



The Motueka and Riwaka Catchments

A technical report summarising the present state of knowledge of the catchments, management issues and research needs for integrated catchment management

Compiled by L. R. Basher



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Preface

When beginning any new research programme, a key first step is to understand existing knowledge about the topic. This report is the synthesis of existing knowledge about the environment of the Motueka River catchment. This major catchment, incorporating its smaller neighbour the Riwaka, and the associated coastal ecosystem in Tasman Bay is the base for New Zealand's Integrated Catchment Management (ICM) programme. The ICM research programme, begun in 2000, is a partnership between Landcare Research, Cawthron Institute and Tasman District Council. It is a bold initiative to work with local government, sector groups and communities to provide solutions to the issue of identifying sustainable patterns of land and water uses. ICM research builds on a rich history of New Zealand research on natural as well as human impacts on land and water resources.

'Integrated Catchment Management', or ICM, is an approach, now accepted globally,

to managing our land, rivers and coast in an interconnected holistic fashion. ICM encompasses the principles of integration among science disciplines, integration between communities, scientists and environmental managers, and management of natural resources within catchment or watershed boundaries. In New Zealand, it is reflected strongly in the purpose of our Resource Management Act 1991 in which section 30 requires our environmental management agencies (regional and unitary councils) to achieve "integrated management of the natural and physical resources of the region".

This Technical Report for the Motueka Catchment is a major milestone for this programme. The Motueka River catchment was chosen as a focus for study, not because its problems are unique, but rather because its problems are common. What we learn about the science of integration and the integration of science with management here will be transferable elsewhere, in New Zealand and internationally. Indeed, this is happening now.

The Motueka ICM Programme was singled out as a model for UNESCO's new *Hydrology for Life, Environment and Policy (HELP)* programme. The Motueka River provides an especially suitable case study because the range of management issues is wide and the cost of 'getting it wrong' is especially high. Fortunately, the stakeholders in the Motueka area have demonstrated a special willingness to develop shared visions and work toward common goals. This development of "social capital" is a critically important component of successful ICM efforts.

This Technical Report is neither a beginning nor an end. Rather, it is an important assessment of state. It is intended that this document to be treated as a living resource, to be periodically updated and improved as the participants develop new data and experiences. Ideally this document will serve as a model for other communities, to achieve the outcomes they share. It complements the information presented on the Motueka River ICM website (<http://icm.landcareresearch.co.nz/>) which provides up-to-date information on the research programme, and allows interested people to interact with the programme.

We would like to acknowledge the tremendous efforts of the scientists, collaborators and friends of the Motueka ICM programme who worked together to produce this summary of knowledge, upon which our research is building. We thank the Foundation for Research, Science and Technology for funding the preparation of this report under contracts C09X0014 and C09X0214. Special thanks to Tasman District Council for allowing us access to their records, for the contribution of staff time to the preparation of the report, for assistance with publication costs, and for being a partner in the programme. We thank the Cawthron Institute for their contributions to the report, and for their vision in becoming a partner in the ICM programme. Fish & Game New Zealand, Nelson Marlborough Region made available unpublished data and also contributed to the report. Staff of the Department of Conservation, Nelson Conservancy

made a valuable contribution to the report. Thanks to Bob South (Fish & Game magazine), Terry Duval and Rowan Strickland for allowing us to use their photos to illustrate the report. We thank the numerous other people who contributed to the report, provided information or their perspective on the state of the Motueka River catchment, and discussed the important issues for catchment management with us – we have already learnt a great deal from you. Christine Bezar edited an earlier draft of the report, and Kirsty Cullen produced the final graphics and design layout.

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Executive Summary

The Motueka Integrated Catchment Management project is a programme funded by the Foundation for Research, Science and Technology, which aims to: *“Improve management of and social learning about land, freshwater, and near-coastal environments in catchments with multiple, interacting, and potentially conflicting land uses”*. The project is a partnership between Landcare Research, the Cawthron Institute, and Tasman District Council, with contributions from other research providers and the community. It takes a “ridge tops to the sea” perspective, using the Motueka River as a case-study catchment, to address cumulative effects of past, present, and possible future natural-resource-uses on land, freshwater, and marine resources.

