(Wright, J., 2012: 7)

Water quality in New Zealand:
Understanding the science

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Commissioner's overview

When Parliament appointed me to the position of Environment Commissioner five years ago, I came into the job knowing a great deal about some environmental matters and relatively little about others. Water quality was one area in which I had to work rapidly to come up to speed. I clearly recall an evening with Professor David Hamilton from the University of Waikato when he patiently did his best to give me a rapid grounding in the basic science.

In 2010 I had the rewarding experience of speaking about water quality science to Members of Parliament. A request from several MPs for more led to developing greater expertise within my office on water quality and eventually to this report.

The aim of this report is to provide a guide to water quality science covering those aspects which are most useful for the many New Zealanders who are engaged in, and concerned about, this high profile environmental issue. Water quality science is indeed complicated, much is unknown, and the devil often really is in the detail.

There is effectively no limit to the different aspects of water quality that could be covered, so this report is not intended as a complete reference on the subject. Its scope is confined to fresh water – in rivers and streams, lakes, wetlands, estuaries, and aquifers – and to the three main water pollutants of greatest concern in New Zealand. These three are pathogens, sediment, and nutrients.

Pathogens are invisible microbes that cause disease and obviously deserve being labelled pollutants. But sediment and nutrients are only water pollutants by virtue of being in the wrong place. They belong on the land, not in water.

Too much soil and rock washed off land become destructive sediment in water. Nutrients, specifically phosphorus and nitrogen, should also stay on the land helping plants grow there rather than in water. We want fertile land not fertile water.

In a 2011 interview, the incoming President of Federated Farmers, Bruce Wills, was described as keen to have a frank science-based discussion with the nation about dairy pollution. *"If we've got a dirty river let's understand why it's dirty and what science can tell us about fixing it…"* [1]

I strongly agree with Mr Wills. He has put his finger squarely on the value that science can provide – understanding cause-effect relationships. And because water quality is an issue of such widespread public concern, this understanding must also be widespread.

In this report we have sought to go beyond providing lists of sources of water pollutants and their damaging effects. The aim is more ambitious – to explain as simply as possible why a particular pollutant causes certain effects – and therefore lay a basis for how well a particular intervention might improve or protect water quality.

I was interested to learn, for example, about a key difference between nitrate and phosphate – the main forms in which the nutrients nitrogen and phosphorus occur as water pollutants. Nitrate is very soluble in water, but phosphate most often is not. One intervention aimed at preventing nutrients from moving off land into water is a *riparian strip* – a fenced margin along banks covered with plants that will take up nitrogen and phosphorus as they grow. In general, riparian strips are much better at reducing phosphate than nitrate because nitrate can elude the roots of the plants and travel through groundwater directly into the waterway.

Concerns over the impacts of nutrients on water quality have grown over recent years, but we should not delude ourselves that all has been well in the past. Decades of burning of forested hills to create pasture for sheep farming is largely responsible for the widespread erosion that continues to carry sediment into our rivers and lakes. And while dairy cows are the greatest source of nitrate in many of our catchments, sediment from erosion is the greatest source of phosphate. While on the subject of phosphate, city dwellers concerned about water quality should be aware they can do their bit by switching to phosphate-free detergents and laundry powder.

It is a truism that to be effective, water quality policy and action must be based on science. But what does that actually mean? I think it means the following:

- Measuring the different parameters of water quality
- Understanding the causes of change in those parameters
- Designing interventions that are likely to be effective
- Measuring the effectiveness of those interventions

In 1911, there was an outbreak of typhoid among workers in flax mills in the Manawatū. The cause was deemed to be the rancid water coming out of the mills, but it was actually the sewage from the town of Feilding. While this mistake is not one we would make today, we are still capable of wrongly linking cause and effect. And once that is done, we cannot design interventions that will be effective.

We need, however, to know when more science is *not* needed. A call for more science to be done can sometimes be a way of delaying difficult decisions. There is, for example, no need for more scientific data or modelling to establish the link between the land use change that has taken place in the Waituna catchment in Southland and the dire state of the Waituna Lagoon; there simply is no other explanation.

Scientists themselves are not always the best people to advise when more science is required – their basic motivation quite rightly is to continue to explore and gather new data.

While science is necessary for policy, it is not sufficient. Science does not tell us how to make trade-offs, and trade-offs will almost certainly be needed. It is very unlikely that we can have our cake and eat it too. Even if technical fixes were to become available for dealing with all our water quality problems, they would still cost a great deal of money.

As the writing of this report draws to a close, I am aware that my own knowledge of the science of water quality has increased hugely since my presentation to Members of Parliament in 2010. There is no end to the complexity, but the state of our rivers, lakes, wetlands, estuaries, and aquifers is of great importance to this clean green country of ours. Increasing our understanding is a worthwhile investment and will pay dividends for our children and grandchildren.

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