

- Nutrients (especially nitrogen and phosphorus), which stimulate nuisance growths of aquatic plants and clog channels;
- Ammonia, which is directly toxic to many aquatic organisms.

This new information has resulted in MAF withdrawing its Aglink pond design guidelines which were based on the best available research of the 1970s.

To highlight just one of these concerns, recent studies have shown that New Zealand species of benthic (streambed) invertebrates and fish are particularly sensitive to ammonia (see inset). When ammonia enters lowland stream environments clogged with large aquatic plants (macrophytes), increases in pH caused by metabolic activity of the macrophytes can convert the ammonia into an even more toxic form!

These findings indicate the need for higher treatment standards, especially when there are several discharges to the same watercourse.

Since millions of dollars are currently invested in oxidation pond technology, the challenge is to find low-cost alternatives to either improve the performance of existing ponds or provide additional treatment. Constructed wetlands (see *Water & Atmosphere* 1(2)) may provide one option, although there are others (see inset, additional reading).

Minimising the effects of diffuse-source runoff from developing pasture without significantly impacting upon farm management is a major challenge. In a paper addressing Environment Waikato's response to the Towards Sustainable Agriculture report, senior scientist Dr Beat Huser said that considerable improvement had been achieved in the Waikato in managing agricultural pollution from direct discharges from farms and agricultural industries, and that:

"There is now a need to concentrate on diffuse contaminant sources entering waterways from surface runoff and leaching in to groundwater. This is much more difficult to control, and will require a co-ordinated and collective approach by land owners, the agricultural industry, Regional Councils and other parties."

Already, NIWA's research has established the value of riparian "buffers" to reduce the impacts on streams of runoff from pastoral land. Investigations into their use continue, as do studies looking at the restoration of impacted streams. Other relevant research under way includes the development of computer modelling systems as an aid to decision-making on management options (see article, page 18). Such research is important to ensure that Regional Councils work with the most complete and up-to-date information possible as an aid to policy making.

Given the Regional Councils' pivotal role in promoting sustainable management, the importance of agriculture to New Zealand, and the wealth of relevant information being generated from research, the most effective way to meet the requirements of the RMA is for Regional Council resource managers, researchers and the industry to work together, in a flexible and innovative manner. In many instances, this is already happening with the formation of "Landcare" groups, formulation of grazing management guidelines by Federated Farmers, and sustainable agriculture meetings involving farmers, scientists, and policy makers.

New Zealand's future depends on embracing the philosophy behind the Resource Management Act. Our natural resources, particularly productive land and clean water, are essential for our well-being today, and for that of future generations. ■



*A degraded lowland stream in an agricultural catchment.*

## The Whatawhata project: plans for riparian research

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*The link between agriculture and deteriorating water quality has been firmly established. But it should be possible to repair the damage, as a long-term project at Whatawhata, near Hamilton, aims to demonstrate.*

DURING THE LAST 150 years, New Zealand's landscape has undergone a radical change. Vast

areas of native vegetation, especially forest, have been removed to make way for agriculture. Today, over 50% of the land area is either cultivated or under pastoral use. Changing land use is a key factor influencing the water quantity and quality, and the ecology of our streams, and the link between agriculture and deteriorating water quality has been firmly established. With the Resource Management Act (RMA) now law, it is no longer enough simply to be aware of the