This Technical Report is a contribution to a knowledge base being developed for the Motueka River catchment to assist integrated catchment management. It:

- reviews existing information on the physical, social and cultural environment;

- lists the range of existing data sources (including maps, photos, satellite imagery; climatic, hydrologic, geologic, soils and ecological databases);
- describes the current statutory framework for land and water resource management (including the Resource Management Act, Tasman Resource Management Plan, the Motueka River Water Conservation Order, Department of Conservation Management Strategy for the Nelson Marlborough Conservancy and Management Plan for Kahurangi National Park);
- describes the key issues for land and water resource management in the catchment (water quantity, sediment, water quality, aquatic ecology, riparian management, Motueka Catchment – Tasman Bay interactions) and outlines research needed to underpin improved management of land and water resources.

The Motueka River drains the largest catchment in the Nelson Region, with an area of 2180 km² (including the Riwaka River) and a main stem length

of about 110 km. It provides the major freshwater flow into Tasman Bay, a productive, shallow water body of high economic, ecological, and cultural significance. Environmentally the catchment is very complex with:

- annual rainfall ranging from about 950 mm to more than 3500 mm, marked wet (winter) and dry (summer) seasons, and high variability of rainfall (monthly and annual);
- elevation ranging from sea level up to 1850 m;
- a dominance of mountainous and hilly terrain, with limited (but agriculturally very important) areas of flat terraces and floodplains;
- a wide variety of rock types including old igneous and sedimentary rocks, young sedimentary rocks, a large area of clay-bound Moutere gravels, and small (but hydrologically very significant) areas of younger alluvium;
- a complex soil pattern resulting from the variety of landforms, climate and geology;
- vegetation dominated by native (35% of catchment area) and exotic forest, and smaller areas of pastoral grassland, scrub, tussock grasslands, and crops.

The major productive land uses are production forestry (25% of catchment area), sheep and beef farming (19%), and limited but increasing dairying. Horticulture (mainly pipfruit, berryfruit, hops, vegetables) occupies a small, but expanding, area and is a major water user. Most crops are irrigated from surface or groundwater during the summer. A large area of the catchment (55%), mainly in the high rainfall headwaters of the western tributaries (Kahurangi National Park) and upper Motueka (Mt Richmond Forest Park), is conservation land (forest, scrub and tussock grasslands). These areas are very important for soil and water conservation and biodiversity.

The catchment is sparsely populated with a total population of about 12,000, mostly in the town of Motueka (c. 7000). Rural population density is about 2/km². Population growth is estimated at about 2% per annum. Māori groups first settled the Motueka area before AD 1350 and four iwi (Ngāti Rarua, Te

Ati Awa, Ngāti Tama, Ngāti Kuia) have a close spiritual and physical relationship with the Motueka – Tasman Bay area. European settlement began in the 1840s. Widespread deforestation occurred in response to settlement by both Europeans and Māori, although significant reforestation (especially with *P. radiata*) has occurred since then.

Annual flow of the Motueka River at Woodstock is 844 mm, compared to a mean annual rainfall for the contributing catchment of 1600 mm. The Motueka has a mean flow of 58,560 litres/second (L/s) (7-day running mean for Motueka at Woodstock), a median flow of 33,950 L/s, and a mean annual low flow of 10,216 L/s. The measured flow range is from about 5600 L/s to >2,100,000 L/s. Mean monthly flow is distinctly seasonal, with higher flow in the winter and spring, and lower flow in summer months. This seasonality is more marked for low flows. Periodic large floods and extended low-flow periods are a characteristic feature of the hydrology. River flow generation is controlled by rainfall distribution and geology, with large differences in specific discharge between catchments underlain by old, basement rocks (>40 L/s/km²) and Moutere gravel (<20 L/s/km²). Land use can have a significant effect on water yield in areas underlain by Moutere gravel. Aquifers under the floodplain and fans of the Motueka Plains near the coast, and the terraces and floodplains of the upper Motueka River around Tapawera contain groundwater resources. Water is extracted from both these sources, and from surface water, for irrigation and domestic use.

