. The framework is based on the requirements of sections 67 and 75 of the Resource Management Act.

5.4.1 **Develop Infrastructure and Clarify Responsibilities**

The policy development and implementation process, whether it is carried out under the Resource Management Act or through other council processes, demands considerable

interaction between the community and the authority. Effective interaction requires a good policy infrastructure, in which policies are implemented, monitored and reviewed. The system put in place should facilitate, rather than hinder, communication between the community and the authorities. Communication has many transaction costs which can be reduced when land users participate in voluntary groups such as landcare groups. Landcare groups can assist the collection and distribution of information among farmers, and peer pressure can encourage changed practices and assist in enforcement. District and regional councils need to work together to clarify their responsibilities. The development of a joint regional/district plan for land use management is one way in which this could be achieved.

5.4.2 Identify problems

If a water quality problem has been identified, it is important to determine, so far as possible within the limitations of available information, whether the problem results from natural processes, point source discharges, non-agricultural sources (e.g. septic tanks) or runoff from agricultural activities (or a combination of several sources). Failure to identify the source(s) of the problem can lead to management efforts being directed towards activities which are having little, if any effects on water quality.

5.4.3 Identify Catchment Management Objectives and Priorities

Water is subject to competing demands, many of which are incompatible. The community should develop specific, realistic catchment management objectives consistent with the Resource Management Act with clear timelines which are appropriate for different subcatchments. The monetary and non-monetary benefits and costs of alternative objectives should be evaluated. The objectives should be formulated in a way that they are easily understood and are able to be monitored (for example, a water quality standard at the bottom of a catchment).

Water quality objectives should be developed within the context of overall environmental objectives, as multiple goals can be achieved through sustainable land management practices (e.g. protection of biodiversity, cultural and natural heritage values and amenity values).

5.4.4 Understand Farmer Perceptions

Efforts should be focused at encouraging voluntary change. This will require an understanding of farmers' perceptions of environmental and other issues. As there will be limited immediate financial incentives for sustainable agriculture, farmers must be convinced that the environment is important, and that efforts to protect or enhance environmental quality are economic, effective and worthwhile.

5.4.5 Inform Farmers about their Environmental Impacts and Alternative Management Practices

Information available to farmers should be consistent and credible. Technical advice may need to be sought to this end. Farmers and other groups in the community should, as far as practicable, be involved in the development of environmental monitoring programmes and should be encouraged to participate in such programmes. Monitoring must not be an excuse for procrastination. Local discussion groups and demonstration farms appear to be one of the best ways of disseminating information. Farmers could be encouraged to develop whole farm management plans to apply this information efficiently.

5.4.6 Provide Appropriate Incentives

Authorities could support the establishment of demonstration farms and landcare groups and the provision of limited soil conservation and riparian management materials. Rates assistance for retired land could also be considered. Other incentives could include advisory services, farm plan development programmes, and environmental award schemes.

5.4.7 Identify and Control Undesirable Practices

Along with other sources of expert advice, the community should assist in the identification and censuring of undesirable practices, such as inappropriate land use and the inappropriate application of hazardous pesticides.

Rules are one method of promoting desirable practices or outcomes. To retain community support, however, rules should not result in more than about 15% non-compliance¹⁴. Rules must be enforceable, even if the linkage with water quality is less direct. Management practices are most easily monitored, but are most effective if accepted and adopted by farmers without coercion.

5.4.8 Strategic Purchase of Interests in Land

The strategic purchase of interests in land, either through direct land acquisition or through other means (such as esplanade strips and covenants) could also be considered to address urgent water quality issues such as badly deteriorated catchments in which relatively rapid action is required. However, any land acquisition needs to make provision for adequate resources for the ongoing management of weeds and pests.

¹⁴ This figure has been derived from public perceptions of speed camera penalties.

5.4.9 Monitoring and Feedback

The adoption of sustainable management practices can be encouraged by showing farmers that the practices they have adopted are having a desired effect in improving water quality. Catchment monitoring programmes are needed to measure:

- progress in relation to the community's desired objectives;
- the effectiveness of the policy framework;
- the impacts of particular land use practices; and
- non-compliance with rules.

The table on the following page summarises the suggested policy development framework.

5.5 Conclusion

Non point source pollution of waterways from agricultural land use is not a simple issue to address. However, as this paper indicates, there are a variety of methods which may be used by local authorities to help address the problem. Of these, voluntary initiatives which have the support of the community show considerable promise. Ultimately, local solutions to pollution of waterways from agricultural runoff will best be developed through the establishment of a strong relationship and a cooperative process involving the relevant local authorities, land users and other interested parties.

TABLE 1 — SUGGESTED POLICY DEVELOPMENT FRAMEWORK

PHASE	MATTERS TO ADDRESS/RESOLVE
1. Develop infrastructure	<ul style="list-style-type: none"> • Form community groups based on subcatchments to assist the collection and distribution of information among farmers, encourage changed practices, and enforcement • Clarify responsibilities to reduce confusion about the responsibilities of the district and regional councils
2. Identify problems	<ul style="list-style-type: none"> • Is there a water quality problem? • Is the source of the problem natural processes, direct discharges to water, diffuse-source pollution from non-agricultural activities, or runoff from agricultural land use?
3. Identify catchment management objectives and priorities	<ul style="list-style-type: none"> • Community should develop specific, realistic objectives with clear timelines appropriate for different subcatchments • The planning process under the Resource Management Act is an appropriate framework • The objectives should be easily understandable and be able to be monitored
4. Understand farmer perceptions	<ul style="list-style-type: none"> • Survey farmers to identify key issues of concern • Identify information needs
5. Inform farmers	<ul style="list-style-type: none"> • Advice on environmental impacts and alternative land management practices • Information should be consistent and credible • Information collection should involve farmers • Focus on demonstration farms and landcare groups
6. Provide appropriate incentives	<ul style="list-style-type: none"> • Soil conservation and riparian management materials • Rates assistance for retired land
7. Control undesirable practices	<ul style="list-style-type: none"> • Identify and ensure inappropriate land use • Minimise non-compliance to retain community support
8. Strategic purchase of land	<ul style="list-style-type: none"> • Only purchase critical areas of land in upper catchment
9. Monitoring and feedback	<ul style="list-style-type: none"> • Effectiveness of policy framework • Impacts of particular land use practices • Identify non-compliance with rules