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The development of the
'Waterway Self Assessment Form' -
a stream management tool for landowners



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GENERAL INTRODUCTION

General Introduction

Increasing environmental awareness amongst the general public and more specific user groups, such as land owners, has led to concern about the impacts of land use on specific environmental qualities such as water quality and stream biota. As a result, methods for reducing and or ameliorating these impacts have become a key area of research in freshwater ecology over the last decade (Fahey and Rowe, 1992; Hanchet, 1989; Hughes, et al., 1986; Osborne and Wiley, 1988; Quinn, et al., 1997; Watson, 1986; Wilcock, 1986; Winterbourn, 1986). The dominant focus of this research has been in riparian management (Large and Petts, 1992; Platts, et al., 1987; Quinn, et al., 1993).

As many streams and rivers in New Zealand flow at some stage through pastoral land, the responsibility of managing riparian zones is largely that of the landowners. Simple tools for managing waterways and their riparian zones, which take into account the requirements of individual landowners, and also facilitate education and awareness, are now needed (Quinn and Collier, in press).

The Waterway Self Assessment Form (Chapter Two) (Polglase and Death, in press) has been developed to meet these needs, for both the evaluation of, and education about riparian management. The aim of the form is to provide landowners with a means of assessing riparian requirements of their own land, and to provide a practical and direct way of introducing issues of riparian management and stream health. The primary function of the form is to pinpoint problem areas of waterways and provide a management tool for monitoring management progress.

Other self assessment forms with similar aims to the Waterway Self Assessment Form have also been developed such as, the Stream Habitat Monitoring and Assessment Kit (SHMAK) (Biggs and Kilroy, 1998) and AgResearch's Waterway Self Assessment Scale (Parminter and Tarbotton, 1996b). The SHMAK has been designed for use with farming or community groups rather than individuals, this is largely because of the high cost involved in purchasing the kit (approximately \$300). It involves detailed measurement, collection and observations of a vast amount of information, and is

therefore relatively time consuming. The collection of some information requires a reasonable level of skill, such as relatively precise identification of macroinvertebrates. In comparison, the Waterway Self Assessment Form has no cost to the landowner. It takes only 10 minutes to complete, which is important as the length of time an assessment takes may influence interest in undertaking an assessment. The Waterway Self Assessment Form is also very simple to use and requires no expert knowledge or skill. The SHMAK is a very useful tool, but with a different target user group to the Waterway Self Assessment Form. AgResearch's Waterway Self Assessment Scale takes a similar approach to the Waterway Self Assessment Form. However, subsequent testing of AgResearch's Scale (Parminter, et al., 1997) found several aspects of it to be flawed, such as the scientific relevance of the results. The Waterway Self Assessment Form has been shown to be scientifically valid in Chapter Four.

The aim of the research carried out here was to develop a method by which landowners could evaluate the riparian requirements of streams themselves. It was important that it be educational and informative, ecologically and scientifically relevant, whilst still being user-friendly to the target users. Each process of the development of the Waterway Self Assessment Form is described in the following Chapters. Chapter One discusses the ecological relevance, and importance of the form to the end users. Chapter Two is the Waterway Self Assessment Form itself. Chapter Three describes the processes of receiving feedback from a group of landowners, peer review and testing of the inter-observer reliability of the form. Chapter Four provides evidence of the scientific validity of the Waterway Self Assessment Form.

References

- Biggs, B. & Kilroy, K. 1998. *New Zealand Stream Health Monitoring and Assessment Kit (SHMAK)*. NIWA, Christchurch, New Zealand.
- Fahey, B. D. & Rowe, L. K. 1992. Land-use impacts. pp. 265-284 in M.P. Mosley (ed.). *Waters of New Zealand*. New Zealand Hydrological Society, Wellington, New Zealand.
- Hanchet, S. 1989. Effect of land use on native fish. *Freshwater Catch*. **39**: 10-11.
- Hughes, H. R., Boshier, J. A. & Lumley, M. 1986. The impact of land use changes on water quality. *New Zealand Agricultural Science*. **20**: 94-97.
- Large, A. R. G. & Petts, G. E. 1992. *Buffer Zones for Conservation of Rivers and Bankside Habitats*. National Rivers Authority (NRA), Almondsbury, Bristol, England.
- Osborne, L. L. & Wiley, M. J. 1988. Empirical relationships between land use/cover and stream water quality in an agricultural watershed. *Journal of Environmental Management* **26**: 9-27.
- Parminter, T., Perkins, A. & Tarbotton, I. 1997. *A research report on the development and testing of Self Assessment Scales for land owner resource management goals*. AgResearch, Hamilton, New Zealand.
- Parminter, T. G. & Tarbotton, I. S. 1996b. *Waterway Self Assessment Scale: Prototype*. AgResearch, Hamilton, New Zealand.
- Platts, W. S., Armour, C., Booth, G. D., Bryant, M., Bufford, J. L., Cuplin, P., Jensen, S., Lienkaemper, G. W., Minshall, G. W., Monsen, S. B., Nelson, R. L., Sedell, J. R. & Tuhy, J. S. 1987. *Methods for evaluating riparian habitats with applications to management*. United States Department of Agriculture and Forest service, USA.
- Polglase, M. A. & Death, R. G. (in press). The Waterway Self-Assessment Form: a Stream Management Tool for Landowners. *The New Zealand Farmer*.
- Quinn, J. M. & Collier, K. J. (in press). Incorporating stream health into New Zealand hill-land farm management. *Nature Conservation*.
- Quinn, J. M., Cooper, A. B., Davies-Colley, R. J., Rutherford, J. C. & Williamson, R. B. 1997. Land use effects on habitat, water quality, periphyton, and benthic invertebrates in Waikato, New Zealand, hill-country streams. *New Zealand Journal of Marine and Freshwater Research*. **31**: 579-597.

- Quinn, J. M., Cooper, A. B. & Williamson, R. B. 1993. Riparian zones as buffer strips: a New Zealand perspective. pp. 53 - 88 in S.E.Bunn, B.J.Pusey and P.Price (eds.). *Proceedings of the Australian Society for Limnology Conference*. Marcoola, South Queensland, Australia.
- Watson, N. R. N. 1986. The impact of land use on water-based recreation. *New Zealand Agricultural Science*. **20**: 125-130.
- Wilcock, R. J. 1986. Agricultural run-off: a source of water pollution in New Zealand? *New Zealand Agricultural Science*. **20**: 98-103.
- Winterbourn, M. J. 1986. Effects of land development on benthic stream communities. *New Zealand Agricultural Science*. **20**: 115-118.