Water quality in the Motueka River tends to be high. Nutrient concentrations are relatively low compared to other parts of the New Zealand, but are highest in the small streams draining pasture and horticultural land and there is evidence of enrichment in the lower reaches of the river. Suspended sediment concentrations are generally low, but tend to be higher in small streams draining pasture and horticultural

land, and in streams draining granite catchments particularly where forest harvesting is occurring. Relatively high concentrations of harmful bacteria can at times be found associated with dairy farming and horticulture.

The Motueka has a moderately diverse range of native freshwater fish species (14 of New Zealand's c. 40 native fish species, including galaxiids, bullies, and eels), and five estuarine and marine species in the lower reaches (black flounder, kahawai, yellow-eyed mullet, stargazers, cockabully). Macroinvertebrate communities are diverse (at least 119 taxa dominated by caddisflies, true flies, mayflies, and stoneflies) and generally dominated by animals characteristic of unpolluted habitats, unmodified streams, and high aquatic habitat quality. Algal growth in the river is prolific during low-flow periods and approaches nuisance levels in the lower reaches at times. High rates of algal production provide a large food source for macroinvertebrates, and support abundant macroinvertebrate and fish populations in the river.

The Motueka is a nationally important brown trout fishery, renowned for the abundance and size of trout. Maintaining high-quality habitat for fish and invertebrates is fundamental to maintaining the fishery. Recently the fishery has shown a decline, ascribed to influx of fine sediment from land disturbance on granite terrain.

The Motueka River flows into, and is a major influence on, highly productive coastal and shallow marine ecosystems in Tasman Bay. The estuarine and coastal area around the mouth of the river is important for a range of fish and shellfish, while Tasman Bay supports a wide variety of plankton, benthic organisms and fish. Scallops, oysters, mussels, cockles and snapper are important commercial and recreational fisheries. The river provides about 62% of the total freshwater inflow to

Tasman Bay, carrying with it nutrients and organic matter. This causes water column stratification, spatial and temporal variation in nutrient concentrations, and affects the ecology of the bay (e.g., high sediment loads during floods cause poor recruitment and growth of scallops in the plume of the river). Following big storms, the Motueka River freshwater plume covers nearly the entire western side of Tasman Bay, extending more than 18 km offshore.

The Motueka Catchment is widely used for recreational activities, including trout fishing, eeling, whitebaiting, tramping, canoeing, rafting, and hunting. Kahurangi National Park, Mt Richmond Forest Park and the Motueka River itself are especially important recreational areas with many thousands of people visiting the river and its catchment each year.

Key resource management and environmental research issues in the catchment centre around:

- 1) *Water quantity*. Over much of the catchment demand for water exceeds supply, resulting in competition for water between land uses (e.g., horticulture and forestry), and between water abstraction and maintenance of in-stream values.
- 2) *Sediment*. Little is known of the influence of land use on sediment generation and transport, how sediment influences trout and native fish populations, and the role of gravel extraction in affecting bed and bank stability.
- 3) *Water quality*. Concentrations of nutrients (primarily nitrogen) and faecal indicator bacteria (and associated pathogens) can be high in the lower reaches of the river and may affect the expanding aquaculture industry in Tasman Bay.
- 4) *Aquatic ecology*. The Motueka River has a world-famous trout fishery, which has declined recently, but there is no consensus on the reasons for this decline. Little is known of the spatial and temporal distribution of native fish fauna, and how these are influenced by land use.
- 5) *Riparian management*. There is increasing

interest in the role of riparian vegetation in maintaining water quality and aquatic habitat, but little is known of which areas in the Motueka could benefit from changed riparian management and what would be the benefits of improved riparian management.

- 6) *Motueka Catchment – Tasman Bay interactions.* The Motueka Catchment is the major source of freshwater and land-derived nutrients into Tasman Bay, and is a major influence on its productivity. The influence of land use on the quantity and

quality of freshwater delivered to Tasman Bay and on the food web within the bay is poorly understood, as are the opportunities for, and effects of, aquaculture on water quality.

The goal of the Motueka Integrated Catchment Management programme is to use historical research, biophysical experimentation, simulation modelling, and social learning to address these resource management issues